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The Copper Queen Smelting Works

By Richard H. Vail

SYNOPSIS—An account of the important smelting operations conducted by the Phelps-Dodge interests at Douglas, Ariz. This was the first large copper works in the United States to bed its blast-furnace stock. The plant now comprises 10 blast furnaces, seven upright converters, nine McDougal roasters and three reverberatory furnaces. Seven more roasters are being built on account of the increased amount of sulphide ore from the Bisbee mines. A new skullbreaker and copper-casting furnace will probably be added. The method of converter-slag disposal is unique and has effected an important saving.

The Copper Queen smelting works at Douglas, Ariz., treats the ore from this company's important group of mines at Bisbee and from the Phelps-Dodge mines in other parts of Arizona, as well as the concentrates from its Nacozari property, the Moctezuma Copper Co., near Nacozari, Sonora, Mex. The company also treats custom ore at its works, which is built on a level site about one mile northwest of Douglas. The plant now comprises 10 blast furnaces, nine 18-ft. McDougal roasting furnaces, three reverberatory furnaces, 19x91½ ft., and seven 12-ft. upright converters, basic lined. The works treated in 1913 over a million tons of new copper-bearing material and produced 133,410,582 lb. of copper, besides over $1,500,000 worth of gold and silver.

The Enlarged Copper Queen Smelting Works, Douglas, Arizona

Power house at left, then general smelting building, converter and blast-furnace stack, reverberatory and roaster dust chambers and stack. McDougal roaster building at extreme right

The Douglas plant started operating in 1904, at which time five blast furnaces and four converters were installed. The plant was doubled in 1906, and during the last two years the eight acid-lined converters have been supplanted by seven basic-lined upright converters of the Great Falls type. Owing to a change in ore conditions—more fine ores and a greater proportion of sulphides—it also became necessary to install roasting furnaces and reverberatories to handle the Nacozari concentrates and flue dust. Notwithstanding these equipment extensions, the grade of the matte has fallen to from 30 to 35%, due to the greater amount of sulphur in the ores.

Ores Bedded in Rock-Walled Pits

The ores smelted at Douglas vary greatly in composition, the most objectionable ingredient being alumina. As many of the ores are of a clayey character, it was decided when this works was built to avoid the use of bins as it was likely that the ores would "hang up." On account of the wide variation in the ores from the Copper Queen mines, an effort is made to mix each lot of ore as it is loaded at Bisbee. This is accomplished by means of an automatic tripper conveyor, and when these lots arrive at the Copper Queen works, they are dumped into one of five rock-walled pits or beds. The only trestle bins at this plant are those for coke and for miscellaneous fluxes, for which a steel structure was provided.

The five rock-walled pits for the ores are 38 ft. wide by 750 ft. long, and 11 ft. deep. When these pits were established, bedding was not the usual practice for copper ores. In fact, this was the first large copper-smelting plant to establish a bedding system in this country, though a number of plants in the Southwest have since installed the Messiter bedding and reclaiming system.

At the Copper Queen works, the greater part of the ore smelted comes from the company's mines at Bisbee. This is usually sent in lots of seven 50-ton cars and a sample car which goes to the sampling mill situated west of the ore pits. This mill has a capacity of 150 tons in 8 hr. and all ores after sampling are returned to the ore pits. Most of the Copper Queen ores arrive in side-dumping steel cars that may be discharged directly into the ore pit. After unloading a group of cars, the ore beds are periodically leveled by the use of a mechanical plow which has been rigged up on an ordinary flat-car and is moved by an electric motor. One of these plows is shown in action by the accompanying engraving. Converter slag and other fluxes (if necessary) are added so that the completed beds constitute a self-fluxing mixture.

The blast-furnace charges are usually drawn from two of the beds while the other three beds are in process of making. The bedded ore is picked up by means of Thew steam shovels, of which six have been provided, although one is generally used for miscellaneous service throughout the works. These are No. 3 Thew steam shovels with a 32-ft. boom and a 1¼-ton dipper. The furnace-charge trains consist of a Baldwin-Westinghouse 13-ton locomotive and 20 side-roll-dump cars of 66 cu.ft. capacity. The charge train runs on the track alongside the ore pit, while the steam shovel has a track on the bottom of the ore pit and cleans out the pit as it proceeds. One dipperful of the ore mixture is put in each car, and the loading of a train of 20 cars usually requires an average of 10 min. per train. At each pit, there are six men engaged in this service, comprising a motorman and swamper on the charge train, an engineer and fireman on the steam shovel, and two laborers in the pit to keep the ore cleaned up behind the steam-shovel dipper. As two beds are operated, the total force of men on this work per day is thirty-six.

After leaving the ore pit, the charge train stops under the coke bin, and coke amounting to about 12.4% of the charge is dropped on top of the ore cars from suspended spring-scale hoppers. When the charge train comes under the coke bins the train is "spotted" so that the weighing hoppers dump directly into the cars and only about two minutes are required for loading the coke. The charge train then proceeds to the feed-floor level, where the electric locomotive uncouples, leaves the loaded charge train standing on the trestle at the feed-floor level, and picks up the empty trains which have been switched out of the furnace building by a 15-ton Baldwin-Westinghouse locomotive that handles all loaded trains delivered to the trestle level.

Flue Dust Now Reduced to 3.92% of Charge

The stock is fed to the furnace by tilting the charge cars, one feeder attending to two furnaces with the assistance of a Mexican laborer for each furnace. The present charge is a difficult one for the blast furnaces, owing to its fineness and its high alumina content.

There are 10 blast furnaces, 44 in. wide at the tuyeres; five are 18 ft. long and the others 20 ft. long. Drawings of these furnaces have been prepared in considerable detail in the JOURNAL[1], but it may be mentioned that the furnaces are no longer tapped intermittently; the change to continuous flow was made in 1908 (?), the blast now being trapped by a mud dam in a water-jacketed trough spout. The steel superstructure of the furnaces is brick lined, and the gases pass to the dust chamber through 8-ft. downtakes. The furnaces have 4-in. tuyeres spaced 12 in. apart, two of which are served by one blast pipe, the air being controlled by a valve of the stop-cock type. Air is received from a 42-in. blast main which divides into two 30-in. branches. The water consumption per furnace per minute is about 400 gal., when the water leaves the jacket at a temperature between 110° and 120° Fahrenheit.

The furnaces have oval settlers 12x20 ft. and 10x23 ft.; these are set at right angles to the long axes of the furnaces. The slag is removed in 140-cu.ft. motor-tilted slag pots, drawn by electric locomotives. The copper in the slag is usually equivalent to about 0.01 of the matte content, but when the copper in the matte exceeds about 43%, the slag loss increases abnormally and this is consequently regarded as the economic limit of concentration.

The furnace tops are kept in good condition, notwithstanding the nature of the charge and the mechanical feeding of same. Owing to the fineness of the charge, a low blast pressure—about 28 oz.—is used. The ores are friable and inclined to make a large quantity of flue dust. The blast-furnace flue dust carries about 7.5% Cu, 22% SiO_2, 27% Fe, 9.6% Al_2O_3, 10% S, 1.3% CaO. Before the velocity in the main dust chamber was reduced to 5 ft. per sec. and the Nacozari concentrates treated in reverberatories, the flue dust amounted to 7.59% of the furnace charge. At present, it amounts to about 3.92%. These excellent results have been attained following an exhaustive study of the dust-settling problem at this works and the installation of a reverberatory furnace to treat the fines. The stack loss has been reduced to 2589 lb. of copper in 24 hr., according to a test made in September, 1913. The other metals lost through the stack were: Silver, 61.2 oz.; lead, 2286 lb.; zinc, 2808 pounds.

The Ore Beds Are Periodically Leveled by the Plow

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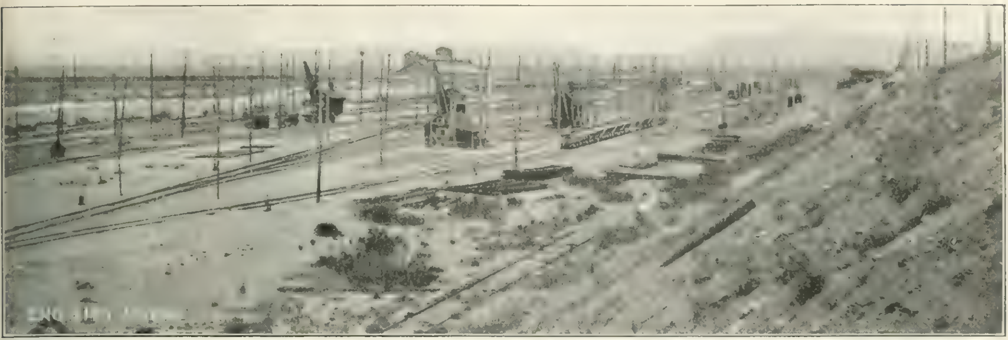
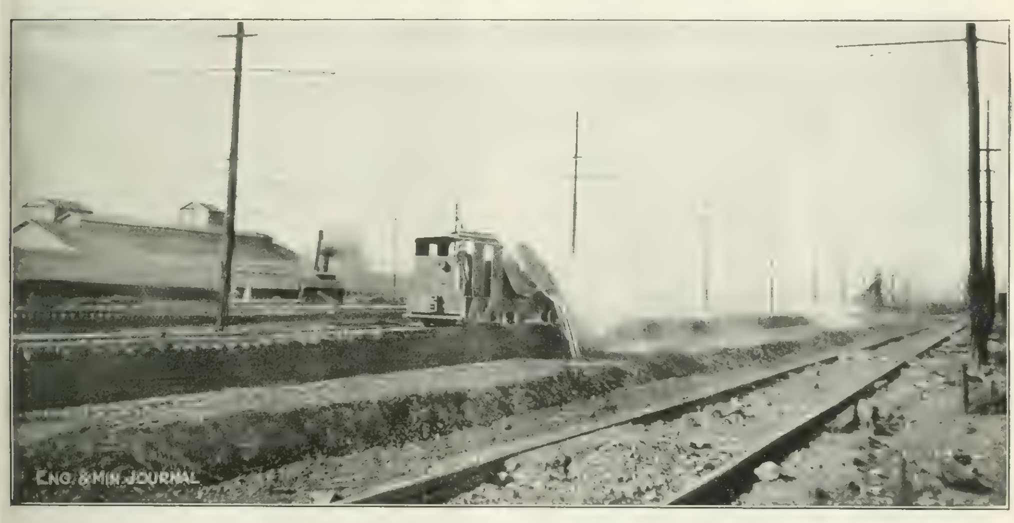
[1] "Eng. and Min. Journ.," Vol. LXXXII, p. 298.

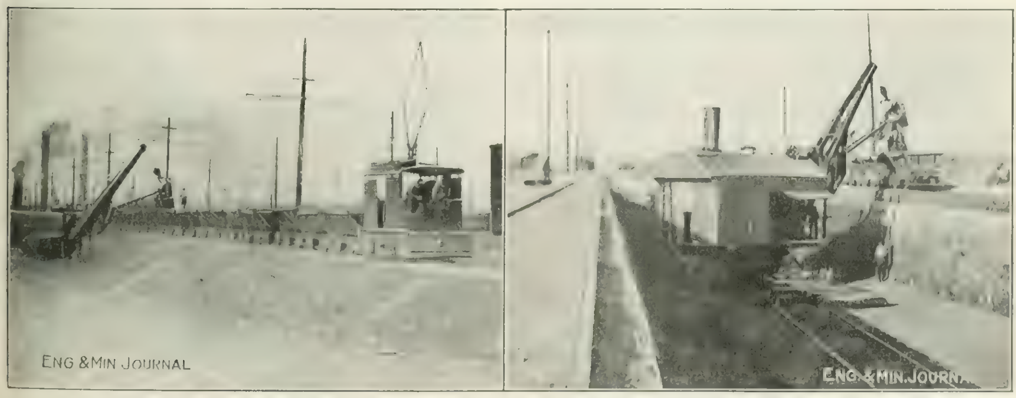


View of Ore Beds from Copper Queen Works



Pouring Molten Converter Slag on One of the Ore Beds

This slag was formerly poured on the ground, broken and loaded in cars by hand, and added to the furnace charge, about 50 men being required for converter-slag disposal. Now the molten slag is poured on the ore beds as the latter are being made, only six men being required for this work. The steam shovels experience no difficulty in digging the thin layers of solidified slag.



Loading the Furnace Charge Trains

A charge train comprising 20 cars is loaded in 10 min., the steam shovels dropping one dipperful in each car. Two men clean up the bottom of the rock-walled pit behind the steam-shovel dipper, shoveling the ore forward to the main bank.

The matte fall ranges from 18 to 20%, and for a recent month was 20.9%. The slag averaged SiO_2, 35%; Al_2O_3, 12.2; FeO, 42.9; CaO, 3.1; MgO, 2.5; Cu, 0.39%. The slags used are high in alumina, and the combined silica-and-alumina limit is set at 48%. The maximum alumina for good running is 12%. Lime flux was abandoned about four years ago and since then no limerock is added regularly to the beds or as flux. Converter slag is used in place of limerock as flux and in consequence the FeO contents of the slag are high, and the CaO correspondingly lower. The average matte analysis for the month was: Cu, 33.4%; Ag, 6 oz.; Au, 0.1 oz. The coke on charge was 12.7%, and the sulphur 12.5%, the copper 6.7%, and the alumina 7.4%. The average blast pressure for the month was 27 oz. and 69,287 cu.ft. of free air were used per ton of charge. The average tonnage of the furnaces was 310 tons or an equivalent of 4.85 tons per sq.ft. of hearth area. An average of 8.08 furnaces were operated last year.

More Roasters Contemplated

There are nine water-cooled McDougal roasters for calcining the Nacozari concentrates, and on account of the increased amount of sulphide ores coming from the Bisbee mines it has been decided to build seven more McDougals. The roasters now in use have six hearths and are 18 ft. in diameter. The Nacozari and other concentrates are usually received in flat-bottom cars that are emptied by shoveling the concentrates into bins under which there is a conveyor leading to a bucket elevator. The latter delivers to an automatic-tripper conveyor that keeps the hoppers supplied with concentrates. When the roasting furnaces were first installed, they were run at a rate of about 68 to 78 tons per day. This was later reduced to 58 tons; when all the furnaces are in operation, the best results are obtained with a duty of about 50 tons per furnace.

The concentrates contain about 32.5% of sulphur, which is reduced to 11% in the McDougal furnaces. The shrinkage in tonnage resulting from roasting is about one-sixth. Practically no fuel is used, except a little oil at the time of starting. About 5.2% of dust is made in the roasters, this being collected in a dust chamber, 42 ft. wide by 144 ft. long, having a cross-sectional area of about 1200 sq.ft. The calculated velocity of the gas flow in the chamber is about 4 ft. per sec. The dust chamber is built of hollow tile and steel, and has wires suspended at intervals of 3¾ in. from chains hung at 6-in. centers.

Reverberatory Furnaces

There are three reverberatory furnaces 19x91½ ft., each equipped with two 520-hp. Erie City water-tube waste-heat boilers. When first started, siliceous fettling, carrying about 80% SiO_2, was used and the furnaces smelted about 229 tons per day, difficulty being experienced with siliceous floaters. The present fettling is siliceous sulphide ores from Bisbee, and flue dust; the ores contain about 15% S, 7% Cu and 23% SiO_2. For the side walls and bridge, these fettling materials are used exclusively, being dropped through the roof; but quartz is thrown in at the throat. With this fettling, the tonnage has increased to 300 tons per day as an average, with occasionally 320 tons for a period of a few days. Fettling with oxidized copper ores resulted in metal loss. It is expected that the new No. 3 furnace, which has about 18 in. of magnesite brick at the slag line, will not require fettling at the throat, but the usual fettling material is dropped along the sides of the furnace.

The charge smelted consists of about three parts calcines, one of flue dust and one of fettling ores. No barren flux is added. The matte fall for a recent month was 31%; the average copper tenor of the matte about 36%, with a slag carrying 37.8% SiO_2, 11.9% Al_2O_3, 39.2% FeO, 1.7% CaO, 0.5% Cu. This was when fettling with Bisbee sulphides; when fettling with oxidized ore and making practically the same slag, the copper content was sometimes as high as 0.56%. The oil consumption is usually about 0.9 bbl. per ton of charge smelted, and occasionally is as low as 0.8 bbl. per ton. The oil is heated by exhaust steam to 175° F., and is atomized in the furnaces by air at 11-lb. pressure.

The reverberatory gases are received in a dust chamber 132 ft. long, built of hollow tile and steel. The first and last bays of the dust chamber have baffles, but in the other bays are steel wires 3¾ in. apart suspended from chains hung at 6-in. centers. Little dust, however, is made by the reverberatory furnaces. In the reverberatory boiler room there are, besides the boiler-feed pumps, two Aldrich triplex electrically driven pumps for supplying cooling water to the roasting furnaces.

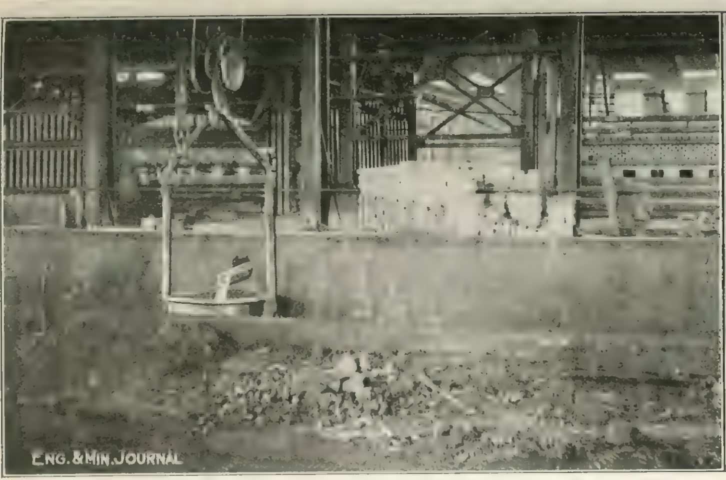
Converting in Upright Shells

The converting department at Douglas formerly comprised eight barrel-type converters, 8x11½ ft. In 1912 was begun the gradual replacement of the barrel converters by seven 12-ft. upright converters having concentric mouths. During the reconstruction, most of the copper production was made in four of the upright stands. The converters were crowded at this period and in consequence collar troubles were experienced, but these have since decreased, with the greater leisure obtained by the operation of the seven upright stands. A collar puller of the Old Dominion type is used.

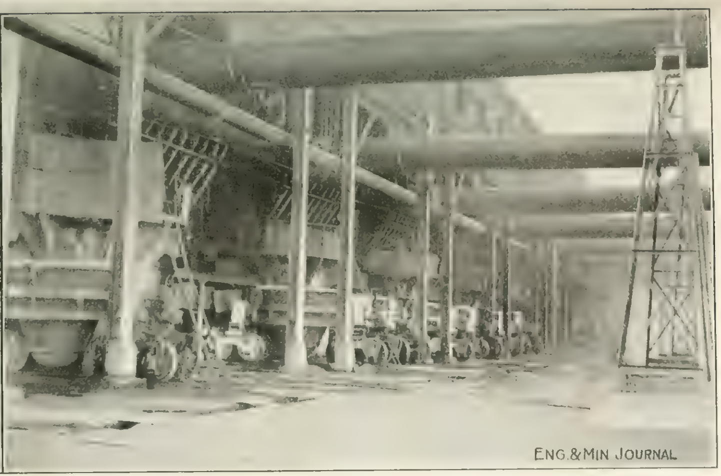
The matte is brought from the reverberatory and blast furnaces in ladles holding 80 cu.ft. The practice in starting a converter is to blow the first ladle, or even two or three ladles without silica, to form a coating of Fe_3O_4; then about one ton of siliceous ore, carrying 74% SiO_2, is added and about six tons of 1[illegible]% matte. The dished bottom of the converter is 16 in. below the tuyeres, at the center. Some slopping of the converters occurs, amounting perhaps to 5% when the converting capacity is crowded. The converter slag as skimmed contains about 1.5% copper, but including all white metal and cleanup, it carries about 5% copper, 22.2% SiO_2, 45.7% Fe, 2.5% Al_2O_3. Ordinarily, two punchers are employed for each of the upright converters, and one skimmer to two converters. A head skimmer is also employed to assist anywhere in the converting operation. As a rule, the converters are operated at high speed.

Novel Disposal of Converter Slag

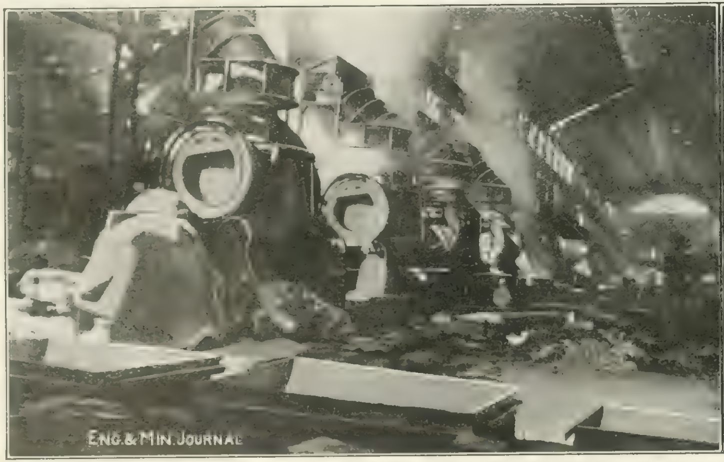
In 1913, Superintendent Rutherford introduced a new method of disposing of the converter slag, which at this plant is needed for fluxing the blast-furnace charge; the slag is now poured on the ore beds. Formerly about 15 Mexicans were employed in breaking and loading converter slag for transfer to the blast-furnace bins. About



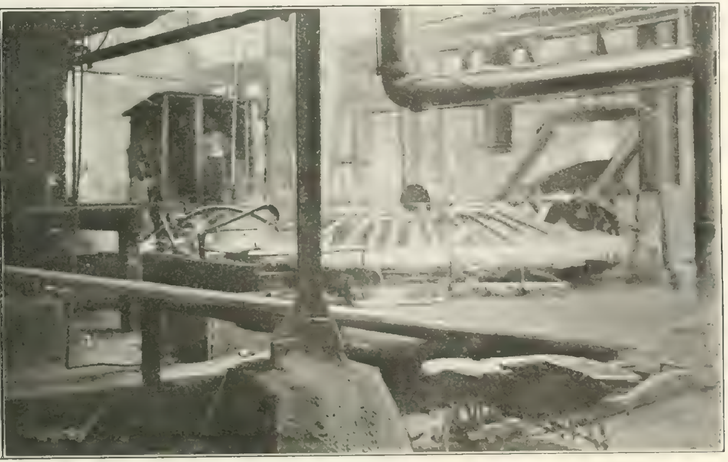
Taking a Tap from the Reverberatory Furnaces
The Copper Queen plant has three oil-fired reverberatories, each 19x91½ ft.



Copper Queen Blast Furnaces
Slag is removed in 140-cu ft. motor-tilted pots, drawn by electric locomotives.



There Are Now Seven Upright Converters at Douglas



Casting the Converter Copper in a Walker Wheel

40 of these men have been eliminated by the new method, effecting a saving of about $60 per day.

Now two men, a motorman and swamper, are all that are required for the disposal of the molten slag. The slag is hauled to the tracks alongside the ore beds, and as the motor moves along the bed, the slag pot is slowly tilted so that its contents are spread over the ore bed in a thin layer. Before the slag layer becomes too thick, more ores are unloaded. The thickness of the slag layer is usually from one to two inches and when loading from the beds, the steam shovels have no difficulty in cutting the bank of ore containing the thin layers of solidified slag.

Important Saving in Converter-Slag Disposal

One of the accompanying illustrations shows the converter slag being poured on the bed. This method of converter-slag disposal, while not applicable to other smelting plants, has admirably disposed of the problem at this works. Summarized briefly, it has eliminated the breaking and loading by hand of approximately 100,000 tons of material per annum.

When the method was first tried, two men were required at the beds to prevent the hot slag setting fire to the railroad ties and wooden trolley poles. Steel ties and steel-sheathed trolley poles have solved the fire problem, and at present only six men are now employed in converter-slag disposal as against about 50 men employed on this work at the beginning of 1913. The converter slag shells have still to be broken, but it is contemplated that these will be disposed of by the new skullbreaker which is to be erected in the main smelting building.

The finished copper charge is poured into two small ladles and taken by electric traveling crane to the pouring stands of two Walker casting wheels, 21 ft. in diameter. The bullion ladles are too small for the present operation with upright converters, two being required in order to take the usual charge from the converter, thus involving extra crane service and often unnecessary delay. However, with the present ample converting capacity, this does not cause the inconvenience that was apparent during the construction period when only four upright-converter stands were available.

The erection of a copper-casting furnace to facilitate the handling of the converter copper is under consideration. Other improvements contemplated in the converting department include a tower to remove crane trolleys. There are four electric traveling cranes in this department, all of 60-ton capacity.

About 40 tons of copper are produced per day per converter. The copper bullion averages 99.2% copper, 0.4 oz. gold, 28 oz. silver. Normally from eleven to twelve million pounds of bullion are produced per month. In 1913, nearly 50,000 tons of siliceous ores were smelted in the converters as flux.

Power Plant

In the main boiler house at Douglas, there are eight 500-hp. water-tube boilers, but since the installation of the reverberatory waste-heat boilers, only four to five of the power-house boilers are regularly used. They are equipped with economizers; all steam generated is superheated in a separately fired Foster superheater to 460° F. and reaches the engines at about 440° F. No feed-water heaters are used, the feed water being drawn from the condenser hotwell. The reverberatory waste-heat boilers are credited with the utilization of 34.57% of the heat developed by the oil burned in the reverberatory furnaces; the oil used is California crude containing 18,400 B.t.u. per lb. and weighing 8.05 lb. per gal. at 60° F. The oil consumed in the boiler plant is 1.125 lb. per indicated horsepower-hour delivered by the power plant.

Air is supplied to the blast furnaces at 28 oz. pressure by 11 rotary blowers direct connected to Nordberg tandem-compound engines. A feature of the blast service at this plant is that each furnace's air supply is received from an individual blower unit, though valve connections are such that a blower can supply air to either of two furnaces, or all the blast-furnace air can be delivered to a common main.

There are five No. 9 Connersville blowers operating at 78 to 90 r.p.m., and six No. 10 Connersville blowers, operating at 56 to 66 r.p.m. There are also two No. 7 Connersville blowers, arranged for electric-motor driving, that are not used at present. Converter air is supplied to a common main at 12½- to 13-lb. pressure by seven Nordberg cross-compound engines, five of which deliver from 4000 to 6000 cu.ft. each and two deliver 12,000 cu.ft. each per minute.

To develop the electric power used within the works, there are four 400-kw. 260-volt direct-current generators direct connected to cross-compound engines. The current is used by 14 electric locomotives, 7 electric cranes and about 60 stationary motors. The exhaust steam from the reciprocating engines may be delivered to condensers or to one of two 750-kw. mixed-pressure turbogenerators, which produce 60-cycle, three-phase, 2300-volt alternating current; this is stepped up to 44,000 volts and transmitted to El Tigre mine, 67 miles distant in Sonora.

The average daily power developed in the Douglas power plant in 1913 was 4595 i.hp., which required 13.65 lb. of steam per indicated horsepower. About 6% of the power is used in the accessories of power generation, such as boiler-feed pumps, water-circulating and air pumps, lighting of boiler and power houses, etc. The cost of a horsepower in 1913 was $54.84 per year.

The Copper Queen reduction works are under the direction of S. W. French, general manager of the Copper Queen Consolidated Mining Co.; G. H. Dowell, assistant general manager; and Forest Rutherford, superintendent. An average of 1039 men was employed at the works in 1913, equivalent to one man for every 1149 tons of charge, or one man to every 999 tons of new marginal material smelted.

Hancock Consolidated

The Hancock Consolidated Mining Co., Hancock, Mich., according to its report for 1913, produced 212,089 lb. of copper, which it sold for $33,912. In addition to receipts from metal produced, it received $13,280 from assessments and borrowed $165,000. Total expenditures amounted to $206,414, leaving a balance of $5778 on hand at the end of the year. The company now owes notes amounting to $260,000 and accounts amounting to $33,146. Against these liabilities it has cash, supplies and accounts receivable amounting to $28,502, making a balance of $264,644 in liabilities. The mill treated 12,612 tons of rock, yielding 16.82 lb. of copper per ton.

Hydro-Electric Plant at a Bolivian Tin Mine

By Mark R. Lamb*

SYNOPSIS—The building of a dam to supply power for a tin-mining operation in a country of great altitude and no constant water supply. Rivers are alternately dry and torrential in the different seasons. Native laborers are exceedingly unsatisfactory, since they are indolent and insufficiently nourished. European power-generating machinery is used to equip the plant.

The installation described here is that of the Cia. Estañífera de Llallagua, in Bolivia, South America. The first project for a dam was for a height of 50 m., and the estimated cost was $145,000, not including the cost of the cement placed on the job. It is impossible to calculate the cost of transportation, which is necessarily by llamas. Later modifications, at the request of the directors who desired to increase the power to accord with the increased development at the mine, were such that the height was increased to 58 m. above bed rock. Lack of facilities for such work, together with its isolated situation, were the causes of an unexpected increase in its cost. It should be said in general that in that part of Bolivia, so distant from the coast, it is utterly impossible to complete such a job at the ordinary calculated cost. There are too many factors which unexpectedly increase expenses.

Difficulties of Transportation

Transportation difficulties are great. Every piece of freight must be handled at least 10 times between the coast and the job, and this handling is done without the usual conveniences and without any consideration for the nature of the material. The roads and trails are scarcely deserving of the names, and it is difficult to transport delicate parts without damage. Important articles made of glass and brass are broken, lost or stolen, and often require months to replace. Due to the distance from the coast there are delays, losses of liquids, damage to cement, and total loss of some packages which can only be replaced by ordering from the factories. As a case in point, I may mention three large transformers which reached the job without a drop of oil. Oil for refilling consisted of the contents of 70 drums, and had to be ordered by cable. The same difficulty occurred with the marble switchboard, not a panel arriving in good condition in spite of its special packing.

Native Labor Unsatisfactory

Suitable labor is usually scarce. In starting the dam construction it was found necessary to recruit in the various mining districts and Indian towns, and to pay an increased wage from the beginning. The wages varied from 80c. to $1.60 per day. Wages are actually paid in bolivianos, which have a fixed gold value of 39c. U. S. currency. Bolivia, like all other countries, is issuing a paper money since the beginning of the war, and the value of the bolivianos will undoubtedly diminish.

The Indians, as well as the half-breeds, live almost exclusively on cocoa, which they chew during the entire day. While cocoa is a stimulating food, it is insufficient for a working man who expects to do any real labor. The result is that the Bolivian workman on the high plateau is not the equal of laborers elsewhere, and this is easily seen where heavy lifting or other muscular effort is required.

A large number of religious holidays and their long duration take the laborer away from his work much of the time, and it is only possible to count on 200 working days in the year. Pay day is more certainly a day of no work than a holiday, since wages must be spent as quickly as received.

Mouth of the Waste Tunnel. Mr. Ghigliotto, Manager of the Llallagua Co.

Skilled Workmen Are Scarce

Good masons, mechanics and carpenters are scarce, and for a big job must be contracted for at increased pay. They earn from $2.50 to $4 per day. These factors must be taken carefully into account, since they influence the cost of the work and increase it over similar work elsewhere in South America.

Bolivia will probably never be a pleasant field of operation, and labor will always be scarce. At the altitude of a mining district, 12,000 to 15,000 ft., the only laborers who can possibly do the work are the natives; that is, it is not possible to import labor from other countries, no matter how rich the mines, so the native population is the only one to perform the manual labor. Besides this, the Government is doing its best to exterminate the natives by placing in their hands an unlimited quantity of 40° alcohol. The Indians who are not under the influence of alcohol are stupefied with cocoa.

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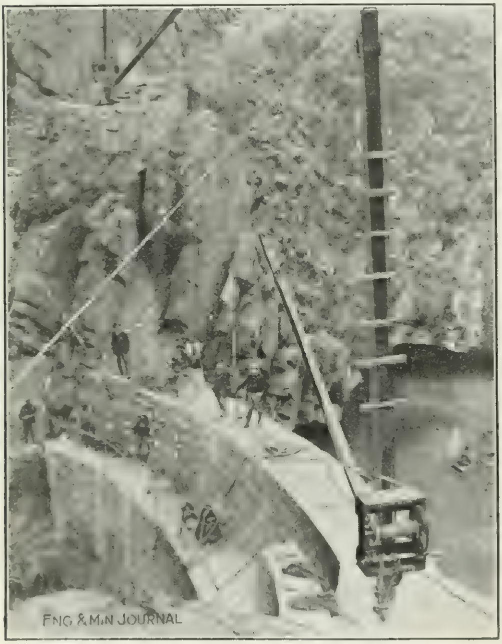
*Manager, Allis-Chalmers Manufacturing Co., Santiago, Chile.

The unexpected seems to present itself more frequently in Bolivia than elsewhere, and it will suffice to mention the fact that there is an absolute interruption of all communication and transportation with each heavy rain. Another thing which cannot be counted on beforehand is the number of small revolutions and rebellions of the Indian tribes.

Site of the Dam

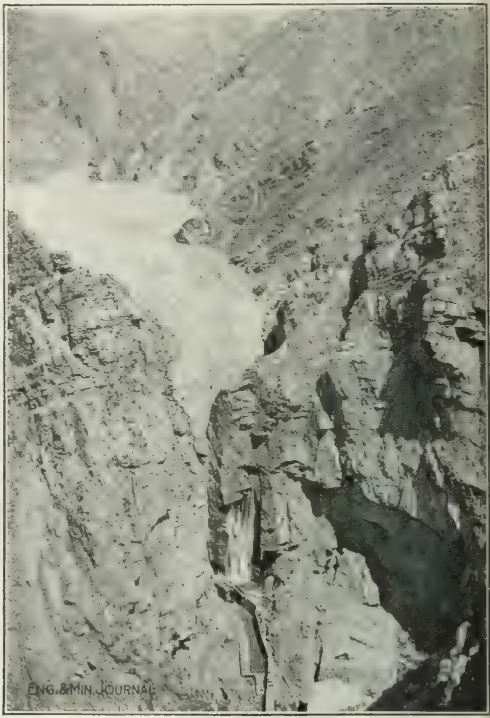
Fifteen kilometers from the Llallagua mine, the Catavi River runs through a narrow gorge in the mountain for a distance of 500 m., and the narrowest point in this cut makes an almost right-angle bend. At this point the cut is only 2 m. wide for a height of 20 m. From this point it opens out, and at 60 m. the width is 30 m. Further up the gorge widens out to 180 m. The Catavi, Uncía, Zauta and Challanta rivers, together with various branches, run out to this cut. The amount of water varies a great deal, and the dry season of the high plateau of Bolivia, which is in November, is succeeded by the heavy rainfalls of the spring, from December to April. In the dry season the total flow of the above rivers does not exceed 200 liters per second, while during the rainy season the flow has reached as much as 70 cu.m. per second. The water is from a shed of 8000 to 10,000 hectares. Several measurements of a rainfall of 20 liters per sq.m. during an hour have been obtained.



Crest of Dam during Construction

This irregular flow makes it necessary to impound all of the water which falls during the rainy season, in order to have a constant supply of power, but the dry-season flow would not be sufficient for requirements. In order to have sufficient fall and water for the turbines during all the year, it was necessary to have a head of at least 30 m., it being figured that an average head of 42 m. would be obtained.

The dam was designed for a height of 58 m., with a waste weir which would maintain a water level of 55 m. during the rainy season. At this level it was estimated that enough water would be stored to supply power during the entire year.



Llallagua Dam and Lake

The lake so formed is 6500 m. long, with a width which varies between 50 and 300 m., and there is capacity for 18,000,000 to 20,000,000 cu.m. of water. The dam is built *en arco,* both horizontally and vertically. The horizontal arch has a 1-ft. 10-in. versed sine, which was considered advisable for resisting the hydraulic pressure.

Construction of the Dam

The dam is built of cut stone laid in river sand and gravel, hydraulic lime and Alsen cement. The work is reinforced with I- and T-beams, and steel cables at three different levels. The dam foundation is 5 m. below the level of the river and 58 m. above the river at the crest. The base of the dam is 38 m. thick. At 55 m. the dam is three meters thick, with a crown 3 m. high and 1½ m. thick.

The water reaches the turbines through a 65-m. tunnel, through which it flows to a Mannesmann 0.70-m.

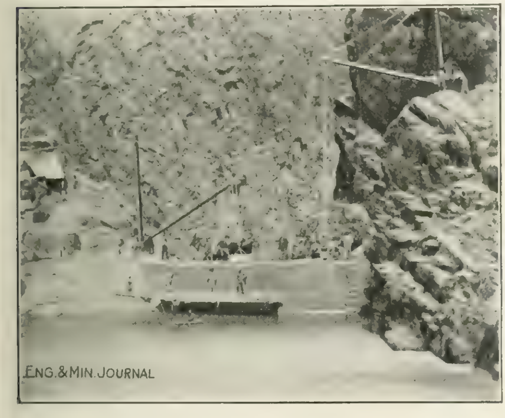
pipe 70 m. long. The turbine house is built for four turbines, direct-connected to their respective generators, of which three are already installed. The turbines are of the horizontal type, built by Escher Wyss & Co. Each turbine passes 180 to 300 liters of water per second, depending upon the water level, and developing 200 to 320 hp. The waste weir is in a depression of a hill, which is at the center of the sharp turn of a river, and located about a kilometer above the dam, discharging to the river bed below the dam.

The generators run 750 r.p.m. and generate a 3000-volt current, which is transformed to 10,000 volts for transmission to the mine. The line loss is 150 volts over the 15 km. The line passes over ground from 3500 to 5000 m. high.

The dam has demonstrated its resistance and strength since completion, having successfully withstood an overflow a meter deep on the crest before the waste channel was completed.

DIFFICULTIES OF THE WORK

The work has been particularly difficult due to its great distance from the coast. The railway haul is 900 km. to Cahllapata, and from there five days' journey in two-wheeled carts to the mine. From the mill there is a day of cart haul to the head of the inclined plain. From the foot of the plain the material was transported on a small Decauville railway to the dam site. The cement was carried from the railway to the works on llamas, and the most of it was lost on the way. The llamas required seven days for the trip, and sometimes were weeks on the way.



LLALLAGUA DAM, UPSTREAM FACE

It is a curious commentary on human affairs that three years were laboriously spent in building this dam, and it had just begun to furnish cheap power to the Llallagua Tin Mining Co., when the company bumped up against a war and has no market for the tin. Although the United States consumes the majority of the world's tin production, there is no one in America who will buy and smelt tin concentrates. Americans are talking loudly about supplying the needs of South America, but they forget that the first need is a market for nitrates, tin, copper, silver, rubber, cotton, and all the various products of South American countries.

La Sirena, a Wonderful Deposit of Jamesonite

By R. W. RAYMOND

Economic Geology for July last (Vol. IX, No. 5) contains a paper by Waldemar Lindgren and W. L. Whitehead describing an ore-deposit of exceptional geological interest and commercial value; namely, the body of lead-antimony ore known as "La Sirena," near Zimapan in the State of Hidalgo, Mexico. From that paper, together with reports by H. O. Hofman and R. H. Richards, on the mechanical and metallurgical treatment of the ore, the following account has been condensed, in the hope that it will prove interesting and instructive to the readers of the ENGINEERING AND MINING JOURNAL.

This deposit is about 9 miles northeast of Zimapan, on the upper slopes of the lower half of the great Moctezuma cañon. The outcrop appears in the face of a high limestone cliff, and the ore apparently follows the bedding of the limestone, dipping about 40 deg. S. into the mountain mass. It is traceable on its course for 1500 ft., and shows, according to Prof. Lindgren, minimum thickness of 30 ft. through 900 ft. of this distance. At some points more than 100 ft. of thickness has been measured. His very cautious estimates are evidently well within the truth. The extent of the body on the dip has not been determined—as it could not be, without explorations, which, on account of the present disturbed political condition of Mexico, have not yet been made.

Professor Lindgren, one of the most acute observers and logical reasoners in the study of ore-deposits, recognizes this case as clearly one of replacement, yet pronounces it to be of "a most unusual type." Its exceptional features may be appreciated through a careful study of his detailed description of its mineralogical character.

The Cretaceous limestone in which it occupies a horizon not more than 2500 ft. below the Cretaceous plateau of the Sierra Madre Oriental is traversed near the eastern end of the deposit by a dike of basic rock (dark gray, jointed, and partially iron-stained porphyry), through which, probably, the metasomatic mineralization took place. But the products of ordinary metamorphism (the recrystallization of minerals, etc.) are confined to the interior and the neighborhood of this dike. The great ore-body itself is not the result of contact-metamorphism, but of replacement facilitated by the shear-zone of the dike. The authors of the paper express their belief "that a vast amount of calcium carbonate has been carried away, but that, volume for volume, this calcite has been replaced metasomatically by minerals deposited from solutions carrying silica, alumina, sodium, boron, fluorine, phosphorus, arsenic, sulphur, iron, zinc, lead and antimony." Of these, the nonmetallic solutions, depositing danburite, garnet, albite and quartz, are believed to have been the earliest, and to have been followed, after no great interval, by solutions of magmatic origin, which deposited pyrrhotite in the still hot dike-mass, and other metallic sulphides in the cooler replacement mass within the limestone.

The metallic ore-minerals (all, probably, later than the gangue-minerals) are, in the order of their formation, arsenopyrite, pyrrhotite, blende and jamesonite (2PbS.Sb_2S_3), a sulphide of lead and antimony.

The most peculiar feature of the deposit is its evident formation at very high temperature. Without quoting in detail the argument establishing this conclusion from the paragenesis of certain minerals (especially the actinolite, which is practically contemporaneous with the jamesonite), we may accept the statement that "there is strong ground for believing that the deposit was found at between 400 and 550° C.," and thus, in the opinion of the authors, "presents a most important link between contact-metamorphic and hydrothermal replacement deposits," having some of the features of both, but not all the features of either.

At present, this occurrence possesses, perhaps, a greater economic than scientific interest. For the world-war has already revolutionized trade in antimony. During the last few weeks, this country has figured perhaps for the first time as an exporter of antimony to Europe, although it is an importer in ordinary times of about twenty million pounds annually. The usual sources of supply are Oriental, and have become seriously uncertain.

The price has risen from about 7c. in July last to about 14c. at the end of November. During the Russo-Japanese war, it reached 27c., and remained at that figure for a considerable period after the declaration of peace. This time, its probable scarcity and consequent rise in price will be enhanced by a large demand for the metal as an ingredient of the alloy used for many sorts of projectiles. A recent circular of the Marlin Fire Arms Co., of New Haven, Conn., gives from 7 to 15% of antimony, from 7 to 10% tin and from 75 to 86% lead as the range of composition for bullets to be used in smokeless-powder, high-velocity cartridges. Modern shrapnel for field-artillery contains about 12.5% of antimony, and consists of spherical slugs, 2 oz. in weight, of which each shell carries from 250 to 300. Every shell thus discharged throws away about 70 oz. of antimony.

The accounts in every day's newspaper of furious artillery fighting along hundreds of miles of firing line are enough to show how great is this sudden demand for antimony, and to warrant the apprehension of famine prices entertained by many industrial consumers.

This situation renders the description of La Sirena almost sensational. For it presents, *prima facie,* the appearance of an enormous body of antimonial-lead ore, so formed and located as to be cheaply mined on a large scale and so constituted mineralogically as to be capable of profitable reduction by known methods. To state, in outline only, the elements of economic value which make up this *prima facie* case:

(1) The size of the deposit is probably even greater than is indicated by the face exposed. At all events, a little development work will make that matter clear.

(2) The quality of the ore is estimated by Professor Lindgren, upon samples taken by himself, as "at least 8% of lead and 1% of antimony." Other samplings at the same places have given similar results; but still others, taken at points not accessible to him, indicate a much higher average. It is safe, therefore, to accept his figures as a minimum average. In any event, they are high enough for profit, provided the ore can be successfully reduced on a large scale.

(3) Here the evidence of Professors Hofman and Richards seems to be conclusive. They have found that the Dwight-Lloyd blast-roasting and sintering process is peculiarly effective in separating lead and antimony with minimum loss of metals. Apparently the presence of these metals combined in the single mineral, jamesonite, is more favorable to such a treatment than their occurrence separately as galena and stibnite. If the ore as mined is not rich enough for direct roasting, it can be concentrated, by methods which Professors Hofman and Richards have proved in the laboratory, to a product containing not less than 25% of lead and 15% of antimony.

This product, or crushed crude ore of sufficient richness, can be treated on the Dwight-Lloyd machines, volatilizing the antimony and arsenic as oxides (to be recovered in dust-chambers), expelling the sulphur to a satisfactory degree, and leaving a sinter high in lead, low in sulphur, arsenic and antimony, and highly suitable for smelting in the blast furnace with siliceous and pyritiferous silver ores and silver-lead ores, such as are produced in the neighboring districts.

The metallurgical proposition seems to be entirely reasonable and feasible. Of course, all the conditions now indicated will have to be verified on a larger scale, and the exploitation of the immense orebody by modern cheap methods will require a large expenditure on mining and transportation, as well as metallurgical plant. But capitalists are not afraid to make large investments in really great mines.

There is but one unfavorable feature in the case: the political condition of Mexico. So long as all the military factions in that country find so much enjoyment in fighting and plundering, and our government takes so much pains not to protect the interests of Americans in Mexico, the song of La Sirena might prove a deceitful lure. But matters in Mexico have now come in every way to such a pass that, since they cannot well become worse, they must soon mend or be mended. Under any government that maintained order and encouraged industry, this immense and unique ore-deposit would be developed quickly into a source of new wealth for Mexico and the world.

Liability for Accident to Miner

By A. L. H. Street*

In a suit for damages for death of a miner who was killed by a fall of rock while at work in a finished chamber, the California Supreme Court lately held that a miner is under no legal duty to make any more extensive inspection of his place of work, to determine its safety, than would be exercised by an ordinarily prudent miner in the same circumstances; that a miner at work in a finished chamber need not exercise the high degree of care to avoid falling rock that is required in driving a new shaft; and that $20,000 was not excessive recovery in this case for the benefit of a surviving widow and four children, it appearing that decedent was only 33 years old and was earning $3.50 per day. (Grabbe vs. Mammoth Channel Gold Mining Co., 143 *Pacific Reporter* 714.)

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From Stavanger, Norway, is Reported the Discovery of Hematite Iron Ore of excellent quality. The discovery comprises three lodes of considerable width, running parallel with each other. The deposits are situated at Lund, in the parish of Dalene, and close to a railway station. According to the "Iron and Coal Trades' Review," they have been examined by a mining expert, who has given a favorable report on them. In several analyses of the ore the iron content varied between 62 and 67%. It is understood that an English company had an option for the purchase of the deposits, and was about to start trial work to ascertain their extent, but operations were postponed on account of the war.

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*Attorney, St. Paul, Minn.

Quartz Veins in Lamprophyre Intrusions

By John F. McLennan[*]

SYNOPSIS—Quartz veins occurring in lamprophyre dikes, especially minette dikes, in granitic rocks, are often gold- or silver-bearing to a limited depth; i.e., within a "reconstructed" zone enriched by downward concentration. Experience shows that while the ore within the altered zone can be profitably mined under conditions favorable for mining, all attempts to find ore at greater depth have proved futile.

In the Sierra Nevada Mountains and the interior Cordilleran region of North America, and likewise in many foreign places, there are numerous examples of gold-quartz veins following lamprophyre dikes or sills in granitic rocks. This class of ore deposit has, as far as I am aware, received little attention from writers on economic geology. Consequently the engineer in quest of information on this subject searches mining literature in vain. This article in its treatment of the vein system in consideration deals particularly with California phases, as being representative of the type.

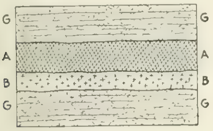

Fig. 1. Ideal Section of a Lamprophyre Controlled Vein

A, quartz vein; B, lamprophyre dike foot wall; G, sheeted or schistoid granite.

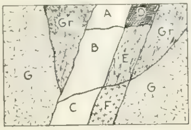

Fig. 2. Ideal Cross-Section of a Lamprophyre Controlled Vein

A, upper portion of reconstructed part of vein further enriched by downward concentration; B, lower portion of reconstructed part of vein; C, primary filling without value; D, kaolinized portion of lamprophyre dike forming foot wall; E, sericitized portion of dike; F, unaltered portion of dike; Gr, altered schistoid granite; G, normal granite.

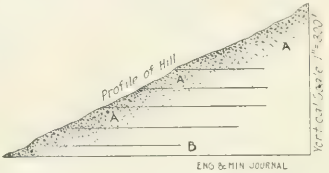

Fig. 3. Longitudinal Section, Golden Jubilee Vein

A, important orebodies; B, primary conditions, quartz without value.

As is characteristic of similar regions in other parts of the world, large tracts of the granite areas of the Sierra Nevadas and adjacent mountain ranges in process of cooling and solidifying by crystallization of the outer portions of the magma were subjected to internal stresses, and, under force of increasing contraction, numerous joint planes, and even rents of much regularity and persistence in length, resulted. The fractures thus developed extended only in minor part to great depth. However, particular instances exist evidencing deeper trends, reaching to submagmas dissimilar in composition to the overlying rock. Into the stronger and more easily accessible fissures, pressure forced up the still liquid material, producing dikes and sills ranging from a few inches to many feet in width. The submagmas, or liquid inclusions, were strongly ferro-magnesian, and the resulting dikes chiefly the lamprophyre, minette. The aplitic intrusions are not referred to, as they do not have direct bearing upon the subject in consideration in this discussion.

From facts demonstrated by exploration, as well as through study of the general phenomena governing the conditions, it is particularly evident that the fissuring action was wholly crustal in nature, and that even the source of the lamprophyre was not, at the time of ejection, lying at remote depths. In fact, a measure of caution is necessary in order not to confound or class this action with the great dynamic forces that gave inception to the profound fault fissures that in the succession of time received their contents from abysmal depth.

Quartz Veins with Lamprophyre Foot Wall

Following many of the lamprophyre dikes or sills and occurring in direct conformity therewith are quartz veins varying in thickness and continuity. In general, these veins along their dip rest on the upper side of the dikes; in other words, the dikes form their foot walls. Genetically, the source of the vein-forming materials is assigned to the magma, which in process of cooling and condensation expelled aqueous solutions charged with silicic acid, together with minute quantities of the metallic compounds distributed in the congealing mass. With the dense lamprophyre acting as a barrier to the further advance of the solutions, stagnation, followed by deposition of vein quartz, took place, the magnitude of the deposits being commensurate with the degree of enlargement of the spaces formed by the progressive shrinkage of the dikes, and also of the region bordering the dikes.

The vertical distance reached by the magmatic waters which deposited the quartz in these veins is not in general, according to evidence, remarkably great. I have on frequent occasions in mine workings observed its total disappearance, either by absorption into the dike or the blending below of the dike rock with the granite mass, or quite commonly by a gradual reduction to pegmatite; and again conditions exist where the quartz continues indefinitely, but only as a barren glassy mass coalesced to its surroundings, and devoid to any determinable extent of metallic minerals.

Post-Enlargement of Veins Resulting through Chemical Action

The granites usually inclosing the lamprophyre dikes and quartz veins range from rock with orthoclase predominating to varieties with plagioclase in excess, there being a like range of the mica, hornblende and pyroxene minerals. Adjacent to the veins, and frequently for considerable distances outward, the granite, as well as the dike rock, has undergone a strong degree of sericitization, followed by weathering, but with marked alteration not, however, extending to great depth, the weathering in particular being limited to a vertical range of a few feet, rarely to a depth exceeding 200 ft. In the process of chemical change, the lamprophyre underlying the veins was deeply altered, with the abstraction of silica, to varying but limited depth, the alteration product usually consisting of a white or gray to yellowish or brownish clayey to sericitic matter with the dikes again gradually assuming normal condition as a certain point is passed. Less frequently, conditions obtain where the underlying dikes still retain their original structural features though metamorphosed and leached, or even when softened. The neighboring granite inclosing the veins also suffered a loss of silica. The siliceous solutions thus developed gathered and brought with them in concentrated form, as it were, much of the gold and various metallic minerals infinitesimally distributed in their path, and invading the practically barren quartz veins caused a complete change in texture and mineralization, or a transformation from a compact glassy mass to a more or less waxy and sometimes cellular quartz of diversified crystallization carrying commercially important quantities of gold. But the conditions that permitted the deposition of the metallic contents and the change through accretion of new gangue-forming material from without, were effective only in the zone of alteration; at a limited distance below the surface, or beyond the range of chemical action, the barren vein matter is certain to be reached, without even a remote hope of finding a restoration of the valuable metal. In veins or parts of veins where the upper portions have not undergone reconstruction, the same textural and valueless fractures obtain as in lower horizons. An additional fact of importance, apparent in the very uppermost portions of the veins, consists of a subsequent further enrichment, through successive downward concentration within the veins themselves, from parts later eroded away.

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Distinctive Characteristics of the Lamprophyre Controlled Veins

A distinguishing feature of this type of gold veins is, in part, their affinity for granitic rocks, either biotite-granite or grano-diorite, and less frequently quartz-diorite. But their chief distinction rests upon their persistent association with the lamprophyre, minette. As hereinbefore stated, the dike-controlled veins may stand at any angular position, even to perpendicular; on the other hand, the minor sheets of quartz following sills are low in dip, and at times are found lying nearly horizontal. The latter, however, on account of their usual extreme thinness, are seldom of economic importance.

In the region next the veins, the granite, in addition to chemical alteration, usually shows ill-defined schistosity and some decay. The minette dike-rock underlying the veins, though at times still retaining its structure in the presence of metamorphism of a strong degree, is usually completely decomposed to a kaolinized product for several feet in depth. At this stage the quartz veins are commonly strong and the gold content in many instances is of good tenor. Further exploration of the deposit shows the inclosing granite to be growing more compact and the kaolinized portion of the dike rock to have passed into a sericitic aggregate or developed into soft rock of schistose structure, with gold yet persisting, however. Still continuing to increased depth, it is discovered that both the granite and dike rock have attained a fairly normal condition, and that the vein-filling has become glassy and bound to the inclosing rock or has changed into pegmatite, or perhaps it has wholly disappeared by fading into the dike, or the dike has blended with the granite, obliterating the channel. In either event, here the wise man stops and sets out for a new venture. The other fellow, however, is keen on depth and drifts and crosscuts—he does not understand.

Mineralogy of the Deposits

The minerals accompanying the gold in the lamprophyre-controlled veins are often quite diversified. In the region north of the Tehachipi Mountains, the gold is frequently associated to varying extent with iron and copper oxides, pyrite, chalcopyrite, galena and sphalerite, and sometimes subordinate quantities of tellurides and their oxidized products, with the tellurium minerals when present giving much trouble in recovery of their gold contents. In the desert regions of southern California, where similar veins occur, silver is often a predominant constituent of the ore and frequently exceeds the gold contents in value.

Citations Illustrative of This Vein Type

Golden Jubilee—This mine, near Carville, Trinity County, Calif., conforms to a minette dike in grano-diorite. The vein in its course climbs a steep hillside and is opened by five tunnels at vertical intervals of 100 ft. Strong alteration follows the vein along the slope of the hill, reaching its greatest depth, which is approximately 200 ft., at the crown, and decreasing as the hill descends. The position of the altered zone is such that it was penetrated by all of the tunnels in their passage to the points hundreds of feet beyond. A phenomenon of large import, is the suddenness with which the gold disappears as the border line of the unaltered or primary conditions is reached. The upper or altered portion of the vein has in time past produced gold to the value of $200,000, with the likelihood at a future period of a further recovery of a like sum, from partly developed ore reserves still existing within the same source. The underlying unaltered territory conformable to the zone of alteration, although extensively explored, reveals nothing but bodies of uninviting massive quartz, devoid of value.

Dewey Mine—In the same grano-diorite area as the Golden Jubilee and three miles from that property is the Dewey mine, representing a certain phase of the type. The surface is deeply altered, and from the altered region some high-grade gold ore was extracted. Later a crosscut tunnel was driven, which passed through a minette dike 12 ft. wide. The vein was found on the other side of the dike, and drifts 8 ft. high were driven to the right and left on the curve of the vein. The top of the drifts shows 4 ft. of quartz, containing gold; at the bottom of the drifts the quartz is rapidly disappearing, with only a few barren stringers passing downward into an underlying schistose portion of the dike.

Granite Basin Mines—Granite Basin lies in the high

Sierras of Plumas County, Calif. The country consists of biotite-granite, grano-diorite and smaller areas of quartz-diorite. Both minette and mica-diorite dikes intrude the granitic rocks. Along these dikes occur quartz veins, which, while in the zone of alteration, yielded profitable gold ore. But the greater number of these veins before attaining depths exceeding 100 ft. petered out. A few of the stronger ones lingered slightly beyond this depth; but they, too, failed. Much foolish work followed, with frequent recurrence of fresh enthusiasm. Various occurrences similar to Granite Basin are found in the adjoining county, Butte.

Mother Lode Counties—In many parts of the Mother Lode counties, though never in the Mother Lode belt, and usually lying at great distances away, lamprophyre-controlled veins characteristic of the discussed type occur in granite. There is, however, another system of veins in this region occurring in granitic rock that cannot be included under this heading, and being widely at variance with the subject in hand is not in consideration here.

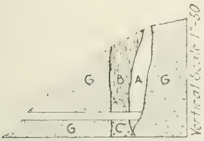

FIG. 4. CROSS-SECTION OF DEWEY VEIN

A, orebody; B, sericitized portion of lamprophyre dike; C, unaltered portion of dike coalescing with granite; G, granite.

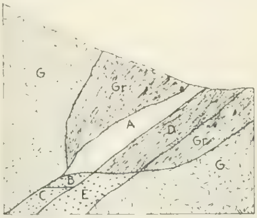

FIG. 5. CROSS-SECTION OF MUD SPRINGS VEIN

A, reconstructed orebody; B, intermediate between quartz and pegmatite; C, pegmatite; D, sericitized blocky lamprophyre; E, unaltered lamprophyre, Gr, altered schistoid granite; G, granite.

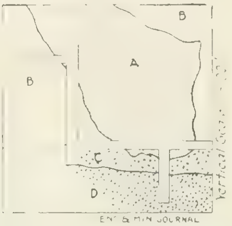

FIG. 6. LONGITUDINAL SECTION OF MUD SPRINGS VEIN

A, reconstructed orebody; C, intermediate between quartz and pegmatite; D, pegmatite; B, thin sheet of quartz without commercial value.

Mud Springs Mine—This mine, in Madera County, Calif., illustrates a particular phase of the lamprophyre-controlled veins. The country is hornblende-biotite granite. The granite has been intruded by a wide dike of minette, and the vein is found overlying and conformable to the dike, which dips at 35°. In proximity to the vein the granite is schistose and some movement is apparent, due to creeping. Both the granite and minette have undergone strong alterations, but, contrary to the greater number of lamprophyre-controlled veins, the upper part of the dike shows little kaolinization, and retains its structure, though soft and crumbly. An orebody was discovered near the surface, and continued along the dip in conformity to the zone of alteration for a distance of approximately 250 ft. The ore consisted of a semiwaxy quartz containing sparing disseminations of galena, and for a considerable period averaged $60 per ton in gold. The total production from this orebody is estimated in round numbers at $500,000. A long drift driven in the inadequately altered territory underlying the location of the oreshoot shows complete impoverishment, while further exploration by a winze sunk from the drift a distance of 80 ft. shows that the texture of the quartz is gradually changing, finally passing into true pegmatite.

Abbey Mine—At a distance of two miles from the Mud Springs is the Abbey mine, having many of the former's characteristics, yet differing in others. Here the intrusive consists of a wide dike of kersantite, along which marked faulting movement occurred. A long shoot of ore discovered at the surface continued down the plane of the vein, which dips at a low angle, to a distance of 100 ft., and produced, according to information from reliable sources, a total of $1,100,000 in gold. Upon the exhaustion of the orebody, further exploration was carried on in hope of making new discoveries, but nothing of value was found—the conditions had changed.

OTHER CALIFORNIA REGIONS

Veins of this type occur in Fresno and Tulare Counties, and in many instances in Kern County, particularly in the Tehachipi Mountains, where they exist in wide distribution, following either dikes or sills, but are without downward persistence, and of the class that pass beyond recognition. Likewise in the ranges of the desert region, veins of the type are found in great number, though many of the desert occurrences may predominate in silver content.

Types akin to those described occur in many sections of Nevada, for example, the Colorado River region, where they are found adjoining lamprophyre dikes and sills in pre-Cambrian gneissoid granite, with values usually good as far downward as characteristic alteration extends. Likewise in Mohave County, Arizona, and other parts of that state, both silver and gold veins follow lamprophyre intrusions in either gneiss or granite. In Idaho a similar type occurs, though unlike in morphologic features. With differing variations, the type is also found in many places in the region of the Rocky Mountains. Some of the conclusions embodied in this article may be new; yet they are the result of years of varied investigation and close study.

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The Relative Thermal Conductivities of Refractory Brick were tested by G. H. Brown ("Trans. Am. Ceram. Soc." 1914, p. 382; abstr. "Journ. Soc. Chem. Ind."). The composition of the three sample bricks tested was: Silica brick: SiO_2 95.48, Al_2O_3 1.92, Fe_2O_3 1.42, %; quartzite brick: SiO_2 83.36, Al_2O_3 11.79, Fe_2O_3 1.69, %; clay brick: SiO_2 63.24, Al_2O_3 32.97, Fe_2O_3 1.33, %. Readings were taken up to 1300° C. The relative thermal conductivities of the bodies, silica, quartzite and clay, were found to be as 1017:986:933, silica brick thus having a conductivity 9.0% and quartzite 5.7% greater than that of clay. The conductivity of either magnesite or chrome brick of course considerably exceeds that of silica brick.

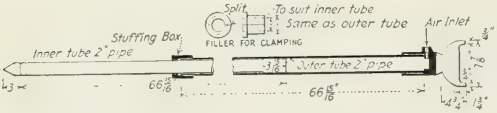
Details of Practical Mining

Pneumatic Drill-Column

By Sven V. Bergh*

An important factor to be considered in getting the highest efficiency out of the modern hammer-drill is the simplification of the drill mounting when such mounting is required. The labor cost, compared with the other costs of operation, is in most cases predominant, and it must be borne in mind that, roughly estimated, only 40 to 50% of the total shift can be used for actual drilling, the rest being absorbed in setting up and other manipulation of the machine.

When a column or bar has to be used the drill may be either attached to it directly or it may be carried on an arm; the column itself may be of either the single-screw or the double-screw type. In any case, its height is adjustable to only a limited extent. Hence, to make a set-up in the best position for the round of holes to be drilled, the workman has to use a good deal of skill and do considerable planning; in most cases a lot of time is wasted in mucking, arranging blocking, picking down back or picking up bottom, in order to get good bearing surfaces for the column.



Compressed-Air Telescopic Mounting for Light Drill

To facilitate these operations, a pneumatic drill-column was devised and has been used with good results for several years at the iron mines of Malmberget, Sweden. It resembles in general the telescopic air-feed of the stoper type of drill. A longitudinal section is shown herewith. The height of this particular column can be varied between 6.23 and 11.48 ft. When the column is fully run out, the compressed air is shut off by means of an automatic cutoff valve. There is no need of the usual arm in order to provide a sufficiently wide range of positions for the machine. The column, drill and all are easily removed from one position to another as required, and the absence of an arm makes this all the easier. The drill-clamp is adjustable with one single screw-bolt, and is made with a hinge so that the machine can be swung over to one side, when the drill steel has to be changed. The clamp is attached to the outer tube. This has a toothed foot-piece which bears on the bottom and resists rotation. The inner tube ends in a point which bears against the back. It is, of course, not subject to any torsion.

The column was found sufficiently stable when the regular drilling pressure was used, but is adapted only to light hammer drills of the stoper type with telescopic air feed and for drilling in soft to medium-hard rock.

It should be noted that when air is turned off, the machine first stops drilling and the air in the column maintains static pressure for some time. It can, however, be exhausted rapidly if desired.

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Errors in Surveying

Cumulative errors should always be recognized as such and carefully avoided, says A. W. Bedell in *Engineering News*. Personal errors are often of this kind. To illustrate, the vibration of a plumb-bob string will be compensating, but if a chainman habitually stands so that his eye will project the point of the bob to the ground obliquely, the error from this will be cumulative.

If a chain is out of alignment by an amount d in a length l, the error in distance from this will be approximately

$$e = \frac{d^2}{2l}$$

This error is of little importance on long tapes, but it is cumulative. It is also worth while to notice that a transit should be centered more carefully in one direction than in another.

Often it is required to know what error of closure is to be expected, consistent with the accuracy of the work done. The usual way of designating errors of closure, as 1 : 3000, etc., is misleading, for the degree of error does not bear a constant relation to the distance. The same accuracy of work which would produce an error of 1 ft. in 3000 ft. would result in an error of only $\sqrt{2}$ ft. in measuring 6000 ft. Since most errors vary with the square root of the distance and since areas vary with the square of the distance, the absolute closing error may be expected to increase only with the fourth root of the area. But if the work includes many cumulative errors, it will vary more nearly with the square root of the area.

If the angular error in a single course be represented by a, resulting in a distance error of y at the end of the course, and if x be the error in linear measurement, the resultant of these is the error of closure e. If the course were long enough to continue around the traverse and close upon itself, the total value of e would be the error of closure of the survey. If the probable angular error in feet per 100 ft. be taken as y_1, the probable linear error per 100 ft. as x_1, the average length of a course in 100-ft. units as n, the number of courses as m, and the total traverse in 100-ft. units as l, equal to mn, then for the whole survey

$$y = ny_1 \sqrt{m}$$

$$x = x_1 \sqrt{mn}$$

and the error of closure

$$e = \sqrt{x^2 + y^2} = \sqrt{lny_1^2 + lx_1^2}$$

On a transit reading to minutes y_1 will be about 0.01 or 0.02, and according to the skill of the chainman, x_1

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*Mining engineer, Chrome, N. J.

will be between 0.01 and 0.1. It will be noticed from the first equation that by increasing the number of courses, the error y will somewhat decrease relatively, for it accumulates on a single course, and it is partially compensated as the number of courses is increased—within limits. This formula is applicable only for compensating errors.

When a measurement is made to the nearest unit of any kind, and made accurately, the probable error from this source of a single reading is not one division, but a quarter of one division. The greatest error possible would be half a division, and the mean of all errors from zero to a half would be a quarter division. Using large units, therefore, is not inconsistent with accuracy, providing instrumental errors are small.

It may easily be demonstrated that leveling can be done by reading the rod only to tenths, giving, with 25 sights to the mile, an error of $\frac{1}{4}$ of $0.1 \times \sqrt{25} = 1\frac{1}{4}$ tenths. It may be added that for many purposes it is well to use larger divisions, as tenths of feet on rods and chains, and to subdivide these to hundredths of feet by estimation with the eye only. Those who have never tried this method will be surprised at the accuracy with which work can be done. The average surveyor with ordinary practice can subdivide a unit into tenths with a mean error of about half a tenth or less. The absence of many small graduations is certainly less confusing.

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Smoothing Out Old Drawings

When it is desired to flatten out old mounted plans, old paper drawings or old cloth or paper prints, says *Engineering News*, the following method has been found to work successfully in every instance where harsh handling or reverse rolling would ruin the appearance of a drawing: Make a thick, boiled starch of flour by boiling flour and water down to almost the consistency of thin dough. Lay the plan out bottom up on a flat surface and apply the starch as a paint, thoroughly rubbing it into the surface. Keep the plan perfectly flat until dry and then it will be found that it will remain smooth. The flour starch will not injure the plan in any manner.

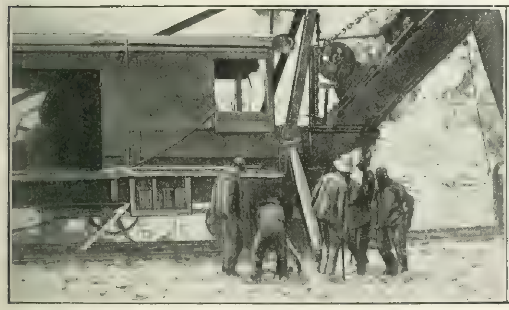
⁂

A Detector for Dangerous Ground is noted in the "Queensland Government Mining Journal." It consists of a telescope rod to which is attached a dry-cell battery, a bell and a red light. Rock movement or pressure is transmitted so as to ring the bell and cause the light to glow. The device can be set to any desired degree of sensitiveness.

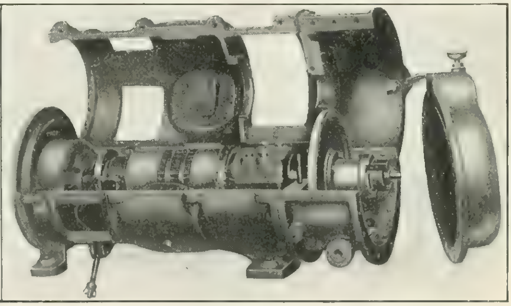
Steam-Shovel Electric-Lighting Set*

For steam-shovel night work adequate illumination is imperative, not only on the bank from which the shovel digs but also around the shovels themselves to permit the necessary inspections and adjustments and to afford safety for the workmen.

At the Utah Copper acetylene had been tried for this work, but proved troublesome, costly and somewhat dangerous, so electrical illumination was adopted. The general illumination of the bank is furnished by a battery of powerful projector searchlights on the opposite side of the cañon from that on which the shovels dig. To supply local illumination, about 20 incandescent lights were placed on each shovel, but it proved a problem to get current to them. One difficulty lay in the fact that shovels must move at short intervals. A method was devised of mounting a reel on each shovel, to carry a semiflexible cable which was unwound on the ground as the shovel proceeded. One end of this cable was tapped to a power circuit carried on poles. This arrangement gave considerable trouble during the several years it was in operation. Rocks rolling from one terrace to another would carry away wires or poles and blasts would frequently throw rock which damaged the cables.



THE GENERATING SET IN PLACE ON THE SHOVEL



THE UNIT WITH CASING OPENED

In December, 1913, the Westinghouse Electric & Mfg. Co. furnished the Utah Copper Co. for trial a 1-kw. general-utility turbo-generator outfit. This set was fastened to the under side of one of the shovel frames as shown in the illustration and was supplied with steam from the shovel boiler.

This shovel made so good a record that the company purchased the turbo outfit furnished on trial and later ordered six more, which are now being installed.

One set will operate an arc lamp and a few incandescents at the same time or about forty 25-watt incandescents alone. Practically no attention is required for the set because it is designed to operate for long periods without care. There are no delicate adjustments to make and every part is accessible for inspection.

Full rating is developed on steam pressures between 90 and 250 lb. A governor controls the speed and keeps it uniform. A fixed resistance furnishes voltage regulation and a rheostat is provided to adjust the voltage when the number of lamps in use is varied. Hence, in spite of the abrupt changes in steam pressure and load that characterize shovel service, steady light is obtained.

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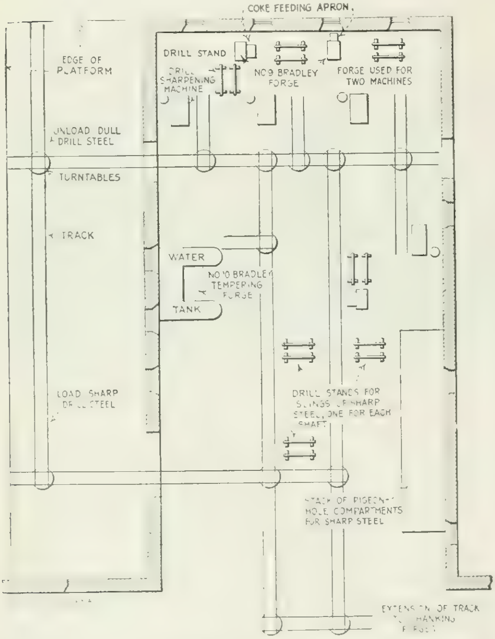
*From information furnished by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Penn.

Handling Drill Steel at the Quincy Mine

By L. Hall Goodwin*

The method of handling drill steel at the Quincy mine, Hancock, Mich., is different from that usually employed at the larger mines of the Lake Superior district, where the problem is to sharpen the steel for several widely separated shafts at a centrally located shop. The method used by the Copper Range Consolidated Co. has been fully described in this department of the JOURNAL[1]; and the Calumet & Hecla system does not differ essentially from that used by the Copper Range, that is, the drills are kept loose and are carried to and from the various shafts in steel boxes, each shaft having its special box.


COKE FEEDING APRON
DRILL STAND
EDGE OF PLATFORM
DRILL SHARPENING MACHINE
NO 9 BRADLEY FORGE
FORGE USED FOR TWO MACHINES
UNLOAD DULL DRILL STEEL
TURNTABLES
TRACK
WATER
NO 10 BRADLEY TEMPERING FORGE
TANK
LOAD SHARP DRILL STEEL
DRILL STANDS FOR SLINGS OF SHARP STEEL, ONE FOR EACH SHAFT
STACK OF PIGEON-HOLE COMPARTMENTS FOR SHARP STEEL
EXTENSION OF TRACK TO SHANKING FORGES

LAYOUT OF THE QUINCY DRILL-SHARPENING SHOP

The main distinguishing feature of Quincy practice is that the steels are kept in slings, each sling containing eight to 10 drills, which are assigned to a certain contract. Dull steels are put up in slings at the working place underground, and sharp ones before they leave the drill shop. The sling consists of a piece of ½-in. flat iron, 1½ in. wide, formed into a ring having an inside diameter of 4 in. The steels are held in this ring by means of three wooden wedges, 8 in. long, placed side by side, the middle one being reversed end for end with respect to the other two, and hammered into place; this forms a firm bundle of convenient size for handling.

All miners have a "contract" number, although only those employed in mine development actually work on contract; for other miners, the number is used only in distributing tools and supplies. Each piece of drill steel is assigned to a certain contract, and the number of that contract is cut on its shank.

Dull drill steels are sent to surface and sharp ones sent underground after each shift has gone off. The dull steels are carried to the shaft by the miners and dropped where they can be easily loaded into the south skip, as it has become an arbitrary rule at this mine always to use the south skip for handling tools and supplies. When all men are up, the man-cars are immediately replaced by skips, and the first skip hoisted in the south road picks up the slings of dull steel from all the levels; the sharp drills are sent down on the next trip of the same skip.

At surface, the skip automatically discharges its load of dull steel at a special dump just above the collar of the shaft. They pass into a concrete chute, the bottom of which is faced with old rails, flange up. This chute starts off at 30°, but its inclination gradually changes to horizontal and it then forms a platform at a convenient height for loading on a wagon. Dull drills are collected and sharp ones distributed by one of the surface teams. The slings of sharp steel are stood up in a row of racks along the south side of the shafthouse, the racks being numbered corresponding to the working levels.

The accompanying sketch shows a plan of the drill shop. It will be largely self-explanatory after it is stated that the drills are transported from one part of the shop to another on flat-topped cars having rigid trucks which necessitate straight tracks and turntables. An extension of the track, as shown, reaches four hand forges used in shanking the steel. The drill sharpeners used are a modified form of the Word machine. Drill stands consist of two wooden horses, their tops faced with a 3-in. strap of ½-in. iron, set at a convenient distance apart. The tops of the cars are 36x48 in., and four iron stakes fit into tenons at each corner.

The sharp steel is sorted by boys in front of a stack of pigeon-hole compartments, drills belonging to each contract being kept in a separate compartment. The pigeon holes are numbered in order by contracts, and the shaft and level numbers are also given. The sharpened drills are removed from the pigeon holes by other boys, who bundle them into slings; the slings going to each shaft are segregated on one drill stand, the shaft number being marked with white chalk on the ring, the contract number with blue chalk on the wedges. The slings are left on the drill stands until a truck load of them has accumulated; they are then wheeled out to the loading platform.

As compared with the practice of the other Lake mines, the Quincy system has the marked disadvantage that the drills are handled a greater number of times by hand than is usual; this disadvantage is largely offset by the drills being in bundles. The principal advantages of the method may be stated as follows: All sorting is done in the drill shop, where it may be easily supervised; drills for each contract are in rigid bundles, which fact tends to secure better distribution of them; the drill steel is easily handled while being distributed to the underground working places; this latter point is of especial force in minimizing delays to the hoisting plant, which is an important factor at these deep, low-grade mines.

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[1] "Eng. and Min. Journ.," May 4, 1912, p. 881.

Details of Milling and Smelting

Precipitating Plant at the Copper Queen Mines

By Charles M. Coats and Glen L. Allen*

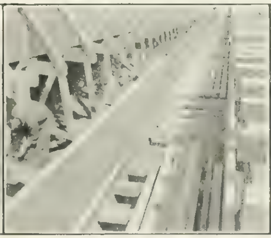
The Copper Queen Consolidated Mining Co. recently placed in operation its new flume-type scrap-iron precipitating plant at Lowell, Ariz., in the Bisbee-Warren mining district. Construction began early in October, 1913, under a 60-day contract with all material furnished to the contractor. Mine water was turned into the plant in February.

The plant covers about 2.6 acres on a gentle slope and, in general, enjoys in its operation all the advantages of a hillside location. The mine water which is pumped from the Czar shaft flows through a 3600-ft. flume and at the plant enters a series of six large tanks, containing heavy scrap, thence into eight sets of flumes containing lighter scrap. The barren water then flows into a settling tank; a portion of this water is then pumped back to the mines and the remainder allowed to go to waste. The general layout of the plant is shown in an accompanying illustration.

Copper Queen Precipitation Plant, Douglas, Ariz.

Upper tier of round tanks. General view of plant.

Precipitating Tanks under Construction



Precipitating Tanks, Showing False Bottoms

Settling Tank

The flume leading water to the plant is of the ordinary open-box type with a 10x24-in. rectangular cross-section and constructed of 12x12-in. planks 16 ft. long. It is supported by simple wooden bents where necessary to maintain a uniform grade of 0.4%. The last 560 ft. of the flume consists of a continuous-stave, 14-in. redwood pipe, which takes the form of an inverted siphon to carry the water under a railroad track.

In order to utilize many heavy pieces of scrap iron which the company had on hand, the management decided to employ the six large redwood tanks mentioned above as the first unit of the plant. These tanks are 20 ft. in diameter, 10 ft. deep, with a fall between tanks of 0.4%. They are so connected with the launder that the water may be cut off from any one or all of the tanks while the cement copper is being flushed from under the heavy false-bottom grating which keeps the scrap off the bottom of the tank. Each tank is provided with a sloping floor and two especially designed doors near the bottom. These doors facilitate the removal of the cement copper, which is flushed from the tanks into launders leading to the settling tanks.

The second unit of the plant consists of a series of eight double parallel flumes with small connecting launders at the end of each flume. Each double flume is 250 ft. long, 4 ft. wide, 15 in. deep, has a uniform slope of 1%, and is supported upon wooden bents. The sides are built of 2-in. by 12-ft. planks, bottom of 3-in. by 12-ft. planks, pine with a tongue-and-groove joint throughout. The bottom was first wedged in place, then nailed with iron nails. The sides of the flume were bolted and braced. A false bottom 8 in. from the true bottom supports the scrap iron. Baffle boards divide each flume into either four or five compartments and serve to regulate the depth of water. Stoppered holes at the ends of each compartment allow the cement copper to be sludged into the collecting launders below. A 24-in. gage track between each double flume is used to distribute the iron.

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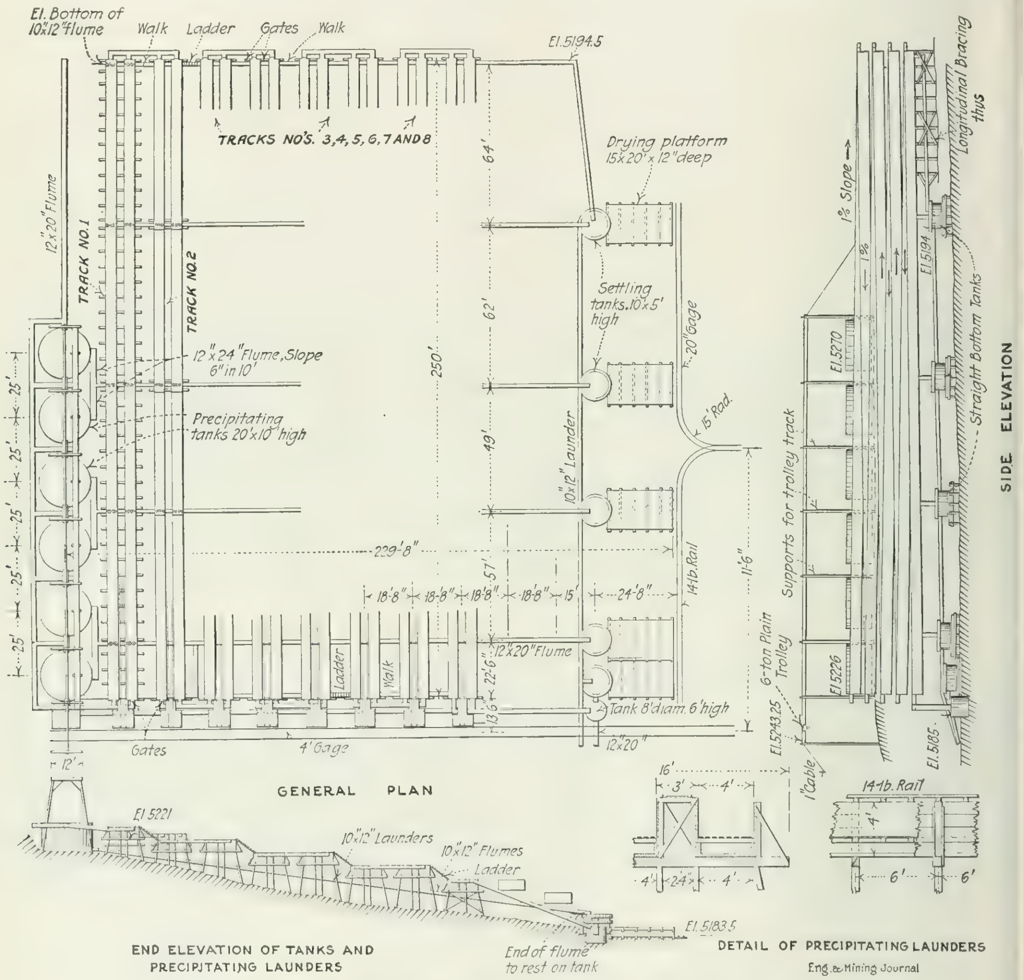
*804 Louisiana St., Lawrence, Kan.



Plan, Elevations and Details of Copper Queen Precipitating Plant

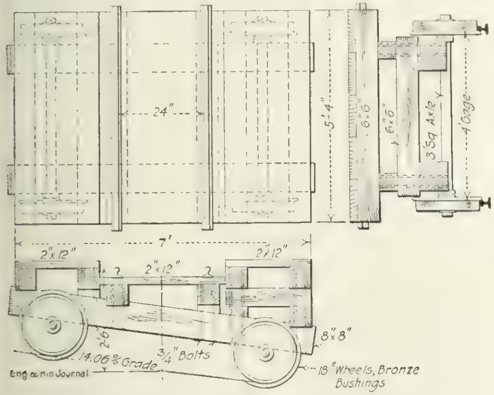
The double-flume arrangement permits the mine water to be diverted from one flume to the other during cleanup, while the sectional arrangement of each allows it to be cleaned one section at a time. When a flume is to be cleaned, the water is diverted, the stoppered holes in the bottom of the section are opened, the water drained into settling tanks or into some lower flume, and the copper then washed from the iron down through the false bottom into the launders to settling tanks by means of hose carrying water under pressure.

The third unit of the plant consists of a system of five redwood settling tanks of special design and two storage tanks. These settling tanks are 10 ft. in diameter, 5 ft. deep, with a 10x10-in. circular launder or lip around the periphery. The sludge from the precipitating tanks and flumes flows into these settling tanks, the cement copper settles to the bottom, and the clear water decants over the edge into the lip and flows into a final settling tank, thence into a storage tank to be pumped back to the mines. When a settling tank is to be cleaned, the clear water is siphoned off, the doors in the sides are opened, and the sludge shoveled out to the drying vats.

The drying vats are simply shallow wooden boxes, 20x15 ft. by 12 in. deep. Here the cement copper air-dries for several days before it is collected for shipment to the smelter. From the vats the cement copper is shoveled into end-dump mine cars and trammed down to the loading station, where it is run out over a movable track and dumped into railroad cars.

The scrap iron for precipitating purposes comes to the loading platform on railroad cars. From these it is lifted by a swinging-boom crane and placed in a small mine car, which rides upon an especially designed truck which carries the smaller car up an incline to the end of one of the flumes. Here the smaller car is run off on to the track, which runs over the top of the flume and the iron distributed along the flume where necessary. Heavy iron for the precipitating tanks is loaded directly on to the truck and pulled up the incline to the loading platform at the top. Here the iron is picked up by a six-ton traveling Triplex block and distributed to the tanks.

The inclined track is 4-ft. gage, and supported upon heavy wooden bents throughout. It has such a grade that the especially designed truck passes the ends of the flume tracks horizontally. This arrangement permits the mine car carrying scrap to be run off the truck on to the flume tracks, thus expediting the handling of quantities of scrap. The truck is drawn up the incline by an electric geared hoist.



Transfer Car for Precipitation Plant

The plant is designed to handle from 300 to 2500 gal. of mine water per minute, varying according to the seasons, the maximum amount usually being pumped during July and August. A sample of the water taken as it leaves the mine (Aug. 29, 1914), then filtered to free from matter in suspension, gave a partial analysis as shown:

COPPER QUEEN MINE WATER ANALYSIS

Constituent	Grams per liter
Fe, total	0.334
Fe (ic)	0.087
Fe (ous)	0.247
CaO	0.368
MgO	0.032
Al_2O_3	0.242
Mn	0.146
Cu	0.296
Zn	0.060
SO_4	3.4249
Au	Trace
Ag	Trace
Pb	None

The water, upon entering the plant proper, has practically the temperature of the air. This is due to its 3040 ft. of travel in an open flume before reaching the plant.

The plant is so designed that about 300,000 gal. of the outflow may be pumped back daily to the Holbrook shaft through an 8-in. wood-lined pipe, by means of a Triplex geared pump. The upper levels of the Holbrook mine were worked out years ago and the stopes gobbed with moderately rich waste. This offers an attractive field for enriching the mine water; so these old workings were drifted and crosscut and a system of pipes introduced which distributed the barren water through these drifts. This water percolates through the old gob or stope filling, leaching out the copper, and is collected in the sump on a lower level to be pumped back to the precipitating plant again. Water is also pumped through burning sulphide stopes to collect copper there.

The average extraction for the period July 1, 1914, to Sept. 1, 1914, was 98.11%. A series of samples taken from a representative flow of water as it passed different points in the plant gave the following data:

PRECIPITATING PLANT EXTRACTION

Contents— Grams per liter	Cu	Ferric iron	Free acid	Extraction %
Water leaving the mine, heads.	0.424	0.116	0.360	0.0
Entering precipitating tanks...	0.281	0.051	0.140	33.72
Leaving precipitating tanks....	0.169	0.031	....	60.14
Leaving the plant, tails........	0.010	0.010	0.140	97.66

From the analytical data it may be seen that 33.72% of the copper is extracted in the flume leading to the plant, 26.41% of the total copper content is extracted in the six precipitating tanks, and 37.52% in the flumes, leaving 2.34% in the tails. Extraction also tends to vary with the seasons, being slightly higher in the winter and lower in the summer or rainy season.

The cement copper from the new plant is expected to be similar in quality to that produced by the old plant.[1] A typical sample of this precipitate contained 35% moisture and the dried sample assayed: 39.12% Cu; 16.5% Fe; 5.2% SiO_2; 2.0% CaO; 12.9% Al_2O_3; and 1.4% S. Calculating from the copper, ferric iron and free acid in heads and tails assays, it may be seen that theoretically 1.23 lb. of iron are consumed per pound of copper produced. Assuming the scrap to be 85% Fe gives 1.45 lb. iron per pound of copper produced.

The approximate cost of the plant was $35,000. A total of 350,000 ft. of lumber, at $21.50 per M laid down at the plant, was used in its construction. The cost of scrap is practically nil. The plant operates economically in point of attendance. It gives fair extractions and handles widely varying amounts of water of variable copper content.

Some difficulty was experienced in filling the plant for the first time, because of the lapse of time between completing the plant and connecting it up with the mine water. This lapse let the plant dry out, thus causing it to leak badly.

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Wet Extraction of Mercury

A method to extract mercury from its ores in a wet way is outlined by Edwin B. Thornhill, of Gray Summit, Mo. (U. S. pat. 1,119,377). The plan is to treat the ore with a mixture of an alkaline sulphide and an alkaline hydrate, and to regenerate the solution by precipitating the mercury on a metal which does not form a sulphide in the wet way, such as aluminum or chromium. The reactions are:

$$HgS + Na_2S + x\,H_2O = Na_2S.HgS.x\,H_2O$$

$$3\,(Na_2S.HgS.x\,H_2O) + 8\,NaOH + 2\,Al =$$
$$6\,Na_2S + 3\,Hg + 2\,Na\,AlO_2 + x H_2O$$

It will be noted that sodium sulphide is formed at the expense of the hydrate.

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[1] Eng. and Min. Journ., Oct. 31, 1913. H. W. Chittenden.

The Cost of Doing Things

Churn-Drilling Costs

By C. H. Palmer, Jr.*

The figures here presented were compiled from drilling operations recently completed at the property of the Pacific Mines Corporation, seven miles south of Ludlow, Calif., at which point the company's standard-gage railroad connects with the main line of the Atchison, Topeka & Santa Fé Railroad.

Twenty-four holes having an average depth of 258 ft. were drilled within a radius of 1100 ft. to prospect the extension of the present orebodies, which dip gently to the north. A Star rig No. 23 was used, and holes were drilled with an 8¼-in. bit and 2½-in. manila drill cable. When casing was required the hole was continued with a 6-in. bit. The work was done by two drilling crews, each consisting of a driller and a helper. On days when it was necessary to move the rig, both crews assisted. The driller received $6 a day and his helper $4.80.

An average of the formation passed through consisted of:

Wash formation, ft	21
Trachyte porphyry, ft	210
Kaolinized hanging wall, ft	4
Ore zone, ft.	18
Quartz-monzonite foot wall, ft	5
	258

No difficulty was encountered in drilling these formations, although the hanging-wall material was sticky and the hard-ore zone necessitated sharpening the bit about every 5 feet.

RECORD OF HOLES 1 TO 24 INCLUSIVE TOTAL FOOTAGE DRILLED, 6186

	Fuel Coal	Oil and Grease	Firebrick	Labor	Cable	Water	Coke	Repair Parts and Tools	Unclassified	Sum Total
Total costs.	1133.13	42.72	42.48	3700.0[illegible]	685.06	335.97	102.40	258.06	155.72	6456.54
Foot costs	0.183	0.007	0.007	0.598	0.111	0.054	0.016	0.042	0.025	1.043
Per cent. of total cost...	17.55	0.66	0.66	57.31	10.62	5.20	1.59	3.99	2.42	100.0

RECORD OF WELLS NOS 1 AND 2

	Fuel Coal	Oil and Grease	Labor	Cable	Water	Coke	Repair Parts and Tools	Teaming	Unclassified	Sum Total
Total Costs	202.83	10.32	772.30	157.50	45.90	13.12	68.57	409.85	18.10	1698.49
Foot costs	0.250	0.013	0.952	0.194	0.057	0.016	0.084	0.505	0.022	2.093
Per cent. of total cost	11.94	0.61	45.47	9.28	2.71	0.77	4.04	24.14	1.06	100.00

RECORD OF WELL NO. 3

	Fuel Coal	Oil and Grease	Firebrick	Labor	Cable	Water	Coke	Repair Parts and Tools	Teaming	Pipe	Unclassified	Sum Total
Total costs	232.83	2.85	6.05	1141.50	221.56	99.40	13.80	37.15	168.58	589.16	1.13	2514.01
Foot cost	0.407	0.005	0.011	1.998	0.386	0.174	0.023	0.065	0.294	1.030	0.002	4.395
Per cent. of total cost	9.26	0.11	0.24	45.41	8.81	3.95	0.55	1.48	6.71	23.43	0.05	100.00

The topography is mild within the radius drilled. The weather is hot in summer and the country arid, the water-supply being obtained at Ludlow for $1.50 per 1000 gal. Coal costs $8.15 per ton delivered at the mine.

These holes required 15 lb. of coal and 21.6 gal. of water per foot drilled. The costs do not include those for moving the rig for drill-hole set-ups, which amounted to $215 for coal and water and $263 for labor. The accompanying table gives the distribution of time in the drilling operations:

TIME DISTRIBUTION

Total possible drilling hours—3092	Hr	%
Actual drilling	2626	84.93
Casing	59	1.91
Removing casing	34	1.10
Repairing drilling machine and rope	141	4.56
Fishing for tools	19	0.61
Unforeseen delays	213	6.89
(Moving the rig for set-ups took in all 527 hr.)	3092	100.00

Wells Nos. 1 and 2, total footage drilled 811, having an average depth of 405 ft., were drilled for a water-supply for milling and domestic purposes, and were located about 5.5 miles east of the mine. The formation passed through consisted of wash, fine sand and clays. The costs and time distribution were as shown:

TIME DISTRIBUTION

Total possible drilling hours—703	Hr.	%
Actual drilling	444	63.16
Casing	78	11.10
Repairing drilling machine and rope	81	11.52
Fishing for tools	58	8.25
Unforeseen delays	42	5.97
(Moving the rig for set-ups took in all 149 hr.)	703	100.00

These holes required 61 lb. of coal and 22.5 gal. of water per foot drilled. Moving the rig for drill-hole set-ups cost $51 for coal and water and $192 for labor in addition to the above figures.

The higher per-foot cost, in comparison with holes Nos. 1-24, was due to the necessity of casing both the wells, while the distance from supplies and shops added to the cost in the form of teaming and repairs, respectively.

Well No. 3, total footage drilled 572, was drilled on the southern edge of a dry lake 7.8 miles north of Ludlow, Calif., and a short distance west of the Tonopah & Tidewater R.R. Drilling was carried on under difficult conditions. The excessive heat, accompanied by high winds, partly accounts for the high labor charges noted below. One drilling crew was used. Eight-inch pipe was used to case the hole, which was necessitated by caving, caused by the encountering of salt water flows in the dark clays.

The material drilled consisted of:

Wash formation, ft	70
Yellow clay, ft	180
Dark sticky clays, ft	322
	572

The sticky clays made the progress slow and added to the water costs. Boulders also caused troubles and delays. Water was delivered to a point near the well by the T. & T. R.R. for $2.50 per 1000 gallons.

This hole required 100 lb. of coal and 61 gal. of water per foot drilled, the latter including the water used for the domestic purposes of two drillers for 95 days. The pipe was not recovered.

While the preceding costs seem high, they may be taken as a fair average by those contemplating drilling similar footages under the trying conditions of an arid country. Sand storms greatly hindered work on well No. 3 and excessive heat at night made sleep difficult. This decreased the efficiency of the drillers and is partly responsible for the high labor charges. An unavoidable loss of time resulted from these circumstances which had a corresponding effect of increasing the water and fuel costs.

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*Mining engineer, 1823 West 48th St., Los Angeles, Calif.

Wells Nos. 1 and 2 were drilled under more suitable conditions than well No. 3, although far from satisfactory for efficient labor returns. As all drill and domestic supplies had to be carried a distance of 5.5 miles over heavy roads, teaming charges were high.

Conditions were more satisfactory for low costs while drilling holes Nos. 1 to 24 inc. Repair shops were at hand and living conditions were excellent. Boulders encountered in the wash formation retarded, however, the work; also drilling the hard-ore zone and monzonite, and often portions of the trachyte was very slow, which especially increased the fuel and labor charges.

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Churn-Drill Costs at Miami

By H. P. Bowen*

During the last five years, the Miami Copper Co. has done about 44,500 ft. of churn drilling, consisting of 73 holes of an average depth of 605 ft. In this work two No. 23 Star traction machines, equipped with No. 24 boilers and derricks, were used. All holes were started with a 10-in. bit and in a few cases it was necessary to use the 4¼-in. tools to reach the desired depth. Two-inch manila rope rope was used in starting and this was replaced by ¾-in. steel drilling cable when water was encountered, which occurred usually at from 300 to 400 ft. One-half of the holes were drilled at the corners of 200-ft squares and the others on 400-ft. squares.

The drilling was divided into two 18-month periods, in each of which a nearly equal footage was drilled and the following scales of wages paid:

Wages

	First Period 12-hr. Shift	Second Period 8-hr. Shift
Foreman	$200.00 per month	$200.00 per month
Samplers	100.00 per month	100.00 per month
Drillers	6.00 per shift	5.00 per shift
Helpers	4.80 per shift	4.00 per shift
	9-hr. Shift	8-hr. Shift
Laborers	$2.00 per shift	$2.15 per shift
Machinists	4.25 per shift	4.25 per shift
Carpenters	4.25 per shift	4.25 per shift
Blacksmiths	4.25 per shift	4.25 per shift

Coal costs $8.30 f.o.b. Miami, and from $1 to $1.50 more delivered to the rigs.

After the completion of the second drilling period, all tools, casing and repair parts were collected, repaired and stored. The drills were taken down and rebuilt on new frames, new parts being used where necessary, new tubes were placed in the boilers and the engines lined up. The machines were then housed-in, giving practically two new machines. Besides ordinary running expenses, the accompanying statements include the original cost of the machines and the cost of rebuilding them, the cost of all repair parts, tools, and casing charged out to churn drilling, whether actually used or not, the cost of two buildings, one for churn-drill supplies and the other in which the drills were stored. No credit has been allowed for the value of the rebuilt machines nor for the still serviceable tools, casing and supplies.

The drilling cost of the two periods differed but slightly, the most noticeable variance being in the cost of repair parts which changed from 1c. per ft. for the first period to over 5c. per ft. for the second.

COSTS OF DRILLING

Item	Per Ft.	Item	Per Ft.
Churn drills	$0.819	Churn drill roads	$0.4382
Churn drill tools	0.2037	Water-supply expense	0.0417
Wire drilling cable	0.0336	Foreman	0.1289
Sand line	0.0080	Engineers and draftsmen	0.0689
Manila rope	0.0598	Samplers	0.1505
Belting	0.0015	Drillers and helpers	0.6160
Casing and drive shoes	0.0872	Tin and plate shop	0.0131
Repair parts	0.0316	Blacksmiths	0.0130
Coal and coke	0.2835	Machinists	0.0165
Lubricating oil and grease	0.0094	Carpenters	0.0095
Iron and steel	0.0049	Miscellaneous labor	0.0135
Galvanized and corrugated iron	0.0064	Grinding and assaying samples	0.0394
Bolts, nuts, washers and rivets	0.0010	Teaming	0.2376
Timber and lumber	0.0136		$2.6976
Coaloil and gasoline	0.0059	Supply warehouse	0.0097
Small tools	0.0019	Churn drill storehouse	0.0067
Packing and waste	0.0019	Casing racks	0.0028
Miscellaneous	0.0086	Rebuilding machines, etc.	0.0379
Pipe and fittings	0.0015		
Sample sacks	0.0203		$2.7547
Sampler's supplies	0.0051		
Engineering supplies	0.0037		

CHURN DRILL ROADS

Item	Per Ft. of Hole Drilled	Item	Per Ft. of Hole Drilled
Explosives	$0.0321	Labor	$0.3981
Tools and drill steel	0.0063		
Miscellaneous supplies	0.0017		$0.4382

WATER SUPPLY

Item	Per Ft. of Hole Drilled	Item	Per Ft of Hole Drilled
Galvanized iron	$0.0032	Labor	$0.0114
Pipe and fittings	0.0256		
Miscellaneous supplies	0.0013		$0.0415

REBUILDING AND REPAIRING

Item		Item	
Foreman	$157.58	Iron and steel	$6.72
Drillers and helpers	498.50	Bolts, nuts, washers and rivets	8.46
Tinners and plate shop	53.81	Coal oil and gasoline	17.75
Blacksmiths	24.78	Small tools	3.07
Machinists	145.00	Packing and waste	14.27
Carpenters	83.62	Miscellaneous supplies	9.77
Miscellaneous labor	41.65		
Teaming	199.96		
Repair parts	415.20		$1680.14

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*Miami Copper Co., Miami, Ariz.

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Cost of Test Pitting

The following are actual costs of test pitting in hard clay and hardpan with many large boulders, where the ground dulls the picks rapidly. Foreman's wages were $3; laborers, $2. Two-inch hardwood plank was used for cribbing when necessary. No superintendence or office expense charged.

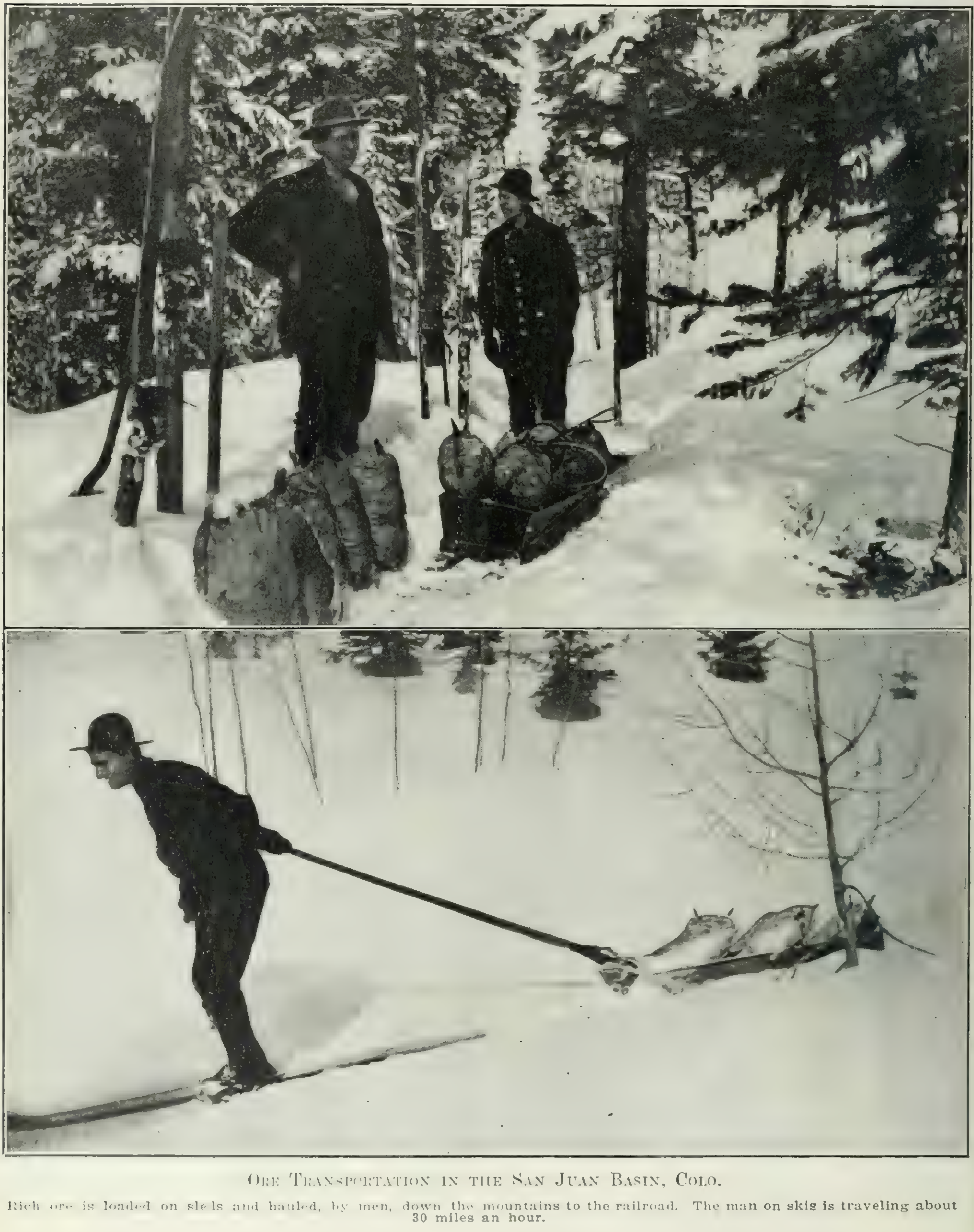
Pit	Depth, Feet	Hours Labor	Cost	Per Foot
1	17	80	$18.00	$1.06
2	24	140	29.00	1.21
3	7	15	3.50	0.50
4	22	75	16.50	0.75
5	23	100	24.00	1.04
6	26	240	48.00	1.84½
7	41	270	56.00	1.366
8	46	335	72.50	1.58
9	38	255	64.00	1.70
10	33	240	54.00	1.67
11	10	60	12.00	1.20
12	9	100	22.00	2.444
13	9	20	4.00	0.444
14	17	60	12.00	0.706
15	12	55	12.50	1.00
Filling pits Nos. 1, 2, 3, 4,			6.00	
Filling pits Nos. 5, 6, 7, 8, 9, 10,			35.00	
Filling pits Nos. 11, 12, 13, 14,			7.00	

The contract price for sinking a test pit in sandy soil and doing all necessary cribbing, all supplies to be furnished and tools sharpened free of charge, to 20 ft. in depth is $1 per ft.; from 20 to 30 ft., $1.25 per foot.

⁂

The Cleanup of Lena Gold Fields for the year ended Sept 30, 1914, was 370,256 oz. from 873,635 cu.yd. washed; in addition, 28,901 oz. of gold were obtained from slag treatment and by purchase from outsiders, thus bringing the total value of the production handled by the company up to £1,500,150 (about $7,275,000). The properties are situated in the Irkutsk province of Siberia. Little washing is done between October and March owing to the gravel and water being frozen

Photographs from the Field



Ore Transportation in the San Juan Basin, Colo.

Rich ore is loaded on sleds and hauled, by men, down the mountains to the railroad. The man on skis is traveling about 30 miles an hour.

OLD HARNEY PEAK TIN MILL, S. D.
Abandoned 20 years ago. A monument built by British capital.

HYDRAULIC MINING IN FLORIDA
Removing phosphate rock by placer-mining methods.

TYPICAL PRESENT-DAY SCENES IN MEXICO CITY

1. Carranzistas driving commandeered horses through the city before leaving. 2. Entry of Villa and Zapata, Dec. 6 1914. 3. Zapatistas with their banner demanding land division. 4. Villa leading his forces, on Dec. 6. 5 and 6. Indian boy before and after receiving his free dinner. 7. A boy soldier of Villa's army, nearly as tall as his rifle. 8. A Zapatista, typical except for his boots, which are unusual.

Lake Superior Iron Ore

The Lake season closed early in 1914, partly on account of slow business and partly by reason of bad weather. Shipments of iron ore from the upper ports in November were 1,070,092 tons, this including one cargo of 1411 tons from Escanaba, which did not get away until Dec. 1. For this season the shipments were just about two-thirds those of 1913. The rail shipments are not yet reported. The dock statistics, as collected by the *Marine Review,* give the shipments by ports for the entire season as follows, in long tons:

LAKE IRON ORE SHIPMENTS

	1913		1914	
	Tons	Per Cent	Tons	Per Cent.
Escanaba	5,399,444	11.0	3,664,451	11.5
Marquette	3,137,617	6.4	1,755,726	5.5
Ashland	4,338,230	8.9	3,363,419	10.5
Two Harbors	10,075,718	20.6	5,610,262	17.5
Superior	13,788,343	27.9	11,309,748	35.3
Duluth	12,331,126	25.2	6,318,291	19.7
Total, water	49,070,478	100.0	32,021,897	100.0
Rail shipments	876,638			
Total	49,947,116			

Water shipments for 10 years past have been as follows:

Season	Tons	Season	Tons
1905	33,476,904	1910	42,620,201
1906	37,513,595	1911	32,130,411
1907	41,288,755	1912	47,435,777
1908	25,427,094	1913	49,070,488
1909	41,683,873	1914	32,021,897

This table shows that the shipments for 1914 were the smallest in 10 years, except those of 1908; though they were only 108,514 below those of 1911. The changes in the port shipments show that the Steel Corporation directed its efforts toward making up its minimum on the Hill leases, doing comparatively little on its other mines. This is plainly shown by the increase in the proportion shipped from Superior, coupled with the decreases at Duluth and Two Harbors. From the Minnesota ranges, the Mesabi, Vermilion and Cuyuna, the proportion did not change greatly, being 73.7% of the total in 1913 and 72.5% in 1914. These figures are approximate only, the production not being apportioned by ranges as yet.

Of the water shipments in 1914 a total of 25,402,655 tons, or 76.2%, went to Lake Erie ports. The shipments of those ports to furnaces have been as follows, for three years past:

	1912	1913	1914
On docks, May 1	6,029,941	5,909,829	5,920,157
Season receipts	37,472,108	39,099,647	25,402,655
Total	43,502,049	45,009,476	31,322,812
Shipments to furnaces	33,421,251	35,747,800	21,976,941
On docks, Dec. 1	10,080,798	9,261,676	9,345,871

The ore not delivered to Lake Erie ports went to Lake Michigan, chiefly to South Chicago and Gary.

THE HILL ORE LANDS

The following comments from the Cleveland *Iron Trade Review* well state the position of the Great Northern Trustees for next season: "In fact, it can be officially stated that the trustees will not permit their agents to make any special effort to sell a large tonnage at present prices. Unless the market improves materially, it is very probable the Great Northern will dispose of only a little ore during 1915. . . .

"In addition, the Great Northern properties are not in a position to ship any exceptional tonnage during the coming season. . . . The larger openpit producers which were operated by the Steel Corporation under the Hill lease, such as the Leonard, North and South Uno, Dale, etc., have been, to a great extent, mined out to the point where steam-shovel operations on a large scale are no longer profitable. These properties still contain large bodies of ore, but they will have to be reclaimed by scramming, milling, underground mining and other slower methods. It is to remedy this condition that the Great Northern is developing the large new Dunwoody and Hill Annex pits. The Hill Annex will not be in shape to ship at all in 1915 and the Dunwoody only a fraction of its eventual annual tonnage.

"Therefore, as far as 1915 is concerned, the Great Northern trustees would not be in a position to deluge the ore market, even if they were inclined to do so. They will have probably 2,500,000 tons available, a large proportion of which will remain in stockpiles, or in the openpits, unless the price of ore shows more strength than is now indicated."

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Safety Rules for Wisconsin Zinc Mines

The accompanying set of regulations governing operations in the lead and zinc mines of Wisconsin will take effect Jan. 3, 1915. These were drawn up at the instance of the State Industrial Commission, actively represented by C. W. Price, assisted by a committee of mine operators in the Platteville district. This committee included W. N. Smith, manager, Vinegar Hill Zinc Co.; John Mcculloch, general superintendent, Vinegar Hill Zinc Co.; H. C. George, mining engineer, Wisconsin Zinc Co.; James Billingsley, manager, Frontier Mining Co.; B. A. Hoskins, general manager, Mineral Point Zinc Co.; L. N. Dana, manager, Indian Mounds Mining Co.

The commission was created by the state legislature. It has power to investigate and to draw up and enforce regulations having to do with the safety and welfare of employees and its rulings are the same as the laws of the state. It is obvious, however, that no commission can be intimately familiar with all conditions prevailing in all industries in a state as large as Wisconsin. The commission, therefore, has adopted the plan of consulting with the operators in any given industry. A general meeting of the operators is held, a committee of operators is appointed, rules are drawn up, etc. A copy of these rules is sent to every operator by the industrial commission, for expressions of opinion, complaints and suggestions. They are finally approved or not by the commission. Following this general procedure, the committee mentioned above was appointed by vote at a meeting of mining operators held in Galena, Ill., in the spring of 1914.

The regulations follow:

GENERAL REGULATIONS

(1) SHAFTS—HOISTING COMPARTMENT—All hoisting compartments hereafter sunk in which men are hoisted in cans by power hoists must be not less than 5½x5½ ft. in the clear.

(2) LADDERS IN SHAFTS—Every mine or isolated underground working reached by a vertical shaft only must have at least one shaft equipped with a substantial ladder. This ladder must be of sufficient strength to sustain a load of 200 lb. for each 8 ft. of length, and must be anchored at the bottom. No ladder shall be inclined backward.

NOTE—A substantial ladder can be constructed in the following manner: Uprights of 2x4-in. selected pine or fir, rounds of ¾-in. pipe or rods, set in mortises 1½ in. deep; uprights tied together every 8 ft. with a bolted rod. Ladders may be connected with wrought-iron or steel straps 1½x½x36 in., attached to each ladder with two ⅝-in. bolts.

(3) LADDERS IN SHAFTS BEING SUNK—Ladders must

be provided in all shafts in course of sinking to within such a distance of the bottom as will secure them from damage by blasting. From the end of such ladders chain or other extension ladders must be continued to the shaft bottom.

(4) RAILING AROUND TOP OF SHAFTS—Every shaft must be equipped at the top with a substantial railing not less than 3 ft. in height, constructed with two rails, the bottom rail being placed midway between the top rail and the floor. Every opening in the railing must be equipped with a bar or a gate. Where bars are used, lap bars with a lap of not less than 2 ft. are permissible.

(5) LIGHTING SHAFTS—In every mine the shaft in use must be lighted at the top and bottom landings with fixed lights.

(6) CABLE HOOK—The cable hook must be closed with a spring snap. All hooks must be made of Norway iron not less than ¼ in. in diameter. Hooks must be kept in good repair.

7) TAMPING BARS AND POWDER PUNCHES—All tamping bars and powder punches must be of wood, or equipped with wood or copper tips.

(8) STORAGE OF DYNAMITE—Dynamite, caps or other explosives must not be stored or thawed in the change house or in other buildings frequented by employees. Dynamite and caps must be kept in separate magazines, both above and below ground. Only a sufficient quantity of explosives may be stored underground to meet the estimated requirements of the succeeding 24 hours. A suitable thawing house must be provided for use where high explosives are to be thawed. Such thawing house must not be heated with steam under pressure. Such thawing house should be located at least 300 ft. from mine structures and dwellings. Refuse must not be allowed to collect in the thawing house, and employees must not be permitted to prepare primers in either the thawing house or the magazine. A suitable magazine must be provided for the storage of high explosives. Where conditions will permit, a naturally isolated situation should be chosen as far from the mine buildings and dwellings as is practicable.

(9) HOISTING AND HAULING CABLES—All hoisting and haulage cables used in vertical and inclined shafts must have a factor of safety of not less than eight, by which it is meant that the ultimate strength of the cable must not be less than eight times the total weight on such cable. Spliced cables must not be used for hoisting. Hoisting cables must be securely fastened to the drum, and when in use must never be fully unwound, at least 1½ full turns being left on the drum.

(10) HOISTING EQUIPMENT—All mine hoists must be equipped with an efficient brake and also an additional device for stopping, such as a friction clutch or an auxiliary brake. The hand or foot levers used for operating the brake must be placed so as to be in immediate reach of the operator in any emergency. All parts of the hoisting apparatus must be kept in good repair.

(11) CAN BAILS—All can or tub bails must be made of Norway iron not less than 1¼ in. in diameter. Bails must never be welded. This order applies to cans of 1000 lb. capacity. On cans, skips, and cars of other capacities, the bails or attachments must be of proportionate strength.

(12) ATTACHMENTS OF CABLES—The cables must pass around an oval thimble, must lap back not less than 18 in. and must be securely fastened with not less than three cable clamps. A tapered socket with babbitt may be used

(13) SIGNAL SYSTEM All shafts where power hoists are used must be equipped with a signal system. A copy of the signal code must be posted at shaft landings and in hoist rooms. The following uniform code of signals must be used: One bell, start or stop, two bells, lower, three bells, prepare to hoist men; three bells followed by one bell, hoist men.

(14) CHANGE HOUSE Where 20 or more men are employed underground, a sanitary change house must be provided Such change house must be properly heated and must be supplied with water and adequate lavatories. The change house must be well lighted and kept in a clean and sanitary condition

(15) MUD OR WATER AT COLLAR OF SHAFT—Pools of water or mud must not be permitted on the floor of the shaft house, at the shaft landing within 6 ft. of the entrance to the shaft way

(16) GREASE AND OIL WASTE—Stairs in mine buildings must be kept free from oil and grease

(17) VENTILATION In mines where smoke, gases, or foul air are not removed by natural ventilation after blasting, before the next shift starts work, some effective means of ventilation must be provided

Rules for Employees

(1) READ THE RULES—Read these rules carefully and be sure you understand them. If you do not understand a rule, ask your foreman to explain It is your duty thoroughly to understand these rules and to obey them.

(2) REPORTING INJURIES In case of accident, no matter how slight the injury, even a slight cut or break of the skin, report at once to your foreman Sometimes a slight cut or scratch will result in blood poisoning if neglected.

(3) CAUTION—Remember that working in mines and about machinery carries with it at all times an element of risk, you are asked always to be careful both for your own safety and for that of others, for many accidents are caused by someone's carelessness.

Hoistman

(1) No other than the authorized hoistman is to operate the hoist.

(2) The hoistman must be in the derrick at least 10 min. before the shift begins and must inspect each cable, hook and brake, and assure himself that everything is in safe condition Before men are lowered, the empty can should be lowered and raised to make sure that everything is safe.

(3) Men must not be hoisted or lowered at a speed exceeding 600 ft. per minute.

(4) The hoistman must not hoist or lower more than four men at one time where cans are used for hoisting.

Miners

(1) Do not crowd around the shaft, top or bottom, when getting into the can.

(2) The tub hooker should be the first man to enter and the last man to leave the shaft, and all bell signals should be given by him.

(3) No man under the influence of intoxicating liquor will be permitted to enter the shaft and no liquor will be permitted on the premises.

(4) Each and every man employed in the mine must, upon entering the ground, examine the drifts wherein he may be and if bad or dangerous conditions are noticed he must report them to the ground boss at once. Do not work under a dangerous roof.

(5) Drill steel of lengths longer than 6 ft. shall not be hoisted with men in can.

Handling Explosives

ALL EMPLOYEES WHO HANDLE EXPLOSIVES MUST OBSERVE THE FOLLOWING RULES:

(1) Don't forget the nature of explosives. By sensible treatment they can be handled safely. Careless treatment makes them a source of imminent danger

(2) Don't handle explosives so near an open light that there is danger from the flame or sparks.

(3) Smoking while handling explosives is strictly forbidden.

(4) Don't throw boxes of explosives or allow them to fall violently.

(5) Don't do tamping with iron or steel bars or tools. Use only the wooden tamping sticks provided for this work.

(6) Don't force a primer into a bore hole

(7) Don't allow explosives to lie around loose in places where you are working

(8) Don't leave blasting caps in the same box with dynamite or close to it.

(9) Don't carry blasting caps in your pocket, and don't tap or otherwise investigate them

(10) Don't attempt to remove blasting caps from boxes by inserting nails or any sharp instrument.

(11) Don't tighten a cap around a fuse by biting it with your teeth, or by the use of a pocket knife. Use a cap crimper for that purpose, and use care in preparing your primers A common cause of misfires is lack of careful attention in priming.

(12) Don't leave dynamite, fuse, or caps in a wet place

(13) Don't use frozen or chilled dynamite. Don't cut or break a piece of dynamite while it is frozen

(14) Don't use any arrangement for thawing dynamite other than the one provided by your employer

(15) When a hole has missed fire the driller must not attempt to remove the charge from the hole, and must not drill within 2 ft of such hole Missed holes must be reported to the foreman.

(16) When squibbing a hole, either blow the hole out or wait until it has cooled before reloading.

(17) Dynamite must not be taken into the mine with caps and primers Don't ride on the can with explosives.

Surface Men

(1) Men working around geared or belted machines must not wear coats or shirts with baggy or ragged sleeves, and overalls must be kept buttoned

(2) When the guards are removed, a machine must not be started until the guards have been replaced

(3) Be careful around moving belts, pulleys, gears, setscrews, etc.

(4) Always apply belt dressing on the side of the belt running from the pulley.

(5) Never put on a belt or take it off while the machinery is running full speed.

(6) Don't oil elevator gears or tighten elevator or any gear boxes when machinery is running.

(7) See that all ladders have some good means to prevent slipping.

(8) Use great precaution in handling electric apparatus. A single shock may mean death or serious injury.

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The Irtysh Corporation

The Irtysh Corporation, Ltd., has been formed in London to acquire from the Russo-Asiatic Corporation the issued share capital of the Ridder and Kirgiz mining companies which, constituted in accordance with the Russian law, hold the concession granted in the Ridder district of the Altai Imperial Estates and the Ekibastus coalfield. The Irtysh Corporation is capitalized at two millions sterling in £1 shares. The present issue, however, is of 6% debentures, £500,000 of which have been created. In addition to being convertible into fully paid shares at £2 10s. per share on or before Dec. 15, 1917, carry the right to an option on the companies' shares at par at the rate of 50 shares for a £100 debenture, for three years from the date of allotment of debentures or 1½ years after the declaration of peace between Great Britain and Germany, whichever period is the longer.

Satisfactory results have been obtained from the development work that has been in progress at the properties in the Altai district of Siberia, according to the technical report now issued. H. H. Knox, who reported on the Ridder mine, calculates that the explorations up to date have disclosed reserves of about 883,000 tons of solid sulphide, and 1,565,000 tons of disseminated ore, or a total of nearly 2,500,000 tons, which is estimated to contain an average profit of over £3 per ton, or a total profit in sight of £7,400,000. Besides this, Mr. Knox states that it is certain that as the explorations progress, further quantities will be added to this amount. A small ore-treatment plant has been erected on the Ridder mine, and it is expected that by the beginning of 1916 this mill will be enlarged to a capacity of 100 tons of solid sulphide ore daily; at the end of that year the mine and plant should be in a position to produce and treat 600 tons daily of mixed ore, or its equivalent of solid ore alone. Mr. Knox estimates that it will be necessary to provide £500,000 in cash, which, together with the profits accruing from the sale of products in 1916, should be sufficient for carrying out this program. The coal property at Ekibastus has been reported upon by Forster-Brown & Rees; this property is expected to earn profits by the sale of coal, in addition to providing the fuel for the lead and zinc-smelting plant which is to be erected to treat the products of the Ridder mine. The latter, it should be noted, is not the only mine included in the Ridder concession.

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Petroleum Exhibit at San Francisco

The U. S. Bureau of Mines is to have exhibits at the Panama-Pacific in two buildings, that of Mines and Metallurgy and that of Machinery. The entire exhibit will include a pictorial display, a geological display, a statistical exhibit, a library of petroleum literature, a technological exhibit, a collection of crude and refined products, a display of housing and sanitary problems, lectures, and an exhibit of fire hazards with methods of prevention and fighting.

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New Mine and Metallurgical Construction

Ash Creek Mining Co., Hornbrook, Calif., broke ground July 1 for a six-stamp mill with capacity of 18 tons, to cost $6000 and to be completed about Dec. 1.

Conzetti Mine, Cecilville, Calif.—Claims bonded to L. E. Spear under agreement to install a 10-ton mill unit every six months until capacity of 100 tons is obtained.

Mountain King Mining Co., Mountain King, Calif., broke ground Oct. 6 for a 150-ton 30-stamp concentrating plant, to cost $50,000 and to be completed in January, 1915.

Phoenix Cyanide Co., Johannesburg, Calif., completed Nov. 26 a 15- to 25-ton agitation and cyanide plant, costing $2500.

Standard Chemical Co., Naturita, Colo., completed Nov. 25 a 30-ton concentrating mill, costing $100,000.

Vindicator Consolidated Gold Mining Co., Independence, Colo., completed Oct. 15 a 500-ton concentrating mill, costing $40,000.

Pittsburg-Dolores Mining Co., Rockland via Yerington, Nev., broke ground June 1 for an 80-ton cyanide mill to cost $40,000, to be completed Apr. 1, 1915.

Northern Ore Co., Edwards, N. Y., broke ground Oct. 1 for a 50- to 100-ton concentrating mill, to be completed Dec. 1, 1914.

Golden Gate Mining Co., Greenhorn, Ore., broke ground July 1 for a 35-ton amalgamating plant, to cost $45,000, and to be completed about Jan. 1, 1915.

Utah Minerals Concentrating Co., Eureka, Utah, completed in November a 100-ton centrifugal concentrating plant, to treat Chief Consolidated ores.

Hammond Mining Co., Glacier, Wash., is reconstructing an old milling plant and adding modern cyanide equipment.

Field Mining & Milling Co., New Diggings, Wis., broke ground in December for a 450-ton zinc concentrating mill to cost $30,000 and to be completed in April, 1915.

Good Hope Mining Co., Keystone, S. D., broke ground Oct. 1 for a 10-stamp mill with a capacity of 40 tons, to cost $10,000 and to be completed Jan. 1, 1915.

Schumacher Gold Mines, Ltd., Schumacher, Ont., expects to break ground in April, 1915, for a 100-ton cyanide plant.

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Reducing the Cost of Radium

The director of the United States Bureau of Mines announces in his annual report that the technical experts of the Bureau have devised a process for the extraction of radium from ores which can be used on a large scale and which is more efficient than that used by the largest foreign producers of radium. Doctor Holmes believes it possible that the cost of radium to the consumer will be reduced to one-third of the present price. He adds that, with radium now selling at $120,000 per gram, its reduction to $40,000 will result in many hospitals throughout the country being able to purchase a supply.

The process devised has already been tested with success in the plant of the National Radium Institute, which is under supervision of the mechanical staff of the Bureau of Mines. The process is to be patented and dedicated to the public.

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December Mining Dividends

Mining dividends paid in December by 38 United States mining companies making public reports amounted to $7,383,297; metallurgical and holding companies paid $8,518,624; and eight Canadian and Mexican companies paid $690,394, as compared with payments of $9,230,918 by 41 companies for December, 1914, and $14,016,551 by metallurgical and holding and $1,174,110 by Mexican and Canadian companies.

United States Mining Companies	Situation	Per Share	Total
Argonaut, g....	Calif.	0.10	$20,000
Boss, g	Nev.	0.10	40,850
Bunker-Hill Con., g	Calif.	0.01	5,000
Bunker Hill & Sull., l.s.	Ida.	0.25	81,750
Butte & Superior, z	Mont.	0.75	406,703
Caledonia, l.s	Ida.	0.01	26,050
Calumet & Arizona	Ariz.	0.50	308,356
Chino, c.	Ariz.	0.50	432,410
Daly-Judge, l.s.	Utah	0.15	45,000
Federal M. & S. pfd., l.s.	Ida.	1.00	119,861
Gemini, g.s.	Utah	5.00	25,000
Golden Cycle, g.	Colo.	0.03	45,000
Hecla, l.s.	Ida.	0.01	10,000
Homestake, g	S. D.	1.65	414,414
Iowa-Tiger, g.s.l.	Colo.	1.00	3,000
Iron Silver, s.l.g.	Colo.	0.10	50,000
Jumbo Extension, g.s.	Nev.	0.05	48,583
Moscow, g.s.c.z.	Utah.	0.03	27,000
Nevada Con., c	Nev.	0.37½	749,796
North Star, g.	Calif.	0.70	175,000
Old Dominion M. & S.c.	Ariz.	0.50	81,000
Portland, g.	Colo.	0.02	60,000
Quincy, c	Mich.	0.50	55,000
Saint Joseph, l.	Mo.	0.05	72,589
Silver King Con., s	Utah	0.10	61,758
Strattons, g	Colo.	0.03	30,375
Stewart, s.l	Ida.	0.20	247,652
Superior & Pittsburgh, c.	Ariz.	1.00	1,499,792
Tomboy, g	Colo.	0.48	150,660
United Globe, c	Ariz.	7.00	161,000
Utah, c	Utah	0.75	1,218,367
Utah Con., c	Utah	0.50	150,000
Vindicator, g.*	Colo	0.06	90,000
Wolverine, c.	Mich.	2.00	120,000
Wolverine & Ariz., c.	Ariz.	0.20	19,431
Yak, s.l.	Colo.	0.04	40,000
Yellow Pine, l.s.z.	Nev.	0.03	30,000
Yukon, g.	Alas.	0.07½	262,500

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Sm. & Ref., com	U.S.	$1.00	$500,000
Am. Sm. & Ref., pfd	Mex.	1.75	875,000
Great Northern Ore	Minn.	0.50	750,000
Inland Steel	Ill.	1.00	78,836
International Nickel, com...	N.J., Can.	2.50	948,133
Lackawanna Steel	N. Y.	1.75	612,115
National Lead, pfd	U. S.	1.75	426,436
National Lead, com	U. S.	0.75	154,915
Old Dominion, c	Ariz.	0.50	146,677
Phelps, Dodge, c....	Ariz., Mex.	3.50	1,575,000
U. S. Steel Co., com	U. S.	0.50	2,541,512

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Crown Reserve, s	Ont.	0.02	35,376
Hedley, g.	B. C.	1.00	120,000
Hollinger, g	Ont.	0.15	90,000
Kerr Lake, s	Ont.	0.25	150,000
Lucky Tiger, g.s	Mex.	0.09	64,380
Peterson Lake, s	Ont.	0.012	63,000
Seneca-Superior, s.	Ont	0.10	47,638

A full review of the year's dividends will appear in the annual statistical number, issued on Jan. 9. The accompanying tables give the details of the December disbursements.

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Tunnel Companies of the United States

A subscriber writes to the Journal asking us to print the names and addresses of tunnel companies which have paid dividends, or are now operating.

The accompanying list, perhaps not complete, at least presents the most important developments of the kind. As to profits, that question is more difficult to answer. Such undertakings are generally believed to be not particularly remunerative, but it is known that the Yak Tunnel has paid large sums in dividends, and the Mascotte is considered one of the best pieces of property in the Heinze estate. The list follows:

Sutro Tunnel, Virginia City, Nev.
Roosevelt Tunnel, Colorado Springs, Colo.
Newhouse Tunnel, Idaho Springs, Colo.
Yak Mining, Milling & Tunnel Co., Leadville, Colo.
The Big Five Tunnel, Ore Reduction & Transportation Co., Idaho Springs, Colo.
Mascotte Tunnel, Utah.

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Samuel Franklin Emmons Memorial Fellowship

The friends of the late Dr. Samuel Franklin Emmons have established a fund, whose income may be used in support of a fellowship to promote investigations in the branches of geology which were cultivated by him, more especially on the economic side. The funds have been placed in charge of the Trustees of Columbia University, but the choice of the fellow and the expenditure of the income are intrusted to a committee consisting of Professors James F. Kemp, John D. Irving and Waldemar Lindgren. The committee announces that it will be prepared to award in March, 1915, a fellowship of $1000 for the year July 1, 1915, to June 30, 1916, inclusive. Applications must be made on blanks which will be furnished by the Secretary of Columbia University, New York, N. Y., and which, when filled and accompanied by testimonials and complete statements of the applicant's qualifications, will be submitted by him to the committee on Mar. 1, 1915. Applications must be received by the Secretary of Columbia University before this date.

The committee requires that applicants should be qualified by proper geological training and experience to undertake the investigation of some problem in or related to economic geology. Each candidate is expected to submit with his application a definite statement of the problem which he proposes to study. The carrying out of the investigation will be under the oversight of the committee and may be undertaken at any place or institution which may be preferred by the holder of the fellowship and which will meet the approval of the committee. The place and publication of results will be decided by the committee. The committee will require that the holder of the fellowship agree to give his entire time and energies to the problem selected, and further agree to contract no other engagements conflicting with or restricting this work without its consent. No objection will be made to the use of the results as a dissertation for the degree of Ph.D. in an approved university.

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Tanalyk Corporation

In the report for the year ended Sept. 30, 1914, R. Gilman Brown, consulting engineer of the Tanalyk Corporation, operating near Kyshtim on the Russian side of the boundary, gives the following statement:

"Total developed ore and stocks amounted at the end of September to 185,000 tons, representing a profit value of £336,000, or sufficient to supply the present smelter and new cyanide plant for more than three years. A further profit of at least £126,000 is expected from ore not yet developed, but confidently expected to be won from the lower levels of Semeonovsky, and additional considerable profits from gold ore alone are indicated by the preliminary work so far done on the outcrops of the other mines, ignoring the extremely good prospects of copper ore underlying these outcrops. With the first unit of the smelter at present working and on completion of the cyanide plant in the spring, profits at the rate of £100,000 per annum are expected. A newly organized geological department has discovered promising prospects at Abasass and Euluke, which are now being developed. The coal mine is opening up well and appears sufficient for all needs for some years to come. A narrow-gage railway has been constructed between the smeltery, Semeonovsky and Mambet, and is now being operated as a horse tram pending the arrival of the locomotives. Two campaigns of the new smelter have been completed, with satisfactory and improving results. Since Aug. 1, operations have been somewhat hampered by mobilization, this being chiefly felt in development and clerical work, and in delays to construction."

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Phthisis Conditions on the Rand

By A. Cooper Key*

It involves no extravagance of language to characterize miners' phthisis as the scourge of the Rand mining industry. The mines employ from 20,000 to 24,000 white men, the unskilled work being performed by natives, although this is governed largely by the native labor available. Owing to the increased use of machine drills, the latter factor is not so important now as formerly. The prevalence of phthisis finally became so serious that in 1911 it was decided to give monetary grants to men no longer able to work. Previously stringent measures had been instituted by the Union of South Africa Mines Department, and the whole subject was brought under continuous investigation by the Miners' Phthisis Prevention Committee, composed of medical men and leading government and mining-company officials. The miners' phthisis act, 1912, elaborated the procedure and increased the allowances under the earlier enactment. It created a board to examine applications for financial relief, the amounts being determined according to the degree of severity of the disease. The secretary of the board stated recently that 4400 applications had been received under the present act, besides 1500 previously.

Over a Million Sterling Paid in Awards

Awards granted up to the end of January amounted to £1,163,000, but part of that will come back to the compensation fund. Medical examination disclosed no signs of silicosis in 335 cases. The men in the first stage receive £8 per month for a year, while those completely incapacitated are awarded £400. Under no conditions will the men be allowed to resume mining work.

Has the Disease Diminished?

Opinions differ as to the progress of the disease. The secretary for mines believes it likely that in four or five years the situation will be different. It is difficult to demonstrate any change now, as men have come in continually for the last five or ten years who are the victims of that period. From August, 1913, there was a rise in the number of applications, but that may have been due to the increased numbers of unemployed. Mr. Van der Merwe, chairman of the board, declared it was impossible to say whether the disease was diminishing, but his colleague saw no signs that it was. One of the medical witnesses thought the present applications were abnormal; and that they would decrease. R. W. Kolze, the government mining engineer, said it was too early to form an opinion as to the progress of the disease. Much of the evidence related to the feasibility of placing victims of incipient phthisis on the land, but one official witness was pessimistic regarding this solution. A mining director suggested that mine workers devote a portion of their earnings to a fund to enable them to return to the land.

Robust Recipients of Compensation

R. A. Barry, manager of the Nourse mines, and a member of the prevention committee, gave some remarkable examples of robust men who had received compensation: A drill packer, in one of the best places in the mine so far as dust is concerned, was at work 12 or 14 months. He secured £400 compensation, went to England and started a public house. There were grave loopholes in the act; men with phthisis came from other countries, managed to get past the doctors, were allowed to go underground, and applied for compensation, though the act stipulates they must have worked underground on the Rand for two out of the preceding four years. Another man who received £96 compensation is a professional football player with a chest expansion of 4 in. Men were certified who had little trace of phthisis, were paid compensation and were unable to go underground again, their livelihood being cut off. This shows that diagnosis of silicosis contains a good deal of guessing. Among the doctors there was some difference of opinion relative to the practical utility of X-ray examinations. Dr. Van Nekerk, medical inspector of mines, gave an instance of a worker who was found free from phthisis by two medical examiners. He was examined by X-ray and obtained a certificate rating him "badly affected with miners' phthisis, Class B."

Improvements in Dust Prevention

Various witnesses testified to recent improvements in the mines. Mr. Hindman, the Miners' Association witness, declared that the mines were doing their best work in the lines of water and supervision. The majority of the men observed the regulations regarding use of water, but more governmental inspection and supervision were necessary. This witness had been mining in various fields for 40 years and attributed his immunity and good health to the use of a respirator and the study of hygiene. Mr. Kolze, the government mining engineer, stated that on the whole the owners supported the department well. Engineers and managers gave all possible assistance and coöperation.

Amount of Dust

Medical members of the committee had not formed any definite opinion as to the relation between the amount of dust and the occurrence of the disease. They could not say that with such an amount as even 5 mg. per cu.m. a man could not certainly contract miners' phthisis. During the last year he had became less positive. A year ago he said that with such an enormous reduction as from 50 to 5 mg. of dust it must necessarily follow that a man could scarcely contract phthisis. The smaller quantity is about that which one gets in the streets, and he concluded that at that rate it would be a long time before a man would get phthisis. However, other facts had been accumulating. The dust found in the silicotic lung after death was of extraordinary fineness. That sampled in a mine is not all so fine, a certain portion being comparatively coarse, and apparently it is the fine dust which causes the trouble. The coarse might contribute, but that was not certain. It may be that, with all the precautions taken, the 5 mg. now remaining may be doing as much injury as the 50 or more before. Years would show how the disease was progressing. The dust found in postmortems was so fine that 50 particles in a row would be about as thick as a hair. He would not advise that mines, proved to be practically free of dust, should be removed from the list of contributors, as it was doubtful if they were not still causing phthisis. Five years hence a scheme might be evolved to relieve the financial pressure on a careful mine, on the basis of dust standards. The advance made in dust prevention and better ventilation during the last two years has been enormous.

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*Editor, "South African Mining Review," Johannesburg, South Africa

Mining & Engineering Society of Alaska

It is reported that the Mining & Engineering Society of Alaska has been formed in Juneau. The following were officers elected: President, Charles E. Davidson; vice-president, H. T. Tripp; secretary, H. P. Crowther; executive committee, Philip Bradley, B. L. Thane, D. D. Muir, R. G. Wayland, C. E. Davidson and B. B. Neiding.

The object of the society, as set forth in the constitution adopted, is to take part in the advancement of the mining and engineering industries in Alaska, and to afford an opportunity for the better acquaintance and the exchange of experiences, ideas, and knowledge among and for the mutual benefit of its members.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALKALI AND ALKALINE-EARTH METALS, Process of Producing. Charles E. Acker, Ossining, N. Y., assignor to The Nitrogen Co. (U. S. No. 1,116,865; Nov. 10, 1914.)

ALKALIES—Process of Recovering Alkalies from Flue Gases of Cement Kilns. Spencer B. Newberry, Baybridge, Ohio, assignor of one-half to John R. Morron, New York, N. Y. (U. S. No. 1,121,532; Dec. 15, 1914.)

ALUMINO-SILICATES. Process of Producing Alumino-Silicates. Robert Gans, Grunewald-Berlin, Germany, assignor to Permutit-Aktiengesellschaft, Berlin, Germany. (U. S. No. 1,121,190; Dec. 15, 1914.)

ALUMINUM ALLOY—Alloy of Aluminum and Process of Making. Thomas A. Bayliss, Warwick, and Byron George Clark, London, England. (U. S. No. 1,117,308, Nov. 17, 1914.)

ALUMINUM ALLOY. William A. McAdams, Bay Shore, N. Y. (U. S. Nos. 1,121,267, 1,121,268, and 1,121,269, Dec. 15, 1914.)

AMALGAMATOR. Arthur James Robinson, Sheridan, Wyo., assignor of one-fourth to Arthur Bullock, one-fourth to James A. Thompson, and one-fourth to Thomas Leech, Sheridan, Wyo., and one-eighth to Richard Williams and one-eighth to Charles Grimm, Greer, Idaho. (U. S. No. 1,121,537, Dec. 15, 1914.)

ANNEALING FURNACE. Carl Kugel, Brunswick, Germany. (U. S. No. 1,118,869; Nov. 24, 1914.)

BRIQUETTE-MOLDING MACHINE. Wesley T. Collins, Colorado Springs, Colo. (U. S. No. 1,117,483; Nov. 17, 1914.)

BRIQUETTING—Method of Forming Agglomerated Bodies from Ores. Wilhelm Schumacher, Osnabrück, Germany, assignor to General Briquetting Co., New York, N. Y. (U. S. No. 1,121,048; Dec. 15, 1914.)

CONCENTRATION—Improvements in or Relating to Ore Concentration. G. A. Chapman, Miami, Ariz. (Brit. No. 18,937 of 1913.)

CONCENTRATOR. Louis Bowerman, Portland, Ore. (U. S. No. 1,118,393; Nov. 24, 1914.)

CONCENTRATOR. Shaking Ore Concentrator. John C. Smith, Salt Lake City, Utah. (U. S. No. 1,118,593; Nov. 24, 1914.)

CONCENTRATORS—Improvements in or Relating to Ore Concentrators. J. Weatherby, New Cumberland, Penn. (Brit. No. 19,302 of 1913.)

CONVEYOR ROLLS. Guard for Conveyor Rolls. Axel G. J. Rapp, Chicago, Ill., assignor to Link-Belt Co., Chicago, Ill. (U. S. No. 1,116,737, Nov. 10, 1914.)

CRUSHING or Pulverizing Mill. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,120,250, Dec. 8, 1914.)

CRUSHING—Reducing System. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,116,777, Nov. 10, 1914.)

DRILL. Charles A. Dempsey, West Chicago, Ill., assignor of one-half to John F. Fowler, West Chicago, Ill. (U. S. No. 1,121,171, Dec. 15, 1914.)

DRILL—Percussive Hammer Drill, and the Like. William Henry Wakfer, South Norwood, England, assignor of one-half to Samuel Pack, Wallington, England. (U. S. Nos. 1,116,159—Nov. 10, 1914; and 1,119,330—Dec. 1, 1914.)

DRILLING MACHINES—Hydraulic Rotary Drilling Machine. Edgar E. Greve, Pittsburgh, Penn., assignor to Oil Well Supply Co., Pittsburgh, Penn. (U. S. No. 1,121,351; Dec. 15, 1914.)

DRILL STEM for Rotary Drilling Machines. Edgar E. Greve, Pittsburgh, Penn., assignor to Oil Well Supply Co., of Pittsburgh, Penn. (U. S. No. 1,117,835; Nov. 17, 1914.)

DRILLING MACHINE. William F. Fletcher, Drill, Va. (U. S. No. 1,117,825, Nov. 17, 1914.)

DRY CONCENTRATOR. Glen D. Harrington, Denver, Colo. (U. S. No. 1,119,950; Dec. 8, 1914.)

ELECTRIC FURNACE. William H. Hampton, New York, N. Y., assignor to The Conley Electric Furnace Co., Inc., Wilmington, Del. (U. S. No. 1,116,884; Nov. 10, 1914.)

ELECTRIC FURNACES—Improvements in Electric Furnaces. A. L. J. Queneau, Jemeppe sur Meuse, Belgium. (Brit. No. 10,061 of 1914.)

ELECTRIC REDUCTION FURNACE. Apparatus for Treating Metals. Samuel T. Wellman, Cleveland, Ohio. (U. S. No. 1,116,772; Nov. 10, 1914.)

ELECTROLYTIC RECOVERY—Improvements in the Electrolytic Recovery of Metals from Their Solutions and in Apparatus Therefor. V. C. Tainton and M. F. L. A. Aymard, Johannesburg, Transvaal. (Brit. No. 19,669 of 1913.)

EXPLOSIVE—Aluminum-Glazed Black Powder. Fin Sparre, Wilmington, Del., assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. (U. S. No. 1,116,944; Nov. 10, 1914.)

FILTER PRESS. Orange James Salisbury, Salt Lake City, Utah. (U. S. No. 1,120,628; Dec. 8, 1914.)

FILTERING APPARATUS. Orange J. Salisbury, Salt Lake City, Utah. (U. S. No. 1,120,629; Dec. 8, 1914.)

GOLD AND PLATINUM RECOVERY. Process of Recovering Rusty Gold and Native Platinum Metals. Robert E. Lyons, Bloomington, Ind. (U. S. No. 1,118,944; Dec. 1, 1914.)

GRAPHITE—Dry Deflocculated Body and Method of Preparing Same. Clinton Paul Townsend, Washington, D. C., assignor to Acheson Oildag Co., Niagara Falls, N. Y. (U. S. No. 1,116,957; Nov. 10, 1914.)

HARDENING—Improvements Relating to the Local Hardening of Iron and Malleable Iron Castings. (Vickers, Ltd., River Don Works, Sheffield, and C. L. Sumpter, Derby, Eng. (Brit. No. 18,643 of 1913.)

HEATER. Utley Wedge, Ardmore, Penn. (U. S. No. 1,121,314; Dec. 15, 1914.)

HEATING AND SMELTING FURNACE. William N. Best, New York, N. Y. (U. S. No. 1,119,227; Dec. 1, 1914.)

HOT-BLAST STOVE. Joseph E. Hausfeld, Cincinnati, Ohio, assignor to The Huenefeld Co., Cincinnati, Ohio. (U. S. No. 1,121,557; Dec. 15, 1914.)

INGOT CASTING. Alexander George McKenna, Washington, D. C. (U. S. No. 1,119,088; Dec. 1, 1914.)

LAMPS—Water-Feed for Acetylene Lamps. John M. Downing, East St. Louis, Ill. (U. S. No. 1,119,936; Dec. 8, 1914.)

LEAD PIGMENT. Process of Oxidizing Lead. Clifford D. Holley, Detroit, Mich., assignor to Acme White Lead & Color Works, Detroit, Mich. (U. S. No. 1,116,702, Nov. 10, 1914.)

MELTING FURNACE. Isaiah Hall, Birmingham, England (U. S. Nos. 1,117,666; and 1,117,667; Nov. 17, 1914.

MELTING FURNACE. Furnace for Melting and Alloying Metals in Vacuo. William Speirs Simpson, London, England. (U. S. No. 1,118,820; Nov. 24, 1914.)

MELTING FURNACE—Furnace for Melting and Refining Copper. Walter S. Rockey, West New Brighton, Hillary Eldridge, Stapleton, and Carle Dawes Clark, New York, N. Y., assignors to Metallurgical Research Co., New York, N. Y. (U. S. No. 1,119,540; Dec. 1, 1914.)

TIN. Process of Detinning. Josef Weber, Essen-on-the-Ruhr, Germany. (U. S. No. 1,115,262; Oct. 27, 1914.)

TIN. Process of Obtaining the Tin from Waste Tinned Metal. Gustav von der Linde, St. Tonis, near Crefeld, Germany. (U. S. No. 1,116,176, Nov. 3, 1914.)

TUBE MILL. Olaf E. Mogensen, Plainfield, N. J., assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,115,715, Nov. 3, 1914.)

TUYERE VALVE. Henry Alinder, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,118,613, Nov. 24, 1914.)

ZINC. Process of Smelting Zinc Ores. James M. Hyde, Berkeley, Calif. (U. S. No. 1,118,012; Nov. 24, 1914.)

ZINC OXIDE. Process of Producing Pure Zinc Oxide. Henry William de Stucklé, Paris, France. (U. S. No. 1,118,894; Nov. 24, 1914.)

Editorials

Canada's Nickel Trouble

Our Canadian friends have been greatly exercised about what may become of the nickel produced by the mines at Sudbury. The chief of these is owned by a subsidiary of the International Nickel Co., an American corporation. Canada herself is the great producer of nickel, but is not a consumer. In fact, Canada is not even a refiner, most of the roughly smelted product of Sudbury being brought to New York for refining. This happened through perfectly natural ways.

In the early days of the International Nickel Co., when the refining of the Sudbury matte was done by the Orford Copper Co. as a separate concern, a great deal of money was spent in an endeavor to work out a process as satisfactory and as economical as that of the Orford. This, however, was found to be impossible, and the International Nickel Co., to protect its own interests, was finally forced to take over the Orford company. This purchase represented a large investment, and in the event of a Canadian export duty being placed on nickel matte, the International would be forced to build a refinery in Canada, and the investment in the Orford plant would be almost a total loss. The Orford plant is exceptionally well situated as regards labor, source of raw materials, market and transportation.

However, the Canadians have been greatly agitated ever since the war broke out regarding the destination of the nickel refined from their ore in the United States. It has been charged by the newspapers that Germany has continued to receive nickel from the International, that the policy of that company was to a large extent dictated by German stockholders, and that, in fact, the Krupp concern itself is an important stockholder.

Such charges naturally created an awkward situation. Any measures that would compel a closure of the Sudbury mines could not be calmly contemplated for that would mean the loss of employment by a good many men. On the other hand, the American owner of the ore, having brought it to its only place for refining, had naturally the right to do what it wanted to with its own. In this juncture, Mr. Monell, president of the International Nickel Co., made the following statement a few days ago:

> TO THE CANADIAN PUBLIC
>
> In view of the wide-spread comment in the Canadian daily and technical press as 'to the destination of shipments of nickel made and being made by the International Nickel Co., and obtained from material of Canadian origin, as well as the references to a European controlling influence in its affairs, the company begs to submit to the Canadian public the following statements of facts:
>
> (1) There is absolutely no influence exerted in the conduct of the affairs of the company, or of any of its subsidiaries, by any European steel-manufacturing or similar industry, nor by any individual connected with them, nor by anyone in European financial circles
>
> (2) Full information as to the destination of shipments of nickel made by the company has been in the possession of the Dominion authorities since the outbreak of the European war and they are currently kept cognizant of all exports of nickel, as well as of all local shipments made by the company.
>
> (3) While recognizing that refining at the point of production, i.e., the mines, is the ideal condition, economic conditions, seriously affecting cost of production, have dictated the present location of nickel refining, and with the present state of the art, any material change in such economic conditions would react in a manner most detrimental to the Canadian nickel industry.
>
> THE INTERNATIONAL NICKEL CO.,
> A. MONELL,
> President.

It will be observed that Mr. Monell does not deny foreign stock interests in his company, which is, of course, something beyond the company's control, it being a public concern whose shares may be freely bought; but he is sufficiently specific in his repudiation of the charges of European influence in the management of the company's affairs. As for the rest, the attitude of the International Nickel Co. ought to satisfy the Canadian people. It has, in fact, acted as if it were a Canadian corporation, keeping the Sudbury mines going while keeping their product away from Canada's enemy. We suppose that may properly be said, inasmuch as keeping the Ottawa government informed implies governmental sanction.

However, the statement of the International Nickel Co. appears to have failed to allay the excitement in Canada, where in the present temper of the people economic arguments do not carry much weight, and there is evidently a strong public sentiment in favor of the government putting an embargo on nickel regardless of consequences. This is being urged by a strong part of the daily press, which says bluntly that they want the assurance of the Dominion Government, not of the International Nickel Co., that everything is all right. The manner in which this is being made a political issue is illustrated by the Toronto *Telegram,* which shouts: "The present situation is that Britishers and other enemies to the Teutonic armies are being shot down by machine guns hardened with Ontario nickel and not an Ontario boy goes into action except at the risk of having to face bullets barbed with the nickel of which his own native province has a monopoly." The Toronto *World,* commenting on the statement of the International Nickel Co., remarks that "Certainly there is not a word of denial of the fact that Germany has got most of the nickel in her warships and torpedo boats that have sent so many British sailors to the bottom of the sea, and the nickel bullets that have ended the lives of so many British soldiers, Canadians included, from the nickel deposits of Ontario."

Of course, there is a good deal of claptrap in such talk, but it is inflaming the public and provoking a delicate situation of which a solution may have to be the purchasing of the International Nickel Co. by the Canadian government, as one Canadian paper ingeniously suggests. But, of course, the government may declare its own part in the supervision of the business. What if the government should be forced to prohibit nickel exports, shutting up the Sudbury mines, and preventing Bethlehem from furnishing nickel-steel to the Allies? The whole question bristles with difficulties.

On Dec. 26 the Canadian government issued a memorandum with regard to the export of nickel matte from

Canada to the United States, stating that the whole subject has been under careful consideration and investigation and that they have been in frequent communication with the British government as to the precautions which should be taken to prevent export to Germany. The books of the International Nickel Co., at New York, are inspected at short intervals by a thoroughly trained and experienced accountant, who goes into all exports, and reports to the Canadian government. By an arrangement between the company and the British government, certain control is exercised in London through the company's British representatives. The company is not under German control, the vast majority of the stock being held in the United States. There may be a few German shareholders, but the proportion is insignificant and there are no German directors. The steps taken by the Canadian government have the approval and sanction of the British government, which expresses itself entirely satisfied with the precautions taken. The memorandum goes on to point out that nickel is used in a large number of American industries and prohibition of the export, except for the most urgent reasons, would be undesirable as it would produce great business disturbance in a country whose sympathies are strongly with the cause of the Allies. Moreover, the government is informed that there is an output of nickel in Norway, controlled by German interests, which could furnish a supply for German requirements during the war.

This memorandum will probably have the effect of allaying the agitation so far as the supporters of the government are concerned, and though it may be continued by the sensational press and opposition partisans, it is not likely in view of the explicit statements of the government to lead to any practical result.

The Copper Export Controversy Again

The means that have been taken to keep Germany from getting copper up to this time appear to be substantially as follows: Holland has agreed not to permit the passage of copper through its domain. Italy has put an embargo on the exportation of copper, and permits importations to be made only under its own supervision, but does not interfere with the passage through Italy of copper destined to Switzerland. This may be, however, only for Swiss consumption, inasmuch as Switzerland herself has put an embargo upon the exportation of copper. Great Britain also made agreements with Denmark, Sweden and Norway, whereby they do not permit copper to pass to Germany, Great Britain agreeing, on the other hand, not to interfere with consignments to special persons in those countries with certificates of guarantee against reëxportation. Thus Germany's gateways are effectively closed and the copper manufacturing industries of that country are suffering keenly.

It is argued that Germany has enough copper of her own production to serve all of her military purposes and that the exclusion of foreign copper is merely detrimental to her industries and conveniences, while certainly it is detrimental to American producing interests. However this may be, Great Britain and her allies have effectively closed the gateways to Germany, wherefore the memorandum from Washington to London, Dec. 24, expressing in vigorous language the American opposition to British interference with neutral commerce, is probably more academic than anything else in so far as copper is concerned.

One of the chief complaints made in this note is against the British treatment of American cargoes of copper. Washington also sets forth its position on consignments shipped "to order," stating that this circumstance alone is not sufficient on which to hold American cargoes, and is not of itself a matter to arouse suspicion. This view has been expressed by the Supreme Court of the United States, but Great Britain announced recently that cargoes shipped "to order" would be regarded as "suspect." In this connection the American note remarks that commerce between neutral nations constitutes the normal relations of peace and not war, and that the presumption of guilt cannot rest on neutral shippers, but the burden of proof must be imposed on the belligerent who interferes.

This seems to be a strong statement of the American case, and it will not be surprising to find Great Britain agreeing to the principle, but unfortunately that is not going to reopen the German market so long as the countries contiguous to Germany maintain their embargoes.

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The Status of Copper Hydrometallurgy

The hydrometallurgy of copper during 1914 has been confined largely to the development of electrolytic precipitation with insoluble anodes. As predicted in the Journal a year or more ago, this has been focused on the use of sulphur dioxide as a depolarizer, although it may be characterized by less euphonious terms in the several patented processes. Experimentation has continued in Arizona along these lines and also with the use of weaker acid lixiviants, without any unexpected or startling developments.

The Nevada-Douglas metallurgists, after a careful series of experiments on sulphuric-acid leaching and electrolytic precipitation with the use of sulphur dioxide, abandoned this method entirely and are reported to have started the installation of the Rankin nitric-acid process. We have not heard any details of the operations with the latter. In view of the magnitude under which leaching processes will have to be conducted on low-grade ores, it seems improbable that it can be made a commercial success for general use. The Butte & Duluth metallurgists also pronounced the supposed advantage of sulphur dioxide as a depolarizer to be a fallacy, and abandoned its use as an acid maker, and stuck to straight electrolytic precipitation.

The Copper Queen metallurgists adhere to the idea of electrolytic precipitation and seem still to have faith in sulphuric dioxide. Chuquicamata will precipitate electrolytically, but will operate under conditions peculiar to itself. The Anaconda company, which is keeping one foot firmly on the ground before it steps off into the quicksand of inexperience, has begun the construction of its gigantic leaching plant, but will precipitate its copper in the time-honored way, using scrap iron, which will be supplemented by iron sponge made from calcined ore. It has been demonstrated that this sponge iron can be made easily and cheaply.

With regard to the use of lixiviants other than sulphuric acid, the Calumet & Hecla has been planning to leach with ammonia, but lately not much has been heard about plans from that quarter and there is a suspicion that some snags have been encountered.

The upset in copper conditions produced by the war has taken the heart out of many who were planning new enterprises and lately we have not heard so much about hydrometallurgical plans as we did early in 1914, but we have heard something surprising in a communication from Stuart Croasdale, who wrote as follows:

> However, the leaven of metallurgical progress is working so quietly and rapidly throughout the mass of research investigation that it now seems almost safe to predict that copper leaching, as a commercial metallurgical process, will become obsolete for ores in the United States before any of the contemplated plants are completed, and there is every promise that oxidized and mixed copper ores, even though they contain gold and silver, can be eventually treated by simpler and cheaper processes.

Mr. Croasdale is one of the hydrometallurgical pioneers and has been enthusiastic respecting copper prospects in that direction. But now apparently he sees a better and easier field to plow.

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Mr. Hammond Proposes a Pan-American Court

John Hays Hammond, at the December luncheon of the Manufacturers' Export Association in New York, suggested the formation of a Pan-American Supreme Court charged with deciding disputes which arise between the commercial interests of this country and of Latin America. Mr. Hammond believes that this court would assure investors of fair treatment and result in attracting capital. He said: "If inspired only by self-interest, the aim of such a court would obviously be to establish confidence in the security of Latin-American investments, and for that reason foreign investors would be assured of fair treatment." Latin-American governments, with a few exceptions, are undoubtedly becoming more stable, but some definite form of assurance is required to change public opinion. The investing public has been accustomed to thinking of each new revolution or government canceling the rights granted by its predecessors, tying up or sacrificing capital that had been invested in the preliminary phases of an enterprise.

Certain citizens of the United States have invested in some extremely successful mining and agricultural operations in Central and South America, but the great majority of investors in the United States have been deterred from entering into Latin-American enterprises by a fancied (or real) insecurity of such investments, as well as by the supine and vacillating foreign policy of the United States in the protection of its citizens. Much capital would undoubtedly flow to Latin America now, if these impediments were removed. There are great mineral possibilities in these countries, but in the United States the appreciation of these possibilities is largely confined to mining engineers, who are impotent without capital. The average investor who supplies the money for new enterprises is still obsessed by the idea that there is no security for his investment in Latin America. If a Pan-American Supreme Court will secure such investments from revolutionary troubles, unreasonable imposts and practical confiscation, the way would be cleared for a further flow of American capital to our neighbors on the south.

BY THE WAY

Now it appears that the bane of apex litigation has fallen upon Tonopah. Some suits have already been started and more are to follow.

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Someone who is evidently interested in disaster is furnishing New York and Boston daily papers with alarming accounts about the scarcity of manganese. The alleged facts in most of these paragraphs are skillfully selected and arranged to give them an appearance of truth, but they are very far from presenting the real case. As a matter of fact, ferromanganese can be had at $65@70 per ton, and we do not know of any steel maker who is particularly worried about future supply. The intimation in a Boston contemporary that steel production in this country must cease about New Year need alarm nobody.

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A well known New York engineer quotes a letter from a correspondent in Petrograd who says that there are now 500,000 tons of goods piled up at Archangel, while the only railway leading from there, a line of 42-in. gage, has capacity for the carriage of but 1500 tons per day one way. We think the estimate of total quantity is probably exaggerated, inasmuch as it would imply 100 to 200 shiploads, which would be a surprising number, although we know that things have been very busy in Archangel during recent months. As to railway capacity, the operation of the Trans-Siberian in the Japanese war made us very respectful of the Russian ability in railroading.

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Every copper producer is tired of the remarks of his friends unacquainted with the copper business to the effect of something like this: "You copper producers are profiting greatly by the war, of course. Well, it's an ill wind that blows nobody good. Go to it and make hay while the sun shines." The copper producer wearily explains that the war having cut off America's largest customer put the copper business in a desperate condition from which it has become only moderately convalescent, being still on crutches and not able to stand without them. His ingenuous friend expresses surprise and remarks that he thought the manufacture of ammunition required a large amount of copper. So it does, but the consumption of copper for military purposes is trifling in comparison with the consumption for peaceful purposes that has been so largely checked. Cartridge cases do not amount to much in comparison with trolley wires.

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Park City Mills

In an article describing the equipment at the Park City Mills, in the JOURNAL of Nov. 28, mention was made of estimated operating costs, and under this head some tests made by the Mines Operating Co. "It was estimated by the Mines Operating Co. that the costs would amount to about $2.50 a ton in a modern 50-ton plant." Owing to possible ambiguity as to what these costs were based on, it may be stated that these tests were made with the Holt-Dern roaster at the Mines Operating Co.'s plant.

PERSONALS

C. Colcock Jones is in southwestern Utah.

J. R. Finlay is now at Grass Valley, California.

C. H. Poirier, manager of the Porcupine Vipond mine at Porcupine, Ont., is in New York.

A. W. Newberry has been in the neighborhood of Barnwell, Calif., and has now returned to Los Angeles.

H. W. Turner arrived in New York from London Dec. 21 and left for San Francisco on the following day.

E. E. Whitely is now assistant superintendent of the Calumet & Arizona Mining Co. at Bisbee, Ariz. D. M. Rait has been made chief engineer of the company.

H. N. Lawrie, chairman of the Oregon Bureau of Mines and Geology Commission, Portland, Ore., was in Chicago recently to attend the dinner and meeting of the Chicago Section of the A. I. M. E.

George Howard Ferguson, member of the Ontario Legislature for Grenville, has been appointed provincial Minister of Lands, Forests and Mines, in succession to Hon. W. H. Hearst, recently appointed Premier.

Woolsey McA. Johnson has resigned as first vice-president of Johnson Electric Smelting, Inc., but continues to be a director in the company and its consulting engineer. Construction work at Keokuk, Iowa, has not yet been begun.

Capt. M. Cooney, a pioneer Mogollon mining man and member of the board of regents of the New Mexico School of Mines, has been missing since Oct. 25 and is believed to be lost in the Mogollon mountains. Searching parties are being organized to scour the country for him.

Frederick P. Dewey is Acting Director of the Mint in place of George E. Roberts, lately resigned. We do not know that Mr. Dewey is a candidate for the Mint directorship, but the idea occurs to us that he would be an excellent director of that bureau and his long service with it entitles him to the honor.

News that we published last week about the wounding of Robeson T. White caused a good deal of alarm among his many friends. This was relieved by the receipt of a cable dispatch, Dec. 28, communicated by Mr. White from Tiflis through the London office of the Caucasus Copper Co. Mr. White reported that his wound was slight and that he is now nearly recovered.

Quincy A. Shaw, president of the Calumet & Hecla Mining Co., has been compelled to relinquish all business as well as his diversified athletic and social activities, because of a physical and nervous breakdown, according to a statement made by his uncle, Maj. Henry L. Higginson, Dec 24. The condition of Mr. Shaw, who is widely known through his management of the mining interests in Michigan organized by his father, the late Quincy A. Shaw, and his participation in sports, is said to have been due to overwork He is now in the care of physicians, who have imposed upon him the restriction of complete rest.

W. L. Jones, vice-president and general manager of the Jones & Laughlin Steel Co., has announced that Capt. Thomas Walters, manager of the company's mines in the Lake Superior district, and who tendered his resignation to take effect the first of the year, will be succeeded by Mark Elliott, of Virginia, Minn., and Charles T. Kruse, of Ishpeming. Mr. Elliott will look after the company's affairs in Minnesota, while Mr Kruse will have charge of the mines in Michigan. At the present time Jones & Laughlin have 11 mines in Minnesota and four in Michigan. Mr Kruse will continue to act as auditor for the Lake Superior district Thomas Walters, Jr., of Ishpeming, will be assistant to Mr. Kruse in the underground work in the Michigan mines. The announcement that Mr Kruse and Mr. Elliott would succeed Captain Walters was well received in the Lake country, where both have spent the greater part of their lives and where they are well known

OBITUARY

Thomas O'Brien, one of the pioneers of Colorado, and for many years a well known miner there, died at Denver, Dec. 11, aged 75 years.

John H. Hancock, chemist at the Ray Consolidated mill at Hayden, Ariz., was accidentally killed while hunting near that place, Dec. 16. He was 25 years old and had been at Hayden four years.

Matthew Sullivan died at Butte, Mont., Dec. 15, aged 75 years He was born in Ireland and came to the United States in 1862. After mining in California and Nevada, he went to Butte in 1880 and had lived there ever since He was a close friend and associate of Marcus Daly He retired from active work 10 years ago.

Mark Birmingham died in New York, Dec. 23, aged about 85 years. He was owner of the controlling interest in the old Mariposa mine, and more recently, through success in a long-fought law suit, chief owner of the Candelaria gold and silver mines at Durango, Mexico. He was one of four brothers, sons of David Birmingham, of Montgomery County, N. Y., and went West in the gold rush of 1849. Mr. Birmingham made a fortune and became a banker in Marysville and later in San Francisco, and through his friendship with Gen. John C. Fremont acquired his interest in the Mariposa. He was the oldest member of California Lodge No. 1 of Masons, a Shriner and a member of the order of Masonic Veterans. He was married twice; his second wife and six children survive him.

Charles Martin Hall, inventor of the process of aluminum smelting which is now in general use, died at Daytona, Fla., Dec. 27, aged 51 years. Dr. Hall was born in Ohio and graduated from Oberlin College in 1885. He continued the study of chemistry, and in 1886 filed application for a patent on his process for making aluminum. His right to the patent was contested and it was not until 1893 that his prior right to the invention was finally established in the courts. In 1911 he was presented with the Perkin medal for his work in chemistry, and at that time a full account of his work was given. He began the commercial manufacture of aluminum with the Pittsburgh Reduction Co. in 1888, and since 1890 had been vice-president of what is now the Aluminum Company of America, its successor. Mr Hall was a member of the American Philosophical Society, the American Institute of Mining Engineers, Franklin Institute and American Electro-Chemical Society, a trustee of Oberlin, member of several clubs and societies. He never married.

Col. Thomas Cruse, a pioneer of Montana and one of its most successful mine operators and business men, died at his home in Helena, Dec. 20, aged 79 years. Born in Ireland, he came to the United States when 20 years old and engaged in mining in California, Nevada, Idaho and Montana. In the '60s he located at Helena, engaging in placer mining in the summer and prospecting in the winter. On one of these trips he discovered the Drumlummon lode in the Marysville district. This he developed under circumstances that would have discouraged most men. At last he interested an English syndicate in the property. The mine was examined by the English people and was sold to them at a figure supposed to have been a million dollars. Colonel Cruse received in addition a large block of stock, which he later sold at a high figure. He never abandoned mining, investing his earnings in banking and ranching enterprises. Up to his death he operated successfully and profitably the Bald Mountain mine in the Marysville district and a mine in the Scratch Gravel district near Helena. He left an estate supposed to be worth several millions of dollars.

SOCIETIES

American Institute of Mining Engineers—The next meeting of the New York Section will be held Jan. 6, at the Machinery Club, 50 Church St. The meeting will be preceded by a dinner served at 6:30 p.m. Following the dinner Dr. L. D. Ricketts will open the discussion of "Problems in Leaching Copper Ores," in which a number of prominent members have already promised to take part. This will be a joint meeting with the American Electrochemical Society, and will be one of the most interesting meetings of the year

TRADE CATALOGS

The Pelton Water Wheel Co., San Francisco, Calif. Catalog. Turbine and Tangential Water Wheels. 102 pp., illus., 6x9 inches.

Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill Bulletin No. 34-S. Small Power Driven Compressors. 16 pp., illus., 6x9 inches

Ingersoll-Rand Co., 11 Broadway, New York, N. Y. Form No 3024. Ingersoll-Rogler Valves for Air Compressing Cylinders. 28 pp., illus 6x9 in Form No 3030. Class ER-1 Ingersoll-Rogler Air Compressors 20 pp illus 6x10 in

Editorial Correspondence

SAN FRANCISCO—Dec. 23

The Argonaut Apex suit will not be reopened. The motion to that effect has been denied by Judge Wood in the superior court of Amador County. The suit of the Kennedy Extension Gold Mining Co. against the Argonaut Mining Co. was decided in favor of the Argonaut on June 29, 1914, when the court filed a written opinion as to the facts proved and the principles of law that he considered applicable thereto. In view of the geological conditions thus far revealed the court now thinks it not improbable that each side might continue indefinitely by additional work to make disclosures which it would deem corroborative to its theory. Neither side was hurried in the preparation for this trial. The court concludes, therefore, that "there must be a time even under the extreme latitude allowed in mining litigation when the opportunity to produce evidence at a trial must be closed against the litigant, and that time appears to have arrived in this case."

Natomas Consolidated bonds have been all deposited under the reorganization, except $155,500. Of this amount $95,000 is held in Belgium, Switzerland and France; the other $60,000 is scattered, its whereabouts not definitely known. The total number of bonds deposited represent $14,103,000. The new company will be formed about the first of the year to take over the old company. The levees of the two reclamation districts are expected to be completed by that time. They are said by the engineers to be safe from ordinary floods. About 80% of the agricultural land is leased and will be planted in barley and wheat. The company will receive 25% of the crop for the first year and 33⅓% of the crops for each of the next succeeding two years. The gold dredges in both the American River and the Feather River fields had good seasons. There were no new boats built during the year. Altogether the outlook for the success of the new organization is hopeful.

New Year Prospects look bright to mine owners and mine investors in California, and it is believed that 1915 will show an appreciable increase not only in gold production but in the production of other mineral substances. The report of the Selby Commission lends positive encouragement to copper miners, and it is now believed possible to smelt copper ores in California without being further harrassed by the farming element. The potash and magnesite industries should make an excellent showing in 1915. The only danger lies in the taking hold of such properties by irresponsible investors. There has recently been prospected a new magnesite deposit in Placer County which it is believed can be developed into a commercial undertaking. New potash deposits will be ready for development in San Bernardino County, and if the enterprise gets into the right kind of hands there is every reason to believe it will prove a commercial success. Dredge operators will probably meet with some opposition in the coming legislature, as there have been complaints of injury to streams by the outflow of water from the dredging ponds. Interference by the legislature will give opportunity for the California Metal Producers' Association to show its strength. There is no doubt that in some instances the operation of dredges should be more carefully regulated, just as it was at one time necessary to regulate the operation of smelting plants.

An Insurance Rate Reduction from 7.86% to 3.25%, obtained by the California Metal Producers' Association, is another good sign for 1915. Recent announcement of rates offered by the Industrial Accident Insurance Commission, made apparently on behalf of the commission, was misleading in that it ignored the lower rate secured by the Producers' Association. While the action of the state commission is commendable, it is quite probable that the old rate would have stood but for the activity of the metal producers.

When the California Metal Producers' Association met with the Industrial Accident Commission, Nov. 5, there was an apparent desire on the part of the commission to reach satisfactory terms with the mine operators regarding insurance. Subsequent to that meeting there were informal conferences between a committee from the commission and a committee from the association. In the beginning the commission was inclined to stand by the rate of 7.86 and decline all mining business. Later it apparently became convinced that the mining insurance business might be a good thing for the fund to handle; and a reduction was offered which would make an average rate of about 5½%. This offer was made on condition that the association would guarantee $100,000 in premiums. Shortly after that a reduction to 5% without the premium guarantee was offered.

The association continued its investigations and negotiations with various stock companies, and by offering the association business as a unit, or practically so, the members were given a rate of 3.25 flat, on unlimited risks covering all employees, regardless of the character of employment, whether underground, surface, mill or dredge. The announcement made on behalf of the commission was a rate of 5% for underground men, 2.79 for millmen, 4.8 for dredgemen, including the proposal to accept unlimited risks on this basis. Had the commission come out squarely in the beginning of these conferences and offered these last rates, it is not at all unlikely that the operators, acting through the association, would have accepted them and taken out insurance through the state fund. But the commission seemed in the beginning determined to maintain the high rate or demand a guarantee; and the apparent inference was that if the metal producers did not accept, then the high rate would stand in 1915, as in 1914, as a basis for stock companies to fix their rates upon. There is no doubt that if the metal producers had not organized the state rate would have remained the same and the stock companies would have continued charging high rates for mine risks.

This accomplishment of the Metal Producers' Association within less than two months after the organization was completed should attract the attention and appreciation of every mine owner and smelter in the state, and induce every operator and manager and owner who is not a member of the association promptly to come in and help to maintain an organization that evidently can be made of great and permanent benefit to the mining industry with proper support of men interested in mining and smelting. The association is sufficiently strong now to support itself and accomplish much for the industry as a whole and for mine owners as individuals, but the greatest good to the entire number will not result until the mine owners all over the state, irrespective of the class of mining engaged in, shall take part as members and workers. The association is not engaged in political reforms, nor has it anything to do with labor troubles. But it is considering and working for the best interests of the whole mining industry. Its membership includes practically all the deep gold mines, all the smelting plants, all the large dredges and a part of the hydraulic and the quicksilver mines. Within the first half of the year 1915 it is expected that every branch of metal production will be fully represented in the membership of the association.

DENVER—Dec. 24

Shut-Downs for the rest of the winter are faced by numerous mines on Breece and Iron Hills, in the Leadville district because of a threatened famine in boiler-water supply. These properties all contain abundance of mine water but it canno be utilized in the generation of steam because of its corrosive qualities. Hence they depend upon pure water derived from the Iron Hill ditch constructed in the early days of the distric for placer-mining purposes. This season's severe cold weather, accompanied by the absence of the normal snowfall, which ordinarily serves as a protective blanket over the ditch and its sources, has closed the ditch and frozen some of the pipe lines leading therefrom to the mines. Among the prominen mines already affected is the Ibex (Little Jonny), operated now chiefly by lessees, and which closed—it is hoped bu temporarily—Dec. 18.

Leadville Boosters are endeavoring to promote a coöperativ local company having for its object the driving of an exploratory, transportation and drainage adit into Prospect Mountain, a prominence north of the main active part of the distric and known to be composed of the same general geologica series as prevails in the region surrounding the city and eas of it. The project contemplates subscriptions calling fo monthly cash installments of $10 per share for a period o years, all funds to be handled and expended by a party o influential business men who will act as directors of th corporation to the end of furthering the development of th district's resources and activities. Prospect Mountain ha been sufficiently prospected with surface work to warrant deep exploitation, for the best ore-bearing horizons lie comparatively deep.

The Cresson Strike is of interest not only on account of its great value but on account of its depth. A visit to the mine and a personal inspection of the bonanza impresses one tremendously. The occurrence of a large chamber of extremely high-grade ore at a depth of 1265 ft. below the surface is sure to inspire confidence in the deep-development possibilities in the district and will undoubtedly stimulate work on the lower levels of many Cripple Creek mines. Contributing influences are the recent favorable developments in the lower levels of the Vindicator and Golden Cycle properties, just over Bull Hill from the Cresson mine. The strike was made in the 12th level of the Cresson in the midst of the main oreshoot. A raise which was being driven as an ore pass from one of the crosscuts in the orebody on this level broke into a chamber almost full of rich ore thickly incrusted with crystals of quartz, strontianite and gold tellurides. The chamber is about 14 ft. wide, 23 ft. long and 36 ft. high. The present cavity is pear shaped and the ore pass enters it at a point a few feet above its present bottom. The full extent of the find has not yet been determined, but its extension downward will soon be learned by means of a crosscut driven to tap it at a point about 27 ft. below the 12th level. When first opened, the cavity had the appearance of a stope filled with broken ore. The filling consisted of fragments of breccia incrusted and permeated with crystals of sylvanite and calaverite. Most of this material could be mined with a pick. The telluride crystals were of two kinds; some were tabular, many over ¾ in. long, and many of these exposing a face having an area of more than ½ sq.in.; others were small and thick. Irregular deposits of crumbly, crystalline material thickly impregnated with telluride crystals formed the richest ore and assayed from $10,000 to $16,000 a ton. This material was carefully sacked, together with other fragments which were thickly encrusted with sylvanite. The balance of the chamber filling was shoveled over a 1-in. screen, the undersize assaying from $5000 to $6500, and the oversize running from $1000 to $1500. After the removal of the bulk of the filling above the chute opening, shots were put into the walls and all of the rock broken down was found filled with sylvanite crystals, as well as the walls from which the material was broken. The walls of the chamber show numerous small vugs lined with quartz and strontianite crystals and sylvanite or calaverite. The net value of the ore actually in sight may be conservatively estimated at not less than $500,000. In view of the fact that the extent of the deposit has not yet been determined it is probable that later development may justify a much higher valuation. The main oreshoot in which the rich chamber occurs is about 500 ft. long and has a maximum width of about 150 ft. on the 12th level. This shoot has been mined down from a point above the 6th level, but at the 12th level the width of the shoot suddenly increases from about 50 ft. to 150 ft. and the richest ore in the mine has been found in this level. The fact that the average value of the ore has increased with depth is a pleasing argument for those who favor deep development in the district. The Cresson is operated by the Cresson Consolidated Gold Mining & Milling Co. Most of the stock is owned by Chicago investors. The property lies in the gulch between Raven and Bull Hills. The mine has been efficiently managed for several years by Richard Roelof and its costs are probably the lowest in the Cripple Creek district.

BUTTE—Dec. 24

Labor Unions—Moyer, Miller and O'Brien commenced suit in the district court, Dec. 17, to oust the officers at present in charge of the affairs of Butte Miners' Union No. 1. These Federation officials allege extravagance and unnecessary expenditure of funds. The court is asked to issue a temporary restraining order prohibiting officers of the local from interfering in any way with Moyer and his representatives in the management of the business of the union. Argument was to have been heard before Judge Lynch, Dec. 21, but went over for a week, after a motion had been made to quash application.

SALT LAKE CITY—Dec. 24

A Mine-Rescue Car of the Bureau of Mines was in Tintic, Dec. 14-22. J. C. Roberts, in charge of the car, met the mine managers and superintendents on the evening of its arrival and gave an interesting talk, offering suggestions along the line of rescue work. Men from the different mines have been sent to the car and given instruction in the use of apparatus and in first-aid work. It is proposed to purchase apparatus and establish a rescue station in the district in charge of a competent man to be paid jointly by the mining companies. General interest was shown in the visit of the car.

SEATTLE—Dec. 23

A Big Strike reported from Candle Creek, a tributary of the Talalena which flows into the Takotna in the Koskokwim region, is responsible for a general movement to the district. The discovery was made on the Aitken & McKinnon property where a Keystone drill was working all last summer and last winter. There has also been a crew of 22 men working in an opencut at the timber line where the ground is only 6 or 7 ft. deep. The paystreak was found on the timber line and is said to be 150 ft. wide and getting wider as it goes down stream, being 480 ft. when the cold weather stopped drilling. The drill holes show an average of $7 to the square foot of bedrock along the left limit of the paystreak; 30 ft. from this rim the average is $6 and from there to the extreme right limit of the paystreak it gradually tapers off to 50c.

On the Upper Tanana, in Alaska, weather conditions hinder mining, according to reports received from all directions. Everywhere in the valley mining men are hoping for snow and sleighing in order that they may start hauling wood and supplies. On Healy River where pay was located last summer, several outfits have prepared for winter work, but will be unable to start until they get supplies. Lawrence & Albrecht who were on Tenderfoot have completed the work of constructing cabins, boiler houses and other buildings but will not start actual operations until snow flies. Josh Ray, Tom Maher and others who have taken property on Healy River will go to Fairbanks as soon as there is sleighing to get supplies so as to start work on a big scale. From the Tolovana, the Big Chena, the Bonnifield, the Kantishna, and other districts come complaints that operations and winter work are being held up for want of supplies.

The Matanuska Coal test results as made by the U. S. Cruiser "Maryland" were given to the public recently by Secretary Daniels and their favorable nature caused a great deal of comment in Alaska. It is believed that this removes any objection that might have been placed in the way of congressional appropriations for the railroad construction work. The only note of doubt in the secretary's memorandum to the committee on naval affairs is contained in the words, "and the results are so satisfactory as to justify the belief that the Matanuska coal is in all respects satisfactory for navy use, provided that the coal tested is a fair indication of the general character of the coal in that field." As against this is the statement given out in Seattle following the news of the report, by George Watkin Evans, consulting engineer, who was retained by the government as chief engineer of the expedition that went to the field last summer and brought out the coal to be tested. He stated recently that "the samples were taken at random and were merely screened without being handpicked. We made tests every day as the coal came down the chute and made no effort to pick out the best coal, because we were not there for that purpose." The test therefore ought to be a fair indication of the coal in the Matanuska field and on this score Alaskans have no fears.

WALLACE—Dec. 24

Shipments of ore and concentrates were 23,000 tons for November from the Cœur d'Alene district, about half the production for the corresponding month of 1913. The reduction in output is due to curtailment because of low metal prices. Most of the mines in the district have reduced their output, some as much 40%. Two of the important mines, the National Copper and the Morning, have closed.

In the Hypotheek mine near Kingston development of ore on the 900-ft. level is of importance because it assures the making of a valuable shipper outside of what had generally been considered the area of valuable deposits of the main Cœur d'Alene district. The mine is six miles west of Kellogg. The ore was found at the intersection of the crosscut with the vein, 180 ft. from the winze. The orebody was crosscut 10 ft., when the flow of water threatened to drown the pumps. Development has had to be suspended until a new pump can be installed. The ore assays from 6 to 30% lead, practically all of the lead being carbonate, an interesting occurrence, geologically, at a depth of 900 ft. below the surface.

HACKBERRY, ARIZ.—Dec. 23

Of the Several Mines in this district, the Copper Giant, since Sept. 28 the property of W. A. Clark, was shut down Oct. 6. It is opened by a 550-ft. shaft in the vein, with drifts on six levels. The work done so far shows the vein to be from 4 to 8 ft. wide, running about 2½% copper with $4 in gold. As soon as financial conditions improve it is proposed to sink to 1000 ft. and probably to install an electric power plant at the railroad. The property is in charge of William Neagle. The Walkover mine, for a time under option to Qualey Bros., is now working with a small force. The ore averages about $30 in gold, but the copper content is increasing with depth. The old Hackberry mine, which in its time produced over $3,000,000 in silver, is under option to Qualey Bros. A vertical shaft was sunk to strike the vein below the old workings, but was not successful, there being no old mine maps giving the necessary data. The shaft was full of water for over two months, but finally, after the installation of a pump and compressor, work proceeded once more. At latest reports the shaft had just broken into the old workings. D. F. Noehl is in charge. The Nevada-Arizona Mining Co. is proceeding with its work at Music Mountain. A good deal of gold ore has been developed. The mill is being enlarged, and a seven-mile pipe line will furnish enough water for the milling operations.

COURTLAND, ARIZ.—Dec. 23

In the Courtland-Gleeson district all the properties are shut down. Some leases are being worked for high-grade copper ore on the properties of the Great Western Copper Co., and of the Calumet & Arizona Mining Co., the ore being shipped to Douglas. Both of these properties are exhausted except for small high-grade copper bodies, and the prospects for the future are not bright. At Gleeson the suspension of operations is entirely due to the shut-down of the Shannon Copper Co., following the demoralization of the market. It seems probable that work on the low-grade cupriferous sulphide bodies will be resumed when normal conditions return.

DULUTH—Dec. 26

The M. A. Hanna contract for Great Northern ore provides for the sale of all ore except that from the Dean mine, which will be operated by Tod-Stambaugh. The total available product for 1915 will be about 3,000,000 tons. An official estimate of the ore in these lands made early in 1914 was 411,449,154 tons. During the time the lands were controlled by the Steel Corporation, it expended about $6,000,000 in development and mined approximately 20,500,000 tons.

HOUGHTON—Dec. 26

Copper Shipments by way of the Great Lakes, from April until the close of navigation, Nov. 18, showed a total of 107,866,000 lb. This can safely be placed as the figure of copper output during the open summer, as practically no copper went by rail this year. This total is divided by ports as follows: Houghton, 17,514 tons; Hancock, 5329; Dollar Bay, 11,260; Torch Lake, 19,830; total, 53,933 tons. In addition to these shipments from Michigan ports 11,122 tons of Western copper passed through the Michigan waterways. This was largely Butte copper on its way from Montana to the Eastern markets, taking advantage of the lower rate by water. Included in the totals given was one shipment of Western copper, 101 tons of electrolytic, that came to Dollar Bay for retreatment and was later shipped to the Eastern markets.

CRYSTAL FALLS—Dec. 26

Prospecting or Exploratory work in Iron County during 1914 was at a low ebb. Several shallow diamond-drill holes were put down on the S. ½ of the N.E. ¼ of Sec. 30—43—32 by a combination of Minnesota interests. This work showed a strong ore formation and disclosed the location of the slate walls, but none of it was carried to sufficient depth to prove the value of this property. The option was thrown up and after six months' time had elapsed the Cole & McDonald Exploration Co., of Duluth, took up the option on its own behalf to drill at depth. This drilling now going on has not progressed far enough to prove or disprove the value of this property.

The Bristol Mining Co., of Ogleby-Norton, recently took options on an extensive area of land west of the Bristol mine in sections 24, 25 and 26, and started test-pit work, together with some churn drilling. The churn drills succeeded in locating the ore formation, and it is of so promising a nature that two diamond drills are now employed, as well as five churn drills. Results are said to be pleasing to the Bristol officials, but no definite information is given out.

The E. J. Longyear Co., of Minneapolis, has been working three outfits, churn and diamond drills steadily during the year on the south half of sections 27 and 28—43—34, lying east of the Rogers mine. The company encountered a heavy surface burden said to go down 300 ft. and more to ledge. Much formation has been shown, but so far as known no ore concentration has been found. This territory is good, as a large ore-basin has been proved by diamond drilling and by the opening of the Rogers mine on section 29, but the surface burden is uniformly heavy and the cost of work necessarily high on that account. On the other hand, the ore has been shown to extend to a depth of 1700 ft.

The St. Clair Exploration Co. did a little diamond-drilling upon the S. ½ of the N.E. ¼ of Sec. 26—43—35, just south of the Chicago & North Western station. It is reported some ore was cut and an important ore formation shown. In addition to surface drilling, underground drilling has been done and also check drilling, notably by the Verona Mining Co., as previously noted in the "Journal."

ST. JOHNS, NEWFOUNDLAND—Dec. 5

Mining on this island, England's oldest colony, is, of course, at a low ebb on account of the war; but there are indications of a revival to come, not only in iron and copper, the two principal ore exports, but also in the other minerals in which the island is rich, but which have lain nearly as undeveloped as when, in 1497, John Cabot was paid £10 by the King of England for discovering the country.

On Bell Island in Conception Bay, not far from St. Johns, the Nova Scotia Steel & Coal Co.'s iron mines are temporarily closed, throwing some hundreds of men out of employment, while the Dominion Iron & Steel Co. is employing a greatly reduced crew working the extensive tracts purchased from the Nova Scotia company for $1,000,000 in 1898. The Nova Scotia company had been shipping much ore to Rotterdam for German consumption, previous to the war, and some of the ore undoubtedly went to make Germany's guns and warships; it has also shipped extensively to Middlesboro, England, and to Philadelphia, as well as to its own furnaces near its coal mines at North Sydney, N. S. Bell Island iron ore, much of which is mined in submarine areas from strata underlying Conception Bay, runs about 50% in iron and possesses the advantage of being a hard, blocky ore well liked for furnace mixtures; a good deal of it occurs in square blocks of the size and shape of bricks. Bell Island, a windy, rocky island, six miles by two, has been elaborately fitted up with modern ore-loading piers, tramways, power houses, and mine machinery by the two companies, and is destined to be a factor in the iron-ore market for years to come. Many million tons are known to exist in the extensive beds under the ocean, occurring in three or four seams varying up to 30 ft. in thickness.

In Notre Dame Bay, farther north on the Newfoundland coast, and off the railroad, is the copper area. Here, at Tilt Cove, Bets Cove, Little Bay, etc., copper has been mined for 50 years. In recent years, however, the English company operating in this area has abandoned the mines and transferred its operations to copper deposits at Bay Verte, 30 or 40 miles up the coast, where promising results are being obtained, although not so large forces are employed as formerly at Tilt Cove. The Tilt Cove mines have reverted to the original owners who are continuing to take out ore where it can be found. The English company, the Cape Copper Co., operated here for a number of years, profitably for the most part, although considerable money was lost in attempting to smelt the ore on the ground instead of shipping it to England. The smelting works were unsuccessful, as the ore requires fluxing.

The Pyrites Mines on Pilley's Island, also in Notre Dame Bay, at one time worked on a large scale by American operators, are now closed and full of water. The oil drilling project at Parsons Pond on the sparsely settled west coast of Newfoundland, about which considerable was heard several years ago when a British company started drilling, has died out temporarily at least, although it is known that oil occurs in that area. Nothing has ever been done in a commercial way to develop the known areas of coal seams in western Newfoundland, which are bound to become important factors in the economic growth of the island. For mining operations along Newfoundland's extensive coast line, coal can be brought from Sydney fairly conveniently in steamers or schooners; from Sydney to St. Johns is about 400 miles by water, while it is only 100 miles from Sydney to Port-aux-Basques situated in the southwest corner of the island.

LLALLAGUA, BOLIVIA—Nov. 19

Conditions in Bolivia are at present anything but good Since the beginning of the war exchange has dropped from over 19 pence to 14 to the boliviano, and business is practically at a standstill. Work on nearly all railroad and development contracts has been stopped and wages for labor have dropped to less than half the figure paid before the war. As it is impossible to sell tin concentrates except in extremely small lots and at low prices, most of the small tin mines have closed down and the larger producers are practicing every possible economy. There is one small smelting plant in Bolivia which is understood to be working at capacity and finding a ready market for its products. It is believed here that someone in the near future must see the advantage of erecting a tin-smelting plant in the United States to handle the Bolivian concentrates. Nothing could be more welcome to the Bolivian miners.

The Mining News

ALASKA

FAIRBANKS YIELD $3,500,000 according to estimates of Wells Fargo for 1914. Total of 174,646½ oz., valued at $3,109,072 shipped by express to States. Compares with shipments of $3,639,899 during 1913. Hot Springs district shipped $200,000 direct this summer. Most of Ruby output also went direct instead of through Fairbanks. Believed private shipments by mail and carrier would make Fairbanks output about same as last year.

MINERAL CREEK promises to be big producer; largest operators, Clifford Philips and associates own 30 claims stretching for four and a half miles from cañon toward head of river, have completed annual assessment work and during summer did considerable prospecting including 600 ft. of open-cut work. Panning in cuts gave good indications but water and lack of machinery prevented reaching bedrock. They will put Keystone drills on property early in spring to reach bedrock and if present indications are fulfilled machinery will be placed on ground.

INDEPENDENCE (Knik)—New mill, probably Lane, will be established on property early in spring.

MASCOT BENCH (Ruby)—Pay on this property where the big nugget was recently found still grows richer, stated miners are now working in ground which goes over $25 to the foot.

MOTHER LODE COPPER (Shushanna Junction)—Company reports finding new vein intersecting Marvelous vein, appears to carry large shoot of high-grade ore. Superintendent Parks expects to ship out 1000 tons during coming season.

WASHINGTON ALASKA GOLD MINING CO. (Valdez)—Long tunnel tapped ore at 200 ft. below surface outcrops. Vein varies from 4 to 5 ft. and said to assay $32 per ton. Work will be continued all winter with view of putting mill on the ground early next spring. B. C. Wiltze manager.

VALPARAISO (Ketchikan)—Work of driving drainage tunnel progressing rapidly and will be kept up as long as weather permits use of water in compressing air. About 509 ft. remains to be driven, and expectations are it will be completed early in spring, when work of getting out ore can proceed. B. A. Eardley manager.

JUALIN (Jualin)—Work on this property north of Juneau to be resumed soon according to reports. Capital for work largely Belgian and shut-down came shortly after announcement of war, although $1,000,000 had been subscribed for development work. With property resuming practically 100 men will be put back to work.

ARIZONA

Santa Cruz County

ELEPHANT'S HEAD (Amado)—Shut down until financial situation is more encouraging.

MORNING GLORY (Patagonia)—Chris. Wilson, owner of his shipping mine, negotiating sale to smelting men. Examination by probable buyers was satisfactory.

CONQUEST (Tubac)—Attempt made to sink shaft on this vein, but at 20 ft. water prevented further sinking, though vein showed 4 ft. solid of copper sulphide ore. Pumps will be installed to handle water and shaft sunk as long as ore holds good. Mine in Agua Caliente water basin on limestone contact; thought there will be serious difficulty in unwatering.

SONOITA COPPER CO. (Patagonia)—This company composed of A. L. Harroun and Kansas City people now opening old Bradford mine on Sonoita Creek below Patagonia. Mine has shipped some copper ore. Company will also sink shaft on the famous Salero mine in near future, this shaft now 00 ft. deep, planned to carry it to 600-ft. level. A. E. Swain manager.

Yavapai County

ARIZONA POWER company has extended service to smelting plant of United Verde at Clarkdale. Other extensions ontemplated.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Last cleanup report shows 9000 tons treated, total recovery $14,100. Net mining said to be $20,899. Large high-grade reserves blocked out. Plans for deepening shaft and opening up new ground delayed by war. Sufficient ore reserve to continue extraction nd treatment. Erection of hospital contemplated.

Calaveras County

BOSTON (Mokelumne Hill)—Reported that sale is under negotiation and that mine will be reopened.

NUNER (Mokelumne Hill)—Mill running on pay gravel nd prospect said to be good for further developments.

BREUSTER (Mokelumne Hill)—This gravel mine in Chile Gulch will resume operation under new management.

Kern County

PEARL-ZENDA (Amalie)—Reported property sold to Phelps-Dodge interests. Mine equipped with 10 stamps tube mill and 50-ton cyanide plant.

KERN PLACER MINING CO. has purchased 12 placer claims in Last Chance, of Charles Koehn, of Koehn Springs. Reported special machinery will be installed by M. P. Boag, f San Francisco. Sufficient water found at depth of 14 ft.

Nevada County

CHAMPION (Nevada City)—Large amount expended in development by North Star and property now in position to resume production. Cleanup of mill for November reported at $35,000.

EMPIRE (Grass Valley)—New orebody encountered by crosscut from 3400-ft. level into Pennsylvania mine. Believed to be rich shoot encountered in Pennsylvania at higher level which has yielded large amount since Pennsylvania was taken over by Empire. Purchase price of Pennsylvania said to be $500,000, reported this amount already taken out, although final payment is not due until spring of 1916.

Plumas County

HYDRAULIC mining on Willows Creek near Buck's Ranch reported by G. W. Fagg to have been successful in past season. Water supply sufficient for extensive operation; he predicts better season in 1915, owing to heavy snows of present winter.

Siskiyou County

H. A. BALL, of Etna, will reopen old George hydraulic claim at Shaddick Creek.

Tuolumne County

HOPE (Sonora)—Five-stamp mill installed recently crushing ore of higher grade than previously and result warrants continuance of development.

MAZZEPA (Jamestown)—New ground to be prospected and this old property reopened. If development warrants, operation of mine will follow.

MONTEZUMA (Jamestown)—Reported C. F. Montgomery, of San Francisco, has begun reopening of this property on west side of Table Mountain.

NORTH STAR (Sonora)—This property, which adjoins Carlotta on north, being unwatered preparatory to development by Eastern men who hold it under bond.

MANGANTE (Jamestown)—Ten-stamp mill and other surface equipment of Mountain Boy mine near Columbia purchased and removed to this property where it can be utilized by both Mangante and Carlin mines.

REPUBLICAN (Sonora)—New results indicate mine can be kept going and contemplated shutdown of mill will be necessary only for repairs. Mine formerly large producer, although depth only 700 ft. Drifts run both ways from five levels. Vein matter about 16 ft. wide carrying fairly good grade of ore. Mine reopened about two years ago and present indications are it will again be listed among producers.

COLORADO

Boulder County

TUNGSTEN mining slowly resuming in the Nederland region although miners expect to hold concentrate until market price advances materially.

HIGHLAND MARY (Hesse, via Eldora)—Work will soon resume in driving deep crosscut adit now in 2000 ft. with 90 ft. of drifts. Several lodes disclosed and will be explored. Altitude of property warrants method of development.

Clear Creek County

STANLEY (Idaho Springs)—Thomas Eagan overhauling Salisbury mill preparatory to treatment of ore he will mine under new lease.

AMAZON (Empire)—Donald Bristol has taken superintendency of this property recently purchased by Denver people and has men taking out lead-silver ore to be shipped crude. Another grade will be concentrated in Silver Mountain mill.

Lake County

MANGANESE ore being shipped by George Cramer, making 65% concentrate for market to replace high grade formerly imported from Germany. Prevailing prices, however, not encouraging.

LAKE COUNTY METAL MINERS' ASSOCIATION has been holding meetings and inaugurating several measures expected to increase activity in district as well as throughout state. Has drafted bill to be urged at coming season of legislature demanding inclosure on surface of abandoned shafts and pits as well as shaft stations in underground workings. Has instructed county's legislators on its views regarding equitable mine taxation. Attempt being made to induce mine owners to grant lessees more favorable royalties. Association favors establishment of U. S. metallurgical testing plant in Denver instead of in Salt Lake City, as proposed. Desires stipulations be made in biennial appropriation to Colorado School of Mines making it obligatory on school to make free assays and treatment tests upon Colorado ores.

Park County

LONDON (Alma)—Still another sublease has been let, this one being to George W. Casey and John Nelson, of Leadville. Entire mine divided into lease blocks eagerly sought by Leadville miners. Ultimately some project must be financed for developing and draining to greater depth. Orebodies abandoned only because of water difficulties.

San Juan County

SILVER LEDGE (Chattanooga)—Lessee Louis Bonavid has repaired aërial tramway destroyed two winters ago, he remodeled mill and is prepared to mill ore from large shoot he struck on fourth level.

SILVER LAKE (Silverton)—Lessees working through Unity tunnel, making shipments of lead-copper ore, propose to drive inclined raise during winter to facilitate handling ore which now must go through series of raises and levels to reach adit.

San Miguel County

SUFFOLK (Ophir)—Jurich & Vukovas have fitted up 10 stamps and air compressor in mill, preparatory to operation of lease.

Summit County

JUNIATTA (Breckenridge)—Cumbre Mining Co., C. Lorimer Colburn manager, recently unwatered this Nigger Hill mine and made first carload shipment of zinc-sulphide ore.

IDAHO

HORST-POWELL (Little North Fork)—Bonded to Alfred Page, of Wardner, for $50,000.

MARSH (Burke)—Granted rehearing before public utilities commission in case against Washington Water Power Co., regarding electric power rate discrimination.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—Mill burned to ground Christmas Eve, loss $250,000. Will not be rebuilt. Rock from mine will go to Centennial-Allouez mill for time being. Was only mill on Portage Lake and employed 100 hands. If new mill is built will be at some other place, as government has been objecting to dumping of stamp sands in lake and has placed limit beyond which point sands cannot be dumped. Isle Royale is C. & H. company.

PORCUPINE (Ontonagon)—Interest increases in Porcupine explorations, on the S. L. Smith property, Sect. 7, 10 miles west of White Pine, on same lode. W. Bolley, recently resigned as superintendent of Baltic mine, in charge of operations. Years ago exploring was carried on at this point but consisted simply of test pits and was not thorough. In no case was formation tapped, sinking carried through overburden only. In present effort formation uncovered for 85 ft. For whole distance Nonesuch lode opened and found healthy. Distance between Nos. 1 and 2 veins never found more than 8 in. Shaft down 45 ft. Primitive methods used as yet; sinking only 2 ft. a shift; drilling by hand; hoisting with windlass. At 45 ft. vein dips at an angle of 80°. In White Pine and Nonesuch properties lode much flatter. Surface equipment at Porcupine simple. Building consists of shaft house in which is also smithy. Bunk house provided for workmen. Rock so far taken out contains both copper and silver.

WHITE PINE (Ontonagon)—Calumet & Hecla's total outlay in opening this property will be close to $2,000,000. Operations include underground development and completion of stamp mill. Fourteen machine drills at work in three shafts. Nos. 3 and 4, permanent shafts. No. 3 down 1100 ft.; four levels cut; hoisting confined to rock from second level; shaft running through good copper ground, better than any so far opened on Nonesuch lode. Shaft house in course of erection at No. 3. Engine- and boiler-house being built; will house Lake Shore engine having 10-ft. drum, and three boilers which will supply steam for No. 4 engine similar in type to No. 3. No. 4 shaft down 1200 ft.; hoisting from second level; rock showing better than average commercial copper. Shaft house to be constructed here soon. At both shafts there is considerable stockpile. No. 1 shaft simply exploratory and at depth of 120 ft. company raised what is now No. 4. No. 2 shaft near original White Pine shaft; work carried on in this old shaft. Copper rock also being hoisted at No. 2 but not so fast as at Nos. 3 and 4. Work on other buildings going ahead satisfactorily. Exterior work on boiler house and stamp mill finished. Crushing plant nearing completion. Forms being set for compressor and steam-turbine plant. This will accommodate six boilers. Trestle 800-ft., will take care of rock from Nos. 3 and 4 shafts. There will be no rock crushers in shaft houses. All rock will be crushed in separate plant, to which it will be carried over trestle. Conveyor belt will take care of crushed rock from plant to mill.

Iron

STEPHENSON CHARCOAL IRON CO. (Wells)—Furnace will go into blast again first of year, after idleness of several months. Orders received for pig iron, encouraging news for iron district.

IRON MOUNTAIN LAKE (Ishpeming)—This mine of Jones & Laughlin, in process of development, has had to be closed because heavy flow of water was encountered that pumps could not handle. Shaft is short distance from Ogden Lake and it is believed water course connected with lake was tapped. Shaft filled to within 50 ft. of surface in comparatively short time. Pumps now being taken to mine and work of removing water will be started as soon as possible.

MINNESOTA

Cuyuna Range

ROWE (Riverton)—Hydraulicking and steam-shovel work stopped.

KENNEDY (Cuyuna)—Recently inspected by Cleveland-Cliffs officials and engineers, with view to taking over, it is said

BARROWS MINING CO. (Barrows)—Good ore shown up in village; company states will sink steel and concrete shaft in spring.

ARMOUR (Crosby)—Stated, but not authoritatively, that Inland Steel is negotiating for Nos. 1 and 2, adjoining Thompson mine of Inland Steel.

BRAINERD-CUYUNA (Brainerd)—Latest shaft, third attempt, now through most difficult section of quicksand; should reach ledge without further difficulty.

WILCOX (Brainerd)—Additional pumping equipment has enabled mine to about clear itself of water. Additional tonnage developed in vicinity recently by E. J. Longyear Co.

DULUTH-BRAINERD (Ironton) — Eastern interests requested and received 30-day extension of option. Property idle but has shaft in manganiferous iron ore ready to produce.

Mesabi Range

HILL ANNEX (Calumet)—About 400 men employed by Guthrie & Co., having contract to remove approximately 8,500,000 cu.yd. of overburden from orebody. Job will take four years. Stripping being dumped on 280-acre tract 1½ miles distant from operation.

MONTANA

Silver Bow County

BULLWHACKER (Butte) — Reported from Spokane that large number of shareholders had come in under the reorganization plan and taken new stock.

NEVADA

Esmeralda County

JUMBO EXTENSION (Goldfield)—Drifting on deepest level in ore assaying $150 to $300. Daily shipments 100 tons $100 ore.

Humboldt County

SATAR PEAK (Rochester)—Small mill running. Mining method unique; about an acre of ground plowed and scraped, disintegrated rock milled at profit. Stated larger mill will be built next spring.

Nye County

BULLFROG MINING SYNDICATE (Pioneer)—Operations will be resumed immediately. Property east of Pioneer Consolidated, fully equipped for work on large scale.

Storey County

CROWN POINT-BELCHER (Virginia City)—Fire of unknown origin reported discovered on 1500 station of joint incline evening of Dec. 20. Bulkheads placed in incline below 1400. Pumps in incline sump shut down, allowing water to rise and preventing spread of fire down incline or to 1600 level of Belcher. No trouble expected in holding fire to small area. After discovery, hose line laid, but heat too great to permit fighting. Same result followed trial of helmets. Bulkheads therefore built. Direction of ventilation prevented rapid spread of fire up incline. Incline used for pumping. Latest advices give conditions much improved.

NEW MEXICO

Grant County

SAVANNA COPPER CO.—Company offering full paid shares at $1 in ratio of one to 20 of present holdings of stockholders of record as of Dec. 30, 1914. Company owns several thousand acres of patented ground in Burro Mountain district, but has been inactive for several years..

Sierra County

ILLINOIS AND SARATOGA (Kingston) — According to court records these mines sold to C. T. Brown, southwestern representative of Empire Zinc, for $5000. Illinois mine produced large quantity of silver in early days.

OREGON

STATE LAND BOARD accepted bid of Jason Moore & Co., of New York, for lease of Abert and Summer Lakes in Lake County on royalty basis for all minerals that may be abstracted from waters. Lease made for 45 years, subject to approval of legislature. Moore & Co. plans to establish plant to cost $6,000,000 at junction of Deschutes and Columbia Rivers and pipe line 260 miles along Deschutes River to be used in transferring product to plant. Bid accompanied by certified check for $10,000, conformed with requirements for tenders and offered state following royalties on products to be secured by evaporation of waters: Potassium salts, 50c. per ton; sodium chloride, 10c.; other salts, 25c. Bid of Oregon Soda & Potash Mining Co. not accompanied by any check nor was it in accordance with other requirements.

SOUTH DAKOTA

LAWRENCE COUNTY in which are situated Deadwood, Lead, Terry, and principal mining centers of the Black Hills, during present year expended $75,000 in road improvement. All work under supervision of competent engineer. Light gradients being adhered to; all bridges of steel, with concrete abutments. Present work of permanent character and of much benefit to mining industry.

UTAH

Juab County

CHIEF CONSOLIDATED (Eureka) — Ore shipments cut down from about 25 cars weekly to seven or eight, awaiting better metal market. Promising breaks such as may lead into new orebodies being followed, instead of mining ore already opened. Much interest taken in fact that Chief has optioned Scotia. Business of Chief so well advanced, as far as the original undertaking is concerned, as to permit of expansion in way of taking over additional properties. Careful examination convinced the management Scotia offered good fighting chance. Sinking on ore started, following completion of construction work and installation of equipment.

Salt Lake County

UTAH METAL & TUNNEL (Bingham) — This company, formerly Utah Metal, reorganized and financed. Compressor plant overhauled, and put in good condition. Development started; drifting being done from main drainage tunnel about 3000 ft. from the Carr Fork end. Some mineralization encountered.

CANADA

Yukon

SEASON CLOSED Dec. 16, when Boyle dredge No. 4, put up for winter at mouth of Bonanza. Boyle No. 2, which sank two months ago partly raised; work on her will begin before spring.

The Market Report

Metal Markets

NEW YORK—Dec. 29

Copper, lead and spelter again experienced a week of excessive dullness and exhibited further softening in prices, but the recessions were not material.

Copper, Tin, Lead and Zinc

Copper—The market was again dull during our last week of record, but the volume of the business was distinctly greater than in the previous week, first hands having played more of a part in the market, a distinct disposition to take what business was offered, even at reduced prices, having been manifested in certain quarters. The business so taken amounted to several millions of pounds, being done at about 12⅞c., regular terms. Other producers, however, stood quite aloof, neither courting business at concessions in price nor holding out for any fixed price, but awaiting the reäppearance of demand in such volume as would make negotiations worth while.

Copper sheets, base price is now 18½c. per lb. for hot rolled and 19½c. per lb. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire 14@14½c. per lb., carload lots at mill.

Copper exports from New York for the week ended Dec. 19 were 14,862,158 lb. Copper imports for the week ended Dec. 23 included 365 long tons of metal and 330 tons of matte.

Exports from Baltimore for the week ended Nov. 28 included 1,736,771 lb. copper, 1,121,016 lb. lead and 448,600 lb. spelter, all to Liverpool.

W. Parsons Todd, 32 Broadway, New York, becomes selling agent for the Copper Range Consolidated Copper Co., whose output has heretofore been sold by the United Metals Selling Co.

Brass Prices, base, were advanced about ½c. per lb. by the American Brass Co. on Dec. 22, and are now as follows: Sheets, high brass, 15c. net per lb.; low brass, 16⅝c. Wire, high brass, 14¾c.; low brass, 16⅝c. Rods, high brass, 14¾c.; low brass, 17⅜c. Tubes, brazed, 18¾c.; open seam, 18¾c. Angles and channels, 18¾c. Scrap allowances are 9½c. net per lb. for high brass; 10⅝c. for low brass.

Tin—In sympathy with the advance on the London Exchange on Dec. 24, prices in this market became a shade firmer, but buyers refused to become interested and business continued stagnant. The market closes entirely nominal.

Lead—This market also exhibited a softer tone, domestic demand being insignificant while foreign buying was not so large as it has been. However, the demand from abroad continues and is the mainstay of the market. In the St. Louis market the price level is beneath that of the A. S. & R. Co., and the price of the latter has also been undercut in the Chicago market, but in the New York market business remains steady at 3.80c. Sales for export from New York, however, are reported at prices figured as netting a few points both above and below that figure.

Spelter—The situation in this metal remained substantially unchanged. Sales of a few hundred tons daily were reported, both for home and foreign consumption, but the aggregate was not large. Domestic consumers generally continue to be conspicuous by their absence.

Zinc sheets, base price, $8.75 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Recent reports from Belgium are to the effect that none of the zinc-smelting works along the Meuse were injured but all of them are idle. The plants in the Campine district are operating, but on a reduced scale.

Other Metals

Aluminum is reported rather firmer, with more inquiry. Contracts for 1915 delivery are being closed at about current prices. Quotations are a trifle firmer at 19@19¼c. per lb. for No. 1 ingots, New York.—In **Antimony** some demand for export is noted, but domestic business is rather flat. Spot is firmer in price than futures. Ordinary brands are quoted at 13½@14c. per lb., New York. Some Hallett's is to be had at 16½c.; while 16@17c. per lb. is asked for Cookson's.—**Quicksilver** has been quiet and is dull and unchanged in price at $50 per flask of 75 lb., New York. London price is £11 5s. per flask.—**Nickel**—Ordinary forms—shot, blocks or plaquettes—are 40@45c. per lb., according to size and terms of order. Electrolytic metal is 5c. per lb. higher.

Exports and Imports of Secondary Metallic Products in the United States, 10 months ended Oct. 31, in pounds:

	Exports		Imports	
	1913	1914	1913	1914
Copper sulphate	3,845,455	7,231,183	....	
White lead	12,837,527	15,287,767	.	.
Zinc oxide	25,660,635	26,481,061		
Zinc dust	156,656	190,792	3,822,572	3,526,382
Zinc dross	56,696	3,415,314		

Exports include reëxports of foreign material. Domestic zinc ore exported, contents not given, was 14,398 tons in 1913, and 8499 tons in 1914; decrease, 5899 tons.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Dec.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Cts. per Lb	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb
24	4.8600	48¾	12.65@12.75	33½	3.80	3.60@3.65	5.55@5.60	5.40
25		..	.....	...	....	......	.....	
26	4.8500	48¾	12.65@12.75	33½	3.80	3.60@3.62½	5.55@5.60	5.40
28	4.8500	48¾	12.65@12.75	33¾	3.80	3.60@3.62½	5.52½@5.57½	5.35@5.40
29	4.8500	48⅞	12.65@12.75	33½	3.80	3.60@3.62½	5.52½@5.57½	5.35@5.40
30	4.8500	48⅝	12.65@12.75	33½	3.80	3.60@3.62½	5.55@5.60	5.40

The quotations herein are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer, and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Dec	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
24	22 11/16	56¾	12.78	57	*	148	145	19⅛	4.16	26⅞	5.84
25		.	.	...	*	...	...	..	..	.	
26	.	.		....	.	.		.	.		
28	22 11/16	56⅝	12.75	57	*	148½	145¾	19	4.13	26⅝	5.78
29	22¾	56¾	12.78	57⅛	62	148½	146	19	4.13	27¼	5.92
30	22¾	56⅝	12.75	57	*	147¾	143¾	19⅛	4.16	27⅜	5.97

*No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Gold, Silver and Platinum

Gold—Exports of gold from New York have been on a limited scale, compared with recent weeks.

Gold output of Rhodesia in November was 74,869 oz., or 6296 oz. less than in October. For the 11 months ended Nov. 30 the total was $12,992,108 in 1914, and $16,218,695 in 1914; an increase of $3,226,587, or 24.8%. The 1914 production was the largest ever reported.

Platinum The market has remained quiet on a limited demand. There is very little doing and sales have been few. Quotations are $41@42 per oz. for refined platinum. Hard metal is $46@49 per oz., according to grade.

Silver—The undertone of the market continues good, with orders from London, apparently for other purchasers than the English Mint, which has been the chief factor in sustaining the price. It is possible the buying may be on China account, but at this writing the information is not at hand to indicate the buyer.

Zinc and Lead Ore Markets

JOPLIN, MO.—Dec. 26

Blende, high price $54, assay base, $49@52, metal base, $47@48; calamine base, $23.50@27.50; average, all grades of zinc, $45.22 per ton.

Lead, high price, $48.50; base $47 per ton 80% metal content; average, all grades of lead, $47.12 per ton.

Mill owners are endeavoring to operate more steadily and some are making an effort to double shift work in the ground, but so far these efforts have been of small avail. It is hard to find miners for the additional work, and continued cold, severe for this locality, prevents an increase. And on the other hand the production of calamine and lead is greatly retarded by the weather. The result is that production is decreased in the face of all efforts to increase it.

SHIPMENTS WEEK ENDED DEC. 26

	Blende	Calamine	Lead	Values
Totals this week	8,987,270	1,442,740	826,850	$255,350
1914 totals..........	510,803,020	39,031,810	87,523,250	12,819,030

Blende value, the week, $216,120; the year, $10,333,710.

Calamine value, the week, $19,760; the year, $463,390.

Lead value, the week, $19,470; the year, $2,041,580.

PLATTEVILLE, WIS.—Dec. 26

The base price paid this week for high-grade zinc ore was $50@51 per ton. The base price paid for 80% lead ore was $45@46 per ton.

SHIPMENTS WEEK ENDED DEC. 26

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,884,530	121,400	329,700
Year	166,656,300	5,120,290	31,751,550

Shipped during week to separating plants, 3,104,230 lb. zinc ore.

The year to date shipment of net zinc ore to smelteries exceeds that of 1913 by 7316 tons, while the gross shipment of zinc ore from mines to smelteries and to custom roasters exceeds the total of 1913 by 26,076 tons.

Iron Trade Review

NEW YORK—Dec. 29

The better feeling in the iron and steel markets continues to hold, and it is now being backed up by an increase in orders. The announcement that the Steel Corporation would not cut wages had a favorable effect, and served to steady prices and bring out buyers who had been looking for lower prices with lower wages.

Some heavy foreign orders for barbed wire are under negotiation at Pittsburgh, and other material for export is also being inquired after.

More pig-iron sales are reported, chiefly foundry and basic. There has also been some inquiry for low phosphorus pig, chiefly in the East.

PITTSBURGH—Dec. 29

The advent of the holidays has only slightly reduced the volume of buying in steel products, there being still a much heavier movement than a month or six weeks ago, both in actual orders and in contracts calling for specifications during the last quarter of the new year. The activity is fairly well distributed among the different finished steel products.

There is somewhat increased railroad inquiry but as yet there is no business of importance traceable to the favorable decision in the eastern rate case rendered Dec. 18. Other buyers, however, appear to have been encouraged by the decision.

Lately the mills have been quoting 1.05c. for immediate specification and prompt shipment for bars, plates and shapes, quoting 1.10c. on contracts involving specification during the first quarter. Some have now withdrawn the 1.05c. price for prompt shipment and others will do so Dec. 31, leaving the market at 1.10c. as minimum. Later an advance is probable to 1.15c. as a strategic move, to induce specifying on the contracts written at a lower price.

A decided increase in the rate of steel-mill operations is expected immediately after the first of the year, to about 50% of capacity.

The general feeling in the steel trade is now decidedly hopeful, on the ground that the whole steel market has now undergone a turn for the better, and that with easy money and other favorable influences the improvement should be more or less continuous.

Pig Iron The market has been rather quiet locally, but with a fair run of small orders for foundry iron. Prices are well maintained. We continue to quote: Bessemer, $13.75; basic, $12.50; No. 2 foundry and malleable, $12.75@13; gray forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—There is nothing new in the situation, and prompt and contract are quoted at $68, Baltimore.

Steel—On most of the long term contracts for billets and sheet bars prices and deliveries have now been arranged for first quarter or first half, the tonnages taken being somewhat larger than the sellers expected. The producers now feel stronger and are disposed to ask higher prices on new contracts for first quarter. Prompt deliveries are still obtainable in a limited way at $18.50 for billets and $19 for sheet bars, f.o.b. maker's mill, Youngstown, and at 50c. higher f.o.b. maker's mill, Pittsburgh. Rods are $24.50@25, Pittsburgh.

IRON ORE

The imports of ore from Chile, brought in by the Bethlehem Steel Co. from its Tofo mines, reached a total of 45,000 tons in 1914. All of this was received at Philadelphia.

Receipts of Lake Superior ore at Lake Michigan ports in 1914 were 6,109,019 tons. The larger deliveries were 3,606,587 tons at South Chicago, 1,431,564 tons at Gary and 661,054 tons at Indiana Harbor.

COKE

Connellsville The market is now very quiet after the recent contracting movement. Two or three contracts remain not finally closed, the prospective buyers trying out the coke. The average contract price in the movement just ended, involving about 250,000 tons a month, is little if any above $1.70. The average realized price on the merchant coke shipped out of the region in the year just ending, including foundry coke, was about $2 per ton at ovens.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, 11 months ended Nov. 30, in short tons:

	1913	1914	Changes
Anthracite	9,699,210	10,223,221	I. 524,011
Bituminous	47,171,538	44,013,552	D. 3,157,986
Coke ..	13,011,863	8,926,580	D. 4,085,283
Total	69,882,611	63,163,353	D. 6,719,258

The total decrease in 1914 was 8.6%. The larger part of the loss was in coke tonnage.

Chemicals

NEW YORK—Dec. 29

The general chemical trade continues to show small activity and the volume of business in most lines is small.

Arsenic—The market remains dull and supplies are quite sufficient for the moderate demand. Quotations are $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is still on a moderate scale and prices are unchanged. Quotations are $4.35 per 100 lb. for carload lots and $4.60 per 100 lb. for smaller parcels.

Nitrate of Soda Business is quiet and no change is expected until next year. Quotations are unchanged and rather steady, at 1.85c. per lb. for all positions.

PETROLEUM

Exports of mineral oils from the United States in November are reported by the Bureau of Commerce at 168,032,001 gal. which is 1,084,449 gal. less than in November, 1913. For the 11 months ended, Nov. 30, the exports were 1,892,389,189 gal. in 1913, and 2,057,767 gal. in 1914; an increase of 165,199,578 gal., or 8.7%. The gain was chiefly in gasoline, fuel oils and residuum

Assessments

Company	Delinq	Sale	Amt
Andes, Nev.	Jan. 5	Jan. 27	$0.03
Bingham Lead, Utah	Dec. 23	Jan. 12	0.0025
Blue Bull, Nev.	Jan. 4	Feb. 8	0.01
Caledonia, Nev.	Dec. 8	Dec. 31	0.05
Cash Boy, Nev.	Jan. 15	Feb. 15	0.005
Century, Utah	Jan. 2	Feb. 2	0.01
Clear Grit, Ida.	Jan. 12	Jan. 29	0.0015
Con. Imperial, Nev.	Dec. 23	Jan. 15	0.01
Crown Point, Nev.	Dec. 8	Dec. 29	0.05
Darby, Ida.	Dec. 14	Jan. 14	0.001
Dfd. Bk. Butte, Nev.	Dec. 1	Dec. 30	0.01
East Hercules, Ida. (post.)	Jan. 1	Feb. 1	0.001
Emerald, Utah (three instal		June 9	0.01
Exchequer, Nev.	Dec. 21	Jan. 11	0.03
Grt. Copp. King, Utah	Dec. 21	Jan. 21	0.001
Gypsy Qn., Nev.	Jan. 12	Feb. 16	0.01
Hale and Norcross, Nev.	Dec. 14	Jan. 4	0.03
Happy Day, Ida.	Dec. 24	Jan. 25	0.0025
Hope, Calif.	Dec. 15	Jan. 11	0.05
Hypotheek, Ida.	Dec. 17	Jan. 11	0.006
Idaho-Nev., Ida.	Jan. 7	Feb. 1	0.001
Id.-Mont, Ida. (post.)	Nov. 2	Jan. 8	0.001
Keystone, Utah	Dec. 21	Jan. 21	0.02
Laclede, Ida.	Jan. 12	Feb. 3	0.003
Lehi Tintic, Utah	Dec. 17	Jan. 16	0.0025
MacNamara, Nev.	Jan. 12	Feb. 3	0.03
Majestic-Idol, Nev.	Dec. 15	Jul. 20	0.005
Mammoth Gold, Nev.	Nov. 23	Jan. 4	0.02
Maxfield, Utah	Dec. 9	Dec. 30	0.0016
Nabob, Ida.	Dec. 31	Jan. 25	0.005
New Yerington, Nev.	Dec. 23	Jan. 13	0.01
O. K. Ex., Utah	Dec. 26	Jan. 12	0.0025
O. K. Silver, Utah	Dec. 14	Dec. 31	0.00167
Oreano, Ida.	Dec. 26	Jan. 25	0.00075
Overman, Nev.	Dec. 22	Jan. 11	0.05
Potosi, Nev.	Jan. 12	Feb. 4	0.02
Rainbow, Ida.	Nov. 30	Dec. 31	0.002
Raven, Ida.	Dec. 30	Jan. 30	0.0003
Riverside, Ida.	Dec. 20	Jan. 20	0.001
Scranton Ex., Utah	Jan. 4	Feb. 5	0.00025
Seg. Belcher, Nev.	Dec. 16	Jan. 11	0.02
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sonora, Ida.	Nov. 30	Dec. 30	0.002
Syndicate, Ida.	Nov. 26	Dec. 28	0.001
Ton. Glp. Qn., Nev.	Jan. 12	Feb. 16	0.01
Umatilla, Nev.	Jan. 4	Feb. 8	0.01
Union Con., Nev.	Jan. 14	Feb. 4	0.05
Utah-Yerington, Nev.	Jan. 2	Jan. 23	0.0006
Wheeler, Utah	Dec. 21	Jan. 11	0.01
Yankee Con, Utah.	Dec. 17	Jan. 4	0.01
Zuma, Utah	Dec. 21	Jan. 12	0.0025

Stock Quotations

COLO. SPRINGS Dec. 28		SALT LAKE Dec. 24	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	03¾	Beck Tunnel	05
Cripple Cr'k Con.	01	Black Jack	05
C. K. & N.	05½	Colorado Mining	10½
Doctor Jack Pot	11	Crown Point	‡.01
Elkton Con.	45	Daly-Judge	‡4.60
El Paso *	1.59	Gold Chain	08
Findlay	02	Grand Central	63
Gold Dollar	04¼	Iron Blossom	1.10
Gold Sovereign	04	Little Bell	10
Isabella	13½	Lower Mammoth	04
Jack Pot	06¼	Mason Valley	‡1.37½
Jennie Sample	02	May Day	16½
Jerry Johnson	03¼	Opohongo	‡.01½
Lexington	.004	Prince Con.	23
Old Gold	01	Seven Troughs	‡.03¼
Mary McKinney	41	Silver King Coal'n	2.45
Pharmacist	.01½	Silver King Con.	1.75
Portland	1.18	Sioux Con.	.02½
Raven B. H.	.03½	Uncle Sam	05
Vindicator	1.18	Yankee	07

TORONTO Dec. 28			
Bailey	01¼	Foley O'Brien	15
City of Cobalt	‡.30	Hollinger	19.85
Coniagas	5.25	Imperial	.01
Peterson Lake	.29	Jupiter	10½
Right of Way	02	McIntyre	.24
T. & Hudson Bay	35.00	Pearl Lake	.03¼
Timiskaming	09	Porcu. Gold	.22½
Wettlaufer-Lor.	04	Preston E. D.	01
Big Dome	6.50	Rea	19
Dome Exten.	08	Seneca Superior	2.00

SAN FRANCISCO Dec. 21			
Comstock Stocks.		Misc. Nev. & Cal.	
Alta	05	Belmont	4.40
Belcher	42	Jim Butler	71
Best & Belcher	04	Lone Star	13
Caledonia	35	MacNamara	.01
Challenge Con.	02	Midway	.07
Confidence	.19	Mont.-Tonopah	.35
Con. Virginia	.13	North Star	.16
Crown Point (Nev	.32	Rescue Eula	06
Gould & Curry	.02	West End Con.	.57
Hale & Norcross	04	Atlanta	53
Julia	.01	Booth	.18
Mexican	.45	C. O. D. Con.	09
Occidental	.85	Comb. Frac.	09
Ophir	.09	Jumbo Extension	2.77½
Overman	.12	Pitts.-Silver Peak	14
Potosi	.01	Round Mountain	44
Savage	.05	Sandstorm Kendall	.15
Sierra Nevada	.07	Silver Pick	.13
Union Con.	.10	Central Eureka	23
Yellow Jacket	.28	So. Eureka	2.00

N. Y. EXCH. Dec. 28	
Name of Comp.	Clg
Amalgamated	52¼
Am. Sm. & Ref., com.	56¼
Am. Sm. & Ref., pf.	99½
Am. Sm. Sec., pf. B	79½
Anaconda	25½
Batopilas Min.	
Bethlehem Steel, pf.	89
Chino	33½
Colo. Fuel & Iron	23
Federal M. & S., pf.	28
Great Nor., ore., ctf.	24
Guggen. Exp.	44
Homestake	110¼
Inspiration Con.	16¼
Mex. Petroleum	52
Miami Copper	17
Nat'l Lead, com.	43¼
National Lead, pf.	104
Nev. Consol.	11¼
Ontario Min.	2
Phelps Dodge	175
Quicksilver, pf.	1¼
Ray Con.	15¾
Republic I&S, com.	18½
Republic I&S, pf.	75¾
SlossSheff'd, com.	23
Sloss Sheffield, pf.	82
Tennessee Copper	31
Utah Copper	48
U. S. Steel, com.	49¼
U. S. Steel, pf.	104¼

N. Y. CURB Dec. 28	
Name of Comp.	Clg.
Beaver Con.	21
Big Four	08
Blue Bell	06
Braden Copper	6
B. C. Copper	‡.50
Buffalo Mines	95
Can. Cop. Corpn.	1¼
Can. G. & S.	‡.04
Caribou	.63
Chambers Ferland	‡.13
Con. Ariz. Sm.	¾
Coppermines Cons.	1¼
Davis-Daly	65
Diam'field-Daisy	09
Dia. Black B.	06
Ely Con.	01
Florence	64
Goldfield Con.	1¼
Goldfield Merger	40
Greene Cananea	24
Kerr Lake	4
La Rose	
McKinley-Dar-Sa.	57
Mines of Am.	2
Mutual Min., pf.	‡2
Nevada Hills	.10
New Utah Bingham	‡7/16
Nipissing Mines	5¾
Ohio Copper	¹1
Oro	1/16
Pacific Smelt	1/16
Stand'd Oil of N. J.	401
Standard S. L.	¼
Stewart	1 7/16
Tonopah	7¼
Tonopah Ex.	2¼
Tonopah Merger	15
Tularosa	1/16
West End Ex.	03
Yukon Gold	2¼

LONDON Dec. 14	
Name of Comp.	Clg.
Alaska Tre'dwell	£7 15s 0d
Camp Bird	0 6 0
El Oro	0 10 0
Esperanza	‡0 10 0
Mexico Mines	3 17 6
Oroville	‡0 7 6
Santa Gert'dis	0 10 0
Tomboy	1 2 6

BOSTON EXCH. Dec. 28	
Name of Comp.	Clg.
Adventure	1¼
Ahmeek	255
Alaska Gold M.	27
Algomah	‡.80
Allouez	35
Am. Zinc	16¾
Ariz. Com., ctfs.	3¾
Bonanza	‡.51
Butte-Ballaklava	‡.22
Butte & Superior	35
Calumet & Ariz.	55
Calumet & Hecla	350
Centennial	15
Cliff	‡1
Copper Range	31
Daly West	2
East Butte	9
Franklin	4¼
Granby	84
Hancock	‡13¾
Helvetia	‡.30
Indiana	‡3
Island Cr'k, com.	‡44
Island Cr'k, pfd.	‡86
Isle Royale	17¼
Keweenaw	‡3
Lake	7¼
La Salle	3¼
Mass	‡3¼
Mayflower	4¼
Michigan	‡.75
Mohawk	47
New Arcadian	6¼
New Idria Quick.	‡3
North Butte	23¾
North Lake	1½
Ojibway	‡.75
Old Colony	‡3¾
Old Dominion	41
Osceola	‡67
Quincy	53
Santa Fe	‡1¼
Shannon	5
Shattuck-Ariz.	19
Superior	23
Superior & Bost.	1
Tamarack	25¼
Trinity	4¼
Tuolumne	23
U. S. Smelting	25¾
U. S. Smelt'g, pf.	44
Utah Apex	2
Utah Con.	9¾
Victoria	‡1
Winona	2
Wolverine	32¾
Wyandot	‡.50

BOSTON CURB Dec. 28	
Name of Comp.	Bid
Alvarado	60
Bingham Mines	4¼
Boston Ely	21
Butte & Lon'n Dev.	12
Calaveras	93
Calumet-Corbin	24
Chief Con.	70
Corbin	‡1
Cortez	15
Crown Reserve	75
Eagle & Blue Bell	90
First Nat. Cop.	1¼
Houghton Copper	1¼
Iron Cap Cop. pf.	‡5
Majestic	17
Mexican Metals	26
Nevada-Douglas	60
New Baltic	1¼
Oneco	80
Raven Copper	10
Smokey Dev.	10
So. Lake	04
Tonopah Victor	‡.19
Trethewey	12
United Verde Ext.	1¾

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	25.979
September	63.078	60.640	53.290	29.088	27.986	24.260
October	63.471	60.793	50.654	29.299	28.083	23.199
November	62.792	58.995	49.082	29.012	27.263	22.703
December	63.365	57.760		29.320	26.720	
Year	60.835	59.791		28.042	27.576	

New York quotations cents per ounce troy, fine silver, London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	13.223	64.166	60.540	69.446	64.955
August	15.400	*	69.200	‡	74.313	‡
September	16.328	*	73.125	‡	78.614	‡
October	16.337	*	73.383	‡	79.250	‡
November	15.182	11.739	68.375	53.227	73.825	*
December	14.224		65.223		69.583	
Year	15.269		68.335		73.740	

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41.582	*	188.731	‡
September	42.410	32.675	193.074	‡
October	40.462	30.284	184.837	‡
November	39.810	33.304	180.869	139.391
December	37.635		171.786	
Av. year	44.252		206.279	

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	3.891	4.223	3.738	20.038	19.051
August	4.624	3.875	4.550	3.715	20.406	‡
September	4.698	3.828	4.579	3.658	20.648	‡
October	4.402	3.528	4.253	3.384	20.302	‡
November	4.293	3.683	4.146	3.585	19.334	18.500
December	4.047		3.929		17.798	
Year	4.370		4.238		18.743	

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.962	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	4.920	5.128	4.770	20.592	21.568
August	5.658	5.568	5.508	5.418	20.706	‡
September	5.694	5.380	5.544	5.230	21.148	‡
October	5.340	4.909	5.188	4.750	20.614	‡
November	5.229	5.112	5.083	4.962	20.581	25.016
December	5.156		5.004		21.214	
Year	5.648		5.504		22.746	

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.99
February	18.15	15.06	17.22	14.12	18.13	14.08
March	18.15	15.07	16.96	13.94	17.53	14.10
April	17.90	14.90	16.71	13.96	16.40	14.13
May	17.68	14.90	15.80	13.90	15.40	14.27
June	17.14	14.90	15.40	13.90	15.10	13.96
July	16.31	14.90	15.13	13.90	14.74	13.90
August	16.63	14.90	15.00	13.90	14.88	14.08
September	16.65	14.90	15.04	13.90	14.93	14.05
October	16.60	14.84	13.61	13.75	14.80	13.97
November	16.03	14.59	13.91	13.43	14.40	13.88
December	15.71	14.70	13.71	13.45	14.28	13.85
Year	$17.09	$14.88	$15.57	$13.78	$15.77	$14.01

New York and St. Louis quotations cents per pound, London pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

100—ANALYSIS—The Estimation of Gold in Blister Copper, Etc. The "Sulphur" Method. K. Prout Webb. (Min. and Eng. Rev., Nov. 5, 1914; 1 p.) 40c.

101—BRITISH COLUMBIA—Annual Report, Granby Consolidated Mining, Smelting and Power Co. (Can. Min. Journ., Nov. 1, 1914; 5¾ pp., illus.) 20c.

102—CHILE—Progress Being Made by the Chile Copper Co. (Min. and Eng. Wld., Nov. 21, 1914; 2 pp., illus.) 20c.

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247—POWDERED COAL, ETC.—A Comparison of the Economy of Powdered Coal, Oil and Water Gas for Heating Furnaces. C. F. Herrington. (Eng. News, Dec. 10, 1914; 2½ pp., illus.) 20c.

248—POWDERED FUEL—Symposium on Powdered Fuel before June, 1914, Meeting American Society of Mechanical Engineers. (Journ. A. S. M. E., Oct., 1914; 36 pp., illus.) Three papers were read, as follows: "Pulverized-Coal Burning in the Cement Industry," by R. C. Carpenter; "Pulverized Coal for Steam Making," by F. R. Low; "An Installation for Powdered Coal Fuel in Industrial Furnaces," by W. Dalton and W. S. Quigley; also discussion. 60c.

249—PRODUCER GAS—Die neueren Fortschritte in Theorie und Praxis der Generatorgaserzeugung. Gwosdz. (Glückauf, Sept. 5, 12, 19 and 26, Oct. 3, 10 and 17, 1914; 11 pp., illus.) The latest advances in theory and practice of producer gas generation.

250—SOLID FUELS—Die festen Brennstoffe in den Jahren 1912 and 1913. Bertelsmann. (Chem.-Ztg., June 23, July 4, Aug. 4 and 8, 1914; 1½ pp.) The solid fuels in 1912 and 1913.

MINING AND METALLURGICAL MACHINERY

251—AIR COMPRESSOR—Test of the Largest Air Compressor Aug. 11 and 12, 1914. G. M. Clark. (Journ. So. Afr. Inst. of Engrs., Nov., 1914; 17 pp.) Describes tests of machine used for delivering compressed air to the mines of the Rand Mines, Ltd.

252—DRILLS—Modern American Rock Drills. L. O. Kellogg. (Eng. and Min. Journ., Dec. 5, 12 and 19, 1914; 9½ pp., illus.) Conclusion of article previously indexed.

253—ECONOMIZERS—Ueber Ekonomiserleistungen. Schulz. (Feuerungstechnik, Aug. 1, 1914; 4½ pp., illus.) On the efficiency of economizers.

254—HOISTING—Förderantage für die neuen oberbayrischen Erzgruben der Deutsch-Luxemburgischen Bergwerks- und Hütten. A. G. Pickersgill. (Zeit. d. Vereines deutsch Ing., Sept. 26, 1914; 4 pp., illus.) Hoisting plant of the new Upper Bavarian mines of the German-Luxemburg mining and metallurgical company.

255—LOCOMOTIVES—Industrial Locomotives. J. W. Hobson. (Colliery Guardian, Nov. 6 and 13, 1914; 5 pp., illus.) Paper before North East Coast Instn. Engrs. and Shipbuilders. 80c.

256—LUBRICATING OILS—Neue Oelprobiermaschine zur Prüfung der Schmieröle bei jeder Temperatur, unter Anwendung verschiedener Metalle als Gleitfläche. Schmitz. (Zeit. f. ane. Chemie, July 28, -914; 2½ pp., illus.) A new oil-testing machine for testing lubricating oils at any temperature, applying different metals as sliding plane.

257—SHOVELING MACHINES at Flat River. E. H. Leslie. (Min. and Sci. Press, Nov. 21, 1914; 1½ pp., illus.) 20c.

258—TUNNELING MACHINE for Clay or Stiff Sand Formations. (Eng. News, Oct. 29, 1914; 3¼ pp., illus.) Describes Bennett machine. 20c.

259—TURBINES—Exhaust Steam-Turbine Practice in Iron, Steel and Metal-Working Industries. C. A. Tupper. (Iron Tr. Rev., Dec. 3, 1914; 5 pp., illus.) 20c.

SAMPLING AND ASSAYING

260—ANALYSIS OF COAL with Phenol as a Solvent. S. W. Parr and H. F. Hadley. (Bull. 76, Eng. Experiment Station, Univ. of Ill., 1914; 41 pp., illus.) 40c.

261—ASPHALT IN OILS—Zur Bestimmung von Asphalt in Erdölen. Holde. (Chem.-Ztg., Sept. 5, 1914; 1 p.) Relating to the determination of asphalt in natural oils. 40c.

262—IODOMETRIC ESTIMATIONS—Ueber Nachfärbungen bei jodometrischen Titrationen. Müller. (Chem.-Ztg., Oct. 17, 1914; 1 p.) On after colorizations in iodometric estimations. 40c.

263—METAL ANALYSIS—Fortschritte auf dem Gebiete der Metallanalyse im Jahre 1913. Döring. (Chem.-Ztg., July 14, 30, and Aug. 6, 11, 1914; 7¾ pp.; to be continued.) Progress made in the analysis of metals in 1913.

264—SAMPLE CATCHER FOR BACKS. A. Livingstone Oke. (Eng. and Min. Journ., Dec. 19, 1914; ½ p., illus.) 20c.

265—SAMPLER—A Home Made Automatic Sampler. Percy E. Barbour. (Eng. and Min. Journ., Oct. 31, 1914; ½ p., illus.) 20c.

266—SLAG—Untersuchung von Thomasmehlen auf Mangan und Vanadin. Holle. (Chem.-Ztg., Oct. 3, 1914; ½ p.) Testing powdered Thomas slag for manganese and vanadium. 40c.

267—SULPHURIC ACID—Die Bestimmung des Arsens, Eisens und Quecksilbers in Schwefelsäure. Nissenson. (Chem.-Ztg., Sept. 29, 1914; ½ p.) Determination of arsenic, iron and mercury in sulphuric acid. 40c.

268—SULPHUROUS ACID—Ueber die titrimetrische Bestimmung freier schwefliger Säure. Sander. (Chem.-Ztg., Sept. 5, 1914; 1 p.) On the titrimetric determination of free sulphurous acid. 40c.

INDUSTRIAL CHEMISTRY

269—ALUMS—Zerlegung der Alaune in ihre Bestandteile. Haas. (Chem.-Ztg., Aug. 6, 1914; ¾ p.) Dissociation of alums in their component parts.

270—AMMONIA—Untersuchungen uber die Bildung von Ammoniak und Zyanwasserstoff bei der Steinkohlen destillation. Simmersbach. (Stahl u. Eisen, July 9, 1914; 10 pp., illus.) Researches on the formation of ammonia and cyanuretted hydrogen. 40c.

271—AMMONIUM CHLORIDE—Chlorammonium (Salmiak) ein neues Nebenprodukt der Kokereien, Gaswerke, etc. Strommenger. (Zeit. f. angew. Chem., Sept. 4, 1914; 1½ pp., illus.) Ammonium chloride (sal ammoniac), a new byproduct of coke ovens, gas works, etc.

272—CALCIUM CARBIDE—Note on the Preparation of Pure Calcium Carbide. M. Dekay Thompson. (Met. and Chem. Eng., Dec., 1914; 1½ pp.) 40c.

273—COAL-GAS RESIDUALS. Fred. H. Wagner. (Met. and Chem. Eng., Nov., 1914; 7 pp., illus.) Paper before Am. Gas Inst. 40c.

274—FERTILIZERS—The Production and Fertilizer Value of Citric-Soluble Phosphoric Acid and Potash. W. H. Waggaman. (U. S. Dept. of Agri., Bull. 143, 1914; 12 pp.)

275—GAS TREATMENT—An Electrical Process for Detarring Gas. F. W. Steere. (Met. and Chem. Eng., Dec., 1914; 3½ pp., illus.) Paper before Am. Gas Inst. 40c.

276—GERMAN CHEMICAL INDUSTRY—Die deutsche chemische Industrie und der Krieg. Witt. (Chem.-Ztg., Oct. 8 and 13, 1914; 1¾ pp.) The German chemical industry and the war.

277—IODINE—La industria del yodo en Chile. Belisario Diaz Ossa. (Bol. Soc. Nac. de Mineria, May and June, 1914; 11½ pp., illus.)

278—PHOSPHATE—Das Sprengen im Superphosphatbetriebe. Bruhn. (Chem.-Ztg., July 18, 1914; 1 p.) 40c.

279—POTASH—Fortschritte der Kaliindustrie im Jahre 1913. Hof. (Chem.-Ztg., Sept. 1, 1914; 2 pp.) Progress of the potash industry in 1913.

280—SULPHURIC ACID—Eine Neuerung an Schwefelsäureturmsystemen. Schliebs. (Chem.-Ztg., July 30, 1914; ¾ p.) An improvement in sulphuric acid tower systems.

MATERIALS OF CONSTRUCTION

281—CEMENT—Geology and Field Relations of Portland Cement Raw Materials at Naga, Cebu. Wallace E. Pratt. (Philippine Journ. of Sci., Apr., 1914; 11 pp., illus.)

The Engineering and Mining Journal

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Introduction

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data. We feel sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered.

PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1912	1913	1914
Aluminum......	pounds	(*g*) 32,990,000	(*g*) 49,601,500	(*h*) 45,000,000
Copper (*a*)......	pounds	1,241,762,508	1,225,735,834	1,135,730,818
Ferromanganese.	long tons	227,725	229,834	172,514
Gold (*b*).........	dollars	93,451,500	88,884,400	92,823,500
Iron............	long tons	29,499,422	30,736,477	23,083,580
Lead (*c*).........	short tons	410,006	433,476	533,373
Nickel (*e*)......	pounds	42,168,769	47,124,330	(*e*) 30,067,064
Quicksilver.....	flasks	(*f*) 25,147	(*h*) 20,000	16,300
Silver (*b*).......	troy ounces	63,766,800	66,801,500	67,929,700
Zinc (*d*)........	short tons	348,638	358,262	360,689

(*a*) Production from ore originating in the United States (*b*) The statistics for 1912 and 1913 are the final and those for 1914 are the preliminary statistics reported jointly by the directors of the Mint and the U. S. Geological Survey, (*c*) Production of refined lead from ore and scrap originating in the United States: antimonial lead is included. (*d*) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Imports; for 1914, first 10 months only. This nickel is refined in the United States for the production of metal, oxide and salts. (*f*) As reported by U. S. Geological Survey. (*g*) As reported by the Metallgesellschaft, Frankfurt am Main. (*h*) Estimated.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1912	1913	1914
Arsenic...............	pounds	5,852,000	4,624,140	8,651,940
Coal, anth. (*a*)..........	short tons	84,478,527	91,626,825	91,552,187
Coal, bitu. (*a*)...........	short tons	449,964,723	478,688,867	419,547,599
Coke (*a*)...............	short tons	42,528,653	45,953,808	34,418,933
Copper sulphate.........	pounds	39,480,741	54,330,000	31,776,670
Iron ore.................	long tons	59,196,778	61,847,116	42,911,897

(*a*) The coal and coke statistics are the estimates of Coal Age.

⁂

To all the contributors, who collaborated in this number we tender our thanks, and also to the many persons who have assisted in the collection of statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1914 and have thereby enabled a close approximation to the actual production in 1914 to be made by Jan. 6, 1915, our date of going to press.

⁂

We commend to our readers a careful reading of the remarkable series of reviews of technical progress that appears in this issue. Mr. Knopf writes of advances in the science of economic geology, Mr. Megraw of stamp milling and cyanidation, Professor Hofman of the metallurgy of lead, Mr. Addicks of the metallurgy of copper, Mr. Ingalls of the metallurgy of zinc, and Mr. Cranston of gold dredging. All of these contributors are of national reputation as experts in their specialties; several of them are of international reputation. Such contributions as they offer in this issue are real enrichments of technical literature and are especially valuable to the general practitioner as expert summaries of what has been done in technical metallurgy.

⁂

Last year we were able to give at this time figures of the world's production of copper, gold, spelter and tin in the year that had closed a few days previously. These figures were not mere guesses, but were based on official reports covering 10 or 11 months of the year, with estimates only for November and December. When the final figures were published several months later, they were found to vary from our preliminary figures by only a trifling percentage. The statistics that we are able to present this year are far more incomplete than last year, and even the collection of those that we are able to publish has been attended by unusual difficulty, reflecting the disturbances created by the war.

⁂

Thus, no information could be obtained from Germany, no producer in that country being willing to communicate information that might be useful to the enemy. Reports that were due to us from Russia, France and Australia were lost or delayed in the mails and it proved impossible to supply missing figures by cable, which sort of communication proved also to be more or less uncertain. On the other hand, some of our communications from London and Japan came along with ordinary dispatch.

⁂

In the collection of the domestic statistics there were also some unexplainable difficulties. The upset conditions in copper production presented a good many opportunities for the duplication of figures, and an unusual amount of telegraphing was necessary to settle doubtful questions. Similar difficulties were experienced by the Director of the Mint in collecting the statistics of gold and silver production, according to communications received from him. His statistics, which are usually published on Jan. 1, were belated several days.

⁂

American mining companies that publicly announce their dividends paid $55,563,732 in 1914, compared with $73,440,701 in 1913. Canadian and Mexican companies paid $15,058,220 in 1914, and $21,654,260 in 1913.

United States metallurgical and holding companies connected with the mining industry, paid $91,782,505 in 1914, as compared with $99,740,693 in 1913.

⁂

The unsold stock of spelter in the hands of American smelters at the end of 1914 was 23,500 tons, a huge decrease from the record stock of 64,000 tons at the midyear.

⁂

The world's 1914 production of gold was $455,305,385, as against $462,699,658 in 1913.

⁂

The world's production of copper was about 913,000 metric tons in 1914, compared with 1,006,000 in 1913.

Metal Markets

NEW YORK—Jan. 6

Copper and spelter have both turned strong. Lead shows a weaker tone. Tin has been about stationary.

Copper, Tin, Lead and Zinc

Copper—The business of the last week was light, but toward the close a distinctly firmer tone developed, partly because of the advance in London and partly because of increased inquiry from domestic consumers, especially the brass makers. While no considerable business has yet developed, those interests which had previously been offering copper cheaply withdrew their offers, and the prices asked were raised to figures approaching 13¼c., regular terms, while some of the principal producers were confident that they would soon be able to sell at their former price of 13½c. regular terms. This was in fact realized in the afternoon of Jan. 6, when some considerable sales were reported at that price, while copper had been available in the morning at 13c. New York.

Business is said to be good with the brass makers, fair with the sheet rollers, but still rather poor with the wire drawers.

The Anaconda company having exhausted its stock of wirebars at Great Falls, Mont., has resumed work in its refinery at that place in order to supply wire drawers in the Middle West. The Great Falls plant will be operated at the rate of 5,000,000 lb. per month for two months, obtaining the crude copper from Anaconda. This does not mean any increase of production by the Anaconda company, but simply a partial diversion from Raritan to Great Falls in order better to fill orders.

The Bureau of Commerce reports the exports of copper from the United States for the week ended Dec. 26 at 2,839,000 lb., of which 1,569,000 lb. were destined to Sweden and 1,151,000 lb. to Great Britain. Imports of copper included 826,000 lb. metal and 1,596,000 lb. in ore and matte.

Visible stocks of copper on Jan. 1 are reported as follows: Great Britain, 19,950 long tons; afloat for British ports 4825; total 24,775 tons. Stocks held in Rotterdam are estimated at 1150 tons.

Tin—In anticipation of poor statistics, the market here developed considerable weakness and business nearly subsided. Even the advance in London, which was mainly based on the spot position, could not arouse domestic buyers from their lethargy. The close is steady.

Visible stocks of tin on Dec. 31 are reported as follows: Great Britain, 7885; United States, excluding Pacific ports, 5511; total, 13,396 long tons, being 1913 tons more than on Nov. 30, and 497 tons less than on Dec. 31, 1913. Stocks include tin afloat.

Lead—Only a small business is reported, the price remaining unchanged at 3.80c., New York, but St. Louis has been a shade weaker.

Spelter—A rather large business is reported, chiefly with domestic consumers, who reappeared in the market after a long absence, sales being fairly large, including several 500-ton lots. The effect of this demand was to produce a sharp advance in the price. From day to day there was a wide diversity in prices asked, certain interests advancing their prices while others remained free sellers lower down. The activity continued right up to the close. Some export business was also reported.

Other Metals

Aluminum shows some inquiry but no large sales beyond the usual contract business. Quotations remain 19@19½c. per lb. for No. 1 ingots, New York.—**Antimony** is slow as to domestic business, but with some sales for export. The English embargo on exports from that country is affecting the market here. Ordinary brands are 13½@14c. per lb.; while 16@17c. is asked for Cookson's.—**Quicksilver** is dull and unchanged, with quotations $50 per flask of 75 lb., New York. London lower, at £11 per flask.—**Nickel**—Ordinary forms—shot, blocks or plaquettes—are 40@45c. per lb., according to size and terms of order. Electrolytic metal is 5c. per lb. higher.

Gold, Silver and Platinum

Gold—The week's engagements include $2,000,000 withdrawn from the New York subtreasury for export. It is believed that this will go to Canada on account of the City of Montreal loan lately negotiated in New York. This loan will also take $5,000,000 gold transferred to New York account at Ottawa, on French government bills.

Sales of gold bars at the Assay Office in New York in December amounted to $1,755,858, making the total for the year $60,616,438, against $34,283,992 in the year 1913, and $31,037,051 in 1912. The larger monthly sales in 1914 were $7,342,042 in October, $8,957,563 in January and $10,797,997 in February.

Silver has been quiet to steady so far this year. No special feature or tendency has developed, and for the present at least the market is quiet with moderate transactions.

Platinum—The market is quiet and demand light. Quotations are variable, $41@43 per oz. being asked for refined platinum and $46@49 for hard metal.

Exports and Imports of Metals, other than iron and steel, in the United States, 10 months ended Oct. 31, as reported by the Department of Commerce:

Metals:	Exports 1913	Exports 1914	Imports 1913	Imports 1914
Copper, long tons	356,821	334,815	153,171	118,876
Tin, long tons	1,054	592	40,647	39,97
Lead, short tons	42,522	60,561	50,216	20,90
Zinc, short tons	7,772	36,395	5,987	84
Zinc in ore, short tons	5,244	140	11,034	8,72
Nickel, lb.	24,575,052	24,589,972	38,614,745	30,067,264
Antimony, lb.	63,620	1,310,238	13,196,424	12,800,09
Aluminum, lb.	44,435	18,939	20,775,102	14,398,031
Quicksilver, lb.	74,947	28,230	....	...
Platinum, oz.	1,191	143	101,717	66,544

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Exports include reëxports of foreign material.

DAILY PRICES OF METALS IN NEW YORK

Dec. Jan	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis Cts. per Lb.	Zinc: New York, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
31	4.8500	48⅞	12.65 @12.75	33⅛	3.80	3.60 @3.62½	@5.60	5.40 @5.45
1		.			. .	. . . . .		
2	4.8500	48½	12.65 @12.75	32½	3.80	@3.60	5.60 @5.65	5.42 5.47
4	4.8488	48¼	12.65 @12.75	33¼	3.80	@3.60	5.65 @5.70	5.47 @5.52
5	4.8488	48¾	12.80 @12.90	33½	3.80	@3.60	5.72½ @5.77½	5.55 @5.60
6	4.8450	48¼	13.00 @13.30	33½	3.80	@3.60	5.77½ @5.82½	5.60 @5.65

The quotations herein are our appraisal of the markets for copper, lead spelt and tin based on wholesale contracts, and represent, to the best of our judgmen the prevailing values of the metals specified as indicated by sales by produce and agencies, reduced to basis of New York, cash, except where St. Louis is giv as the basing point. St. Louis and New York are normally quoted 0.17c. apar

The quotations for electrolytic copper are for cakes, ingots and wirebar Electrolytic copper is commonly sold at prices including delivery to the consume and is subject to discounts, etc. The difference between the price delivered an the New York cash equivalent is at present 0.15 to 0.20c. on domestic busine and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 t 0.10c. below that of electrolytic. Quotations for lead represent wholesale tra actions in the open market for good ordinary brands. Quotations for spelt are for ordinary Western brands. Silver quotations are in cents per troy oun of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New Yor 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Dec.-Jan.	Silver	Copper: Spot £ per Ton	Copper: Spot Cts. per Lb.	Copper: 3 Mos.	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb
31	22 11/16	56¾	12.30	57	61¼	147½	142	19	4.13	27¾	6
1	22¾	.							. . .	.	.
2	22 9/16	- .								. . .	. .
4	22¾	57¼	12.41	57½		151	143	19	4.13	28⅛	6.
5	22¾	57¾	12.57	58¼	62¼	152	145½	19¼	4.16	28⅜	6.1
6	22 11/16	59¼	12.87	59½		151½	146	19	4.13	28¼	6.

*No quotations.

The above table gives the closing quotations on London Metal Exchan All prices are in pounds sterling per ton of 2240 lb., except silver which is in pen per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standa copper, spot and three months, and for best selected, price for the latter bei subject to 3 per cent. discount. For convenience in comparison of London pric in pounds sterling per 2240 lb., with American prices in cents per pound the follo ing approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Gold and Silver

By Frederick Hobart

The gold production of the world in 1914 again showed a reduction, although the decrease as compared with 1913 was less than the difference between that year and 1912. The total, according to our preliminary figures in 1914, was $454,305,885, which is $7,364,173 less than the corrected total for 1913. The decrease from 1912 to 1914 was $20,027,883.

In the table herewith, the figures for 1912 and 1913 have been corrected by official and other reports. Those for 1914 are based upon returns for 11 months, with estimates for the final months of the year from nearly all the principal countries. The figures for the United States are the preliminary estimate which has been furnished us by the Director of the Mint and the U. S. Geological Survey. Some revision of these will be made later, but this revision is generally an upward one, the early estimates being of a conservative nature.

GOLD PRODUCTION OF THE WORLD

	1912	1913	1914
Transvaal	$188,599,260	$181,889,012	$173,275,610
Rhodesia	13,166,230	13,935,681	17,748,275
West Africa	7,386,028	7,846,560	8,805,000
Madagascar, etc.	2,925,000	2,044,600	1,980,000
Total Africa	$212,076,518	$205,715,653	$201,808,885
United States	$93,451,500	$88,884,400	92,823,500
Mexico	22,500,000	20,500,000	17,500,000
Canada	12,559,288	16,216,131	16,550,000
Central America, etc	3,632,500	3,030,400	3,500,000
Total North America	$132,143,288	$128,630,931	$130,373,500
Russia, inc. Siberia	$27,635,500	$29,500,000	$26,500,000
France	1,847,000	1,812,100	1,450,000
Other Europe	3,615,000	2,950,000	2,600,000
Total Europe	$33,097,500	$34,262,100	$30,550,000
British India	$12,115,162	$12,176,783	$12,258,000
British & Dutch E. Indies	4,925,000	4,739,100	4,690,000
Japan and Chosen	7,165,000	7,394,300	7,500,000
China and others	3,750,000	3,658,900	3,625,000
Total Asia, not inc. Siberia	$27,955,162	$27,969,083	$28,073,000
South America	$12,425,000	$13,058,400	$13,250,000
Australasia	56,635,800	53,033,391	51,250,000
Total for the world	$474,333,268	$462,669,558	$455,305,385

Of the principal countries, the Transvaal, which is the largest producer of all, shows a decrease of $8,594,000, which is about the same as the difference between 1912 and 1913. Most of this decrease, however, was in the early months of the year and the second half of 1914 shows a considerable gain over the corresponding period of 1913. Rhodesia and West Africa, on the other hand, show large increases. In North America, the United States, rather unexpectedly, shows a substantial increase, the total coming alomost up to that for 1912.

WORLD'S PRODUCTION OF SILVER

Smelters' Production In Metric Tons

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Great Britain	536.1	499.3	395.1
Germany	423.0	476.0	537.9
Belgium	264.7	252.7	280.0
Spain and Portugal	131.9	117.6	*a*130.0
France	53.0	47.0	*a*47.0
Austria Hungary	63.1	61.2	58.9
Italy	14.2	12.1	14.4
Norway	7.2	7.6	*a* 8.0
Russia	4.9	*a* 5.0	*a* 5.0
Turkey	1.5	1.5	1.5
Sweden		1.2	0.9
Total Europe	1499.6	1481.2	1478.7
United States	3891.9	4073.0	4059.1
Mexico	1055.6	*b*1063.2	*b*1150.2
Central and South America *a*	200.0	200.0	200.0
Canada	509.2	593.4	546.5
Total America	5656.7	5929.6	5974.8
Asia (Japan)	141.6	138.1	148.9
Australia	129.1	136.4	143.0
Total production	7427.0	7685.3	7745.1

a Estimated. *b* Fiscal years 1910-1911 and 1911-1912

GOLD PRODUCTION IN THE UNITED STATES

(Values)

State	1912	1913	1914
Alabama	$16,400	$9,200	$12,200
Alaska	17,198,600	15,201,300	15,850,000
Arizona	3,785,400	4,101,400	4,507,800
California	20,008,000	20,241,300	21,447,800
Colorado	18,741,200	18,109,700	19,881,100
Georgia	10,900	13,300	11,400
Idaho	1,401,700	1,244,300	1,066,000
Maryland	1,200	700	
Montana	3,707,900	3,320,900	3,935,100
Nevada	13,575,700	11,977,400	11,003,800
New Mexico	751,600	892,000	1,207,600
North Carolina	156,000	115,200	118,900
Oregon	759,700	1,477,900	1,594,500
South Carolina	15,400	4,100	6,100
South Dakota	7,823,700	7,214,200	7,310,000
Tenness	11,500	7,700	5,900
Texas	2,200	200	10,300
Utah	4,312,600	3,570,300	3,180,200
Washington	682,600	657,500	607,400
Wyoming	24,300	17,500	2,200
Continental U. S.	$92,989,900	$88,176,100	$91,760,300
Philippines	461,600	707,200	1,060,100
Porto Rico		1,100	3,100
Total	$93,451,500	$88,884,400	$92,823,500

SILVER PRODUCTION IN THE UNITED STATES

(In Fine Ounces)

State	1912	1913	1914
Alabama	200	100	100
Alaska	539,700	366,700	398,500
Arizona	3,445,500	3,912,000	4,306,600
California	1,384,800	1,421,500	1,744,500
Colorado	7,933,100	8,989,700	8,612,900
Georgia	200	100	100
Idaho	7,862,900	9,477,100	12,689,500
Illinois	1,800	2,300	1,800
Maryland	700		
Michigan	513,500	333,700	404,500
Missouri	30,000	38,900	60,000
Montana	12,524,000	12,540,300	10,746,000
Nevada	13,851,400	15,657,400	14,814,200
New Mexico	1,460,800	1,666,900	1,682,100
North Carolina	2,300	1,700	1,300
Oklahoma		800	
Oregon	54,000	172,200	126,700
South Carolina			100
South Dakota	205,800	172,600	180,500
Tennessee	112,000	109,000	95,400
Texas	379,800	429,800	601,000
Utah	13,076,700	11,282,300	11,397,500
Virginia	700	200	1,000
Washington	350,800	218,700	54,100
Wyoming	300	1,200	100
Continental U. S.	$63,761,000	66,796,200	67,918,500
Philippines	5,800	5,300	9,700
Porto Rico			1,500
Total	$63,766,800	66,801,500	67,929,700

The gold production in the United States in 1914, according to the preliminary figures of the Mint and U. S. G. S., reached a total of $92,823,500, being $3,939,100 more than in 1913 and $372,000 more than in 1912. Increases were shown in nearly all the larger producing states, notably in California, Colorado and Alaska. There were small decreases in Nevada and Utah, but nearly all the other producers of any importance either held their own or showed very small changes. California was again the leading producer, with Colorado second, Alaska third, Nevada fourth and South Dakota fifth. Silver production in the United States is given also according to the preliminary figures of the Director of the Mint and the U. S. Geological Survey. The total production was 67,929,700 fine oz., being 1,128,200 oz. more than in 1913

The decrease in gold production was contemporaneous with an increased demand for gold. The usual movement of gold and silver was altogether upset in the latter part of the year by the general disorganization of trade and exchange due to the war, and it is hardly possible at the present time to give an intelligent summary of the actual movements. It is sufficient to say that every nation has done its best to hang on to the gold supplies which it possessed and to increase them wherever possible.

GOLD PRODUCTION OF THE WORLD FOR 20 YEARS

1895	$198,995,741	1905	$378,411,054
1896	211,242,081	1906	405,551,022
1897	237,833,984	1907	411,294,458
1898	287,327,833	1908	443,434,527
1899	311,505,947	1909	459,927,482
1900	258,829,703	1910	454,213,649
1901	260,877,429	1911	459,377,300
1902	298,812,493	1912	474,333,268
1903	329,475,401	1913	462,669,658
1904	349,088,293	1914	454,305,385

Gold and silver movement in the United States, 11 months ended Nov. 30, as reported by the Division of Statistics of the Department of Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports	$81,226,017	$222,485,232	$58,319,092	$46,291,181
Imports	58,631,475	53,278,678	33,057,451	23,219,995
Excess, exports	$22,594,542	$169,206,554	$25,261,641	$23,071,186

The large excess of gold exports in 1914 was due to the payment in gold instead of merchandise of debts due in Europe; a notable instance being the payment in gold of New York City bonds held abroad. In consequence of the war risks and difficulties in shipping, it became necessary to employ some devious methods. Thus the Bank of England established credits at Ottawa in Canada, in South Africa and in Australia where deposits of gold could be made and credited to the depositor in London, thus avoiding the risk of actual transportation by sea and the added danger from hostile cruisers.

Silver

The governing factors in the world's consumption of silver are the use of it in the arts and the requirement for coinage purposes, but especially the absorption in India and China. This being the case, the primary silver market of the world is London, the price in New York being but a reflection of the price there, with a differential covering the cost of delivering the bullion from New York to London. The normal differential between the official prices at London and New York is about 1½c. per ounce, but the disturbance in August caused this to run up to 6c. per oz., and even higher.

At the beginning of 1914 the price for silver was about 26½d. in London. The surplus supply taken over by a London banking syndicate from the India Specie Bank, which became insolvent in 1913, was being gradually liquidated, this process being facilitated by the diminished supply of silver coming from Mexico, the curtailment being estimated at about 2,000,000 oz. per month. The Indian bazaars which had been accustomed so long to deal with the reckless and involved India Specie Bank, were slow to recognize the quite different caliber of the syndicate then engineering the liquidation of the plethora on the London market. This operation naturally weighed upon the market during the first quarter of the year.

In March it was estimated that the available stock of silver in London and in the East was about 8,000,000 oz. less than at the beginning of the year, and early in April it became known that the London syndicate had closed out its holdings. The silver market then naturally began to acquire a little more tone. By the early part of May, a price of 27$\frac{3}{16}$d. in London was reached, the Mexican troubles of that time being a contributary bullish influence. About $2,000,000 worth of silver—chiefly from Cobalt—went down in the "Empress of Ireland." In June the silver market turned dull and declining upon reduced demand from India and China, and at the midyear the price was 25⅞d. In the latter part of July selling by Chinese banks caused a rapid decline to about 24d.

On Aug. 1 official quotations for silver, both in London and New York, were suspended. On Aug. 8 the official price at London was reëstablished at 26d., but this was for spot transactions only. An official quotation of 26d. warranted a New York quotation of 52c. only, the cost of freight and war insurance added to the usual charges then amounting to 6¼c. per oz. New York brokers were not, however, able to sell in London at all, owing to delay in the transmission of cables and the difficulties of transactions in foreign exchange.

MONTHLY AVERAGE PRICE OF SILVER

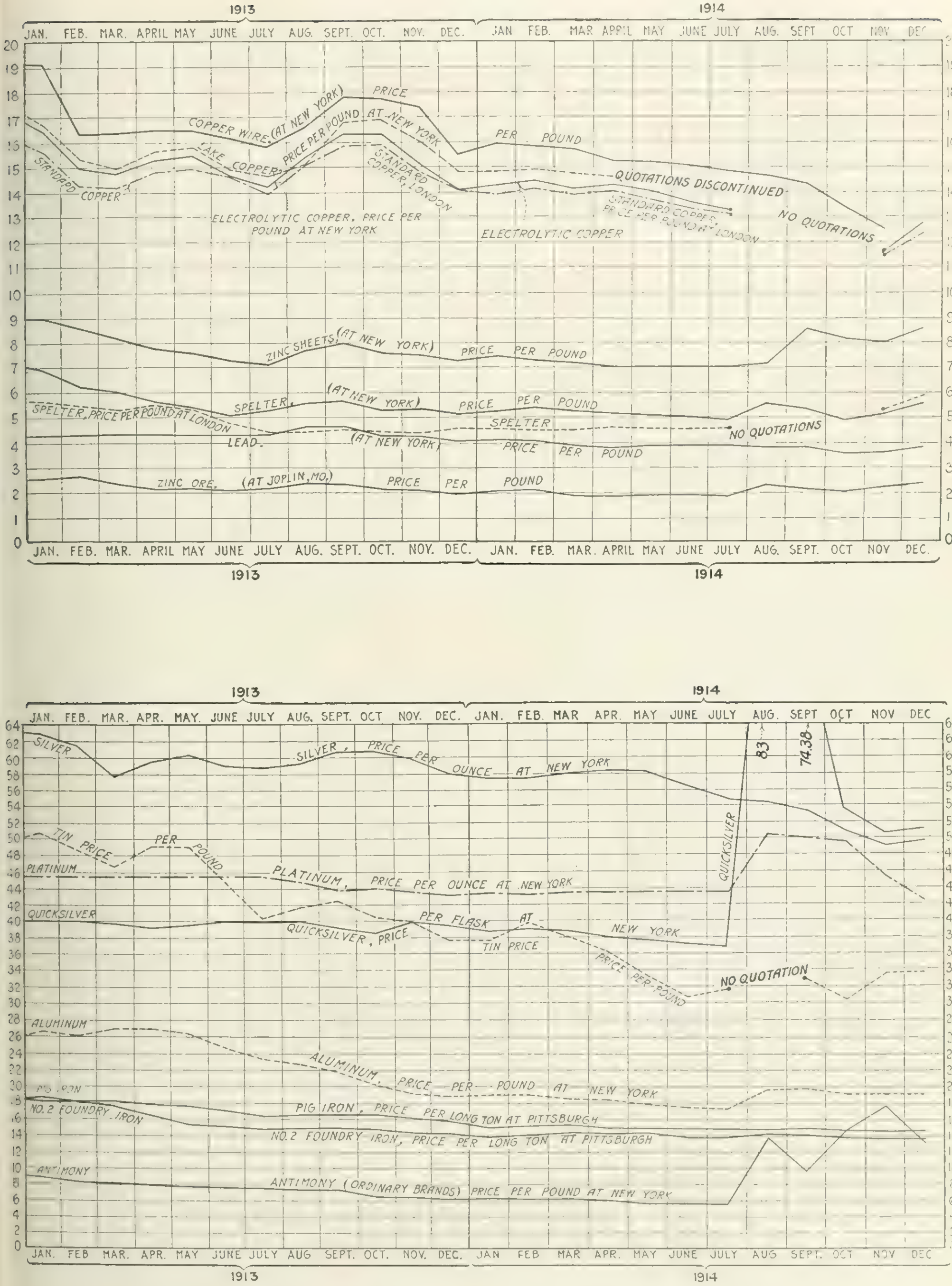
Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	27.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	25.979
September	63.078	60.640	53.290	29.088	27.986	24.260
October	63.471	60.793	50.654	29.299	28.083	23.199
November	62.792	58.995	49.082	29.012	27.263	22.703
December	63.365	57.760	49.375	29.320	26.720	22.900
Year	60.835	59.791	54.811	28.842	27.576	25.313

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

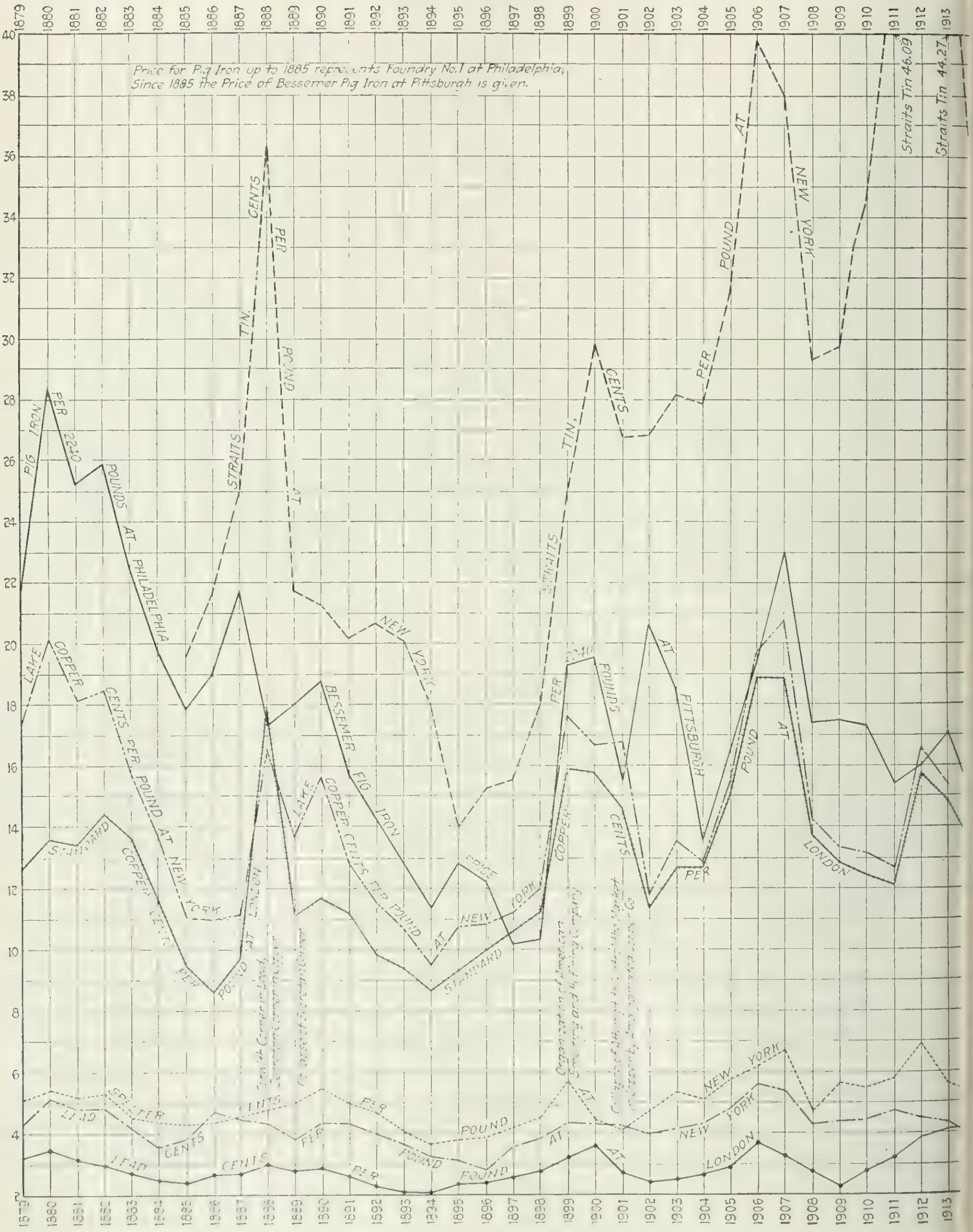
The suspension of silver quotations produced a critical condition among silver miners, although the facts of the situation were promptly and fully recognized. Pressure was immediately exerted upon Washington to induce the U. S. Mint to buy silver. The Mint authorities consequently entered into negotiations with the smelters, as a result of which the Mint on Aug. 11 agreed to take 1,175,000 oz. at 52c. per oz., on condition that the smelters would agree to liquidate all silver that they owed to the miners up to the end of that day.

With the improvement in the situation as regards shipments and foreign exchange, producers began to send large consignments to London, especially in ships of the American Line, selling it for what they could get after it had been delivered there. The only buyer was the English Mint. The demand from the Far East was temporarily nil and continued to be insignificant for several months following. Not only was there great risk in shipping silver to the East, where the German cruiser "Emden" was at large on the Indian Ocean, but both India and China were unable to trade their exports for bullion, as a result of war conditions.

The conditions prevailing in the silver market after the outbreak of the war keenly affected those districts like Cobalt and Tonopah, which are essentially silver producers. Some of the mining companies of those districts which refine and sell their own product accumulated considerable unsold stocks. At the time when quotations were suspended some producers found fault, but in general everybody realized the nature of the emergency and coöperated for the common welfare. For a time silver was unsalable. To any producers who thought the contrary, the refiners were willing to hand back their product and let them sell it themselves if they could. A few tried to do this and made rather a mess of things.



METAL PRICES IN 1913 AND 1914, MONTHLY AVERAGES



Price for Pig Iron up to 1885 represents Foundry No.1 at Philadelphia; Since 1885 the Price of Bessemer Pig Iron at Pittsburgh is given.

Course of Metal Prices Since 1879—Annual Averages

Copper

Both the world's and the American copper production xhibit large decreases from 1913, as was expected; in- ed, the decreases are hardly so large as was expected. is to be remarked, however, that the curtailment of oout 50% by many important producers did not become illy effective until two-thirds of 1914 were gone; and, ioreover, that it was based on their rate of production ı July, 1914; not on their average rate of production ı 1913.

During the first seven months of 1914 the production f copper was about stationary, or perhaps was a little iore than the average rate of 1913. The outbreak of the ar, interfering with consumption in all parts of the orld, with the excision of Germany, a very large con- ımer, was an unforseen calamity. The producers met his condition as best they could. The Anaconda and the orphyry mines curtailed their production by about 50%. The Calumet & Hecla and Phelps, Dodge & Co. curtailed y 25%. As the price for copper fell toward 11c., many f the smaller producers suspended operations. Among hese were Cananea, Shattuck Arizona, Mason Valley and British Columbia.

SMELTERS' PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1911	1912	1913	1914
laska	19,412,000	32,602,000	24,452,000	22,860,000
rizona	300,578,816	357,952,962	399,849,745	374,371,075
alifornia	36,806,762	31,069,029	32,390,272	29,018,200
olorado	8,474,848	7,502,000	7,670,090	8,840,000
laho	3,745,210	5,964,542	8,434,028	5,983,538
Iichigan	216,412,867	231,628,486	159,437,262	157,089,795
Iontana	271,963,769	309,247,735	285,336,153	232,590,737
evada	65,385,728	82,530,608	84,683,961	59,760,906
ew Mexico	1,518,288	27,488,912	46,953,414	66,041,251
tah	138,336,905	131,673,803	147,591,955	150,446,231
ashington	....	1,121,109	448,805	141,023
ast and South	19,656,971	18,592,655	24,333,014	18,351,927
ther states	1,564,207	4,396,667	4,155,135	(a) 10,236,135
Totals	1,083,856,371	1,241,762,508	1,225,735,834	1,135,730,818

(a) Includes copper originating in states other than those enumerated and so copper whose origin could not be correctly distributed at this early date ideed, the distribution for 1914 in several cases in this table must be regarded merely provisional. Thus, Utah is undoubtedly credited with more or less opper that belongs to Idaho and Nevada.

SMELTERS' PRODUCTION

(In Pounds)

Source	1911	1912	1913	1914
. American ore	1,284,932,019	1,489,168,562	1,438,565,881	1,266,563,711
oreign ore	34,392,091	53,701,307	55,803,202	52,277,948
crap	18,529,547	11,949,348	22,427,889	17,534,158
Totals	1,337,853,657	1,554,719,217	1,516,796,972	1,336,375,817
'o foreign refiners	32,413,440	45,735,673	36,682,605	36,199,348
o American refiners	1,305,440,217	1,508,983,544	1,480,114,367	1,300,176,469
rude copper imported	146,422,851	144,480,144	169,315,869	126,188,945
Total crude copper	1,451,863,068	1,653,463,688	1,649,430,236	1,426,365,414

To a more or less extent a similar policy was adopted n foreign countries. Thus, Australia and Spain-Portugal curtailed production. Peru (Cerro de Pasco), Chile and Japan kept on at about the same rate as in 1913. Katanga increased its output, as did Cuba, where a new, rich mine had become productive. Russia had strong incentives to increase production, but the military troubles which caused the two producers of the Caucasus to suspend in November, reduced the total for the year, and even before that Russia had been obliged to import copper from the United States. The revolutionary troubles in Mexico had caused the output of that country to shrink even before the European war. Teziutlan was idle through the year and Aguascalientes and Torreon during most of it, operations not being resumed at those plants until late in the year.

The exports of copper from the United States in the first 10 months of 1914 were 733,302,369 lb., compared with 773,239,795 lb. in the corresponding period of 1913. Although this 10-month period of 1914 comprised only three months of the war, the exportation to Germany had decreased to 176,698,948 lb., compared with 259,217,551 in the corresponding period of 1913. The exports to Austria-Hungary, Belgium, France, Holland and Canada also showed decreases. On the other hand, there were increases in the exportations to Italy, Russia and Great Britain.

After the war began it became evident that Germany would buy a large quantity of copper if she could. However, it appeared that Great Britain made it a matter of military and political policy to keep copper out of Germany and her success in so doing was evidenced by copper becoming worth about 25c. per lb. in Germany. The seizure of many ships carrying copper from New York to Italy and Scandinavia provoked an international question, which was referred to in the American note of Dec. 24 to England in the following words:

WORLD'S PRODUCTION OF COPPER (a)

(In Metric Tons)

Country	1911	1912	1913	1914
United States	491,634	563,260	555,990	515,164
Mexico	61,884	73,617	58,323	35,436
Canada	25,570	34,213	34,880	33,248
Cuba	3,753	4,393	3,381	6,628
Australasia	(b) 42,510	(b) 47,772	(b) 47,325	(e) 33,782
Peru	28,500	26,483	25,487	22,876
Chile	33,088	39,204	39,434	38,270
Bolivia	2,950	4,681	(b) 3,658	(h) 3,500
Japan	(d) 52,303	(d) 62,486	(b) 73,152	(d) 68,058
Russia	(c) 25,747	(c) 33,550	(c) 34,316	(h) 32,000
Germany	(b) 22,363	(b) 24,303	(b) 25,308	(h) 28,000
Africa	(b) 17,252	(b) 16,632	(b) 22,870	25,700
Spain and Portugal	(b) 52,878	(b) 59,873	(b) 54,696	(i) 47,500
Other countries	(b) 26,423	(b) 29,555	(b) 27,158	(h) 23,000
Totals	886,855	1,020,022	1,005,978	913,162

(a) The statistics in this table are our own compilations, except where specially noted to the contrary. (b) As reported by Henry R. Merton & Co. (c) As officially reported. (d) Privately communicated to us from Japan. (e) Exports as reported by Henry R. Merton & Co. (h) Estimated. (i) Communicated through London.

> For example, a shipment of copper from this country to a specified consignee in Sweden was detained because, as was stated by Great Britain, Sweden had placed no embargo on copper. On the other hand Italy not only prohibited the export of copper but, as this Government is informed, put in force a decree that shipments to Italian consignees or "to order" which arrive in ports of Italy cannot be exported or trans-shipped. The only exception Italy makes is of copper which passes through that country in transit to another country. In spite of these decrees, however, the British foreign office has thus far declined to affirm that copper shipments consigned to Italy will not be molested on the high seas. Seizures are so numerous and delays so prolonged that exporters are afraid to send their copper to Italy, steamship lines decline to accept it and insurers refuse to issue policies upon it. In a word a legitimate trade is being greatly impaired through uncertainty as to the treatment which it may expect at the hands of the British authorities.

The total quantity of copper detained by Great Britain was about 15,000,000 lb. Holland, Sweden, Italy and Switzerland put embargoes on the export of copper, wherefore Germany could not openly procure copper through them. The action of Great Britain in detaining the copper consigned to those countries was apparently intended to make sure that it would not be smuggled through them in spite of their embargoes. Up to the present time this question has not been settled.

The Copper Producers' Association suspended the publication of its monthly statistics upon the outbreak of the war, and the probability is that there will be no further publication of them. At the beginning of 1914 the stock of refined copper in the United States was 91,438,867 lb.; at the mid-year it was 106,110,663 lb. All talk about the stocks of copper at the end of 1914 is guesswork. As between June 30 and Aug. 31 there was undoubtedly an increase. As between Aug. 31 and Dec. 31 there is reason to believe there may have been a decrease. Even so, no encouraging deductions are to be drawn therefrom, inasmuch as whatever decrease, if any, there may have been is likely to have been more than offset by increase in the stock of blister copper.

In the early part of 1914 the copper industry was encouraged by the hope of an increase in consumption and the certainty that there was to be no great increase in production in the near future. The hope of increased consumption was disappointed. As to the coming new production, things remain as they were. Inspiration will probably begin during the spring of 1915 and Chuquicamata during the summer. The only big mine now being developed in the United States is the New Cornelia. The Katanga mines of Africa are slowly making an enlarged output and will probably become faster when their new smelting plant is finished. An important addition to copper supply will be made when the present producers consummate their plans to increase their percentage of copper extraction, but the increase in this way will be spread over a series of years.

COPPER PRODUCTION OF CHILE AND PERU, 1913 AND 1914

(In Pounds)

	Chile—1913	Chile—1914	Peru—1913	Peru—1914
Blister copper to U. S....	18,315,000	15,824,060	42,667,436	43,533,967
Copper in ore to U. S....	24,911,465	31,301,049	10,089,592	4,935,324
Copper to England and France....	43,460,480	37,024,960	3,180,800	1,742,720
Sundries, estimated......	250,000	220,000	250,000	220,000
Totals, lb............	86,936,945	84,370,069	56,187,828	50,432,011
Totals, metric tons....	39,434	38,270	25,487	22,876

The Copper Market in 1914*

January—The market opened at 14.55c., a recession from the closing price of 1913, the important buying movement of the latter part of December having exhausted itself. Competitive selling led to a steady decline to 13.85c., which was registered at the middle of the month. Europe then became interested and bought so freely that the price advanced to 14.55c. at the end of the month. Domestic manufacturers also became interested in the market and it was believed that their orders reflected an increase in the ultimate consumption of copper.

February—The activity continued and on Feb. 11 the price stood at 14.65c., the highest point of the year. It appeared soon afterward that the important buying had been satisfied whereupon the market became dull and recesssional. At the end of the month the price was 14.25c.

March opened with more interest on the part of domestic manufacturers, who reported that business among themselves was not so bad as it had been pictured, and intimated that copper looked cheap and they might be tempted by bargains. The producers tried to meet them in this and copper was sold freely on a declining scale. Toward the middle of the month the pressure to sell from all quarters became emphatic, and the price dipped a trifle under 14c. A rather large business then developed, both for domestic and foreign account, the latter predominating, and by Mar. 17 producers had sold so liberally that one after another raised his price, with buyers following the market upward. At the close of the month the price stood at 14.30 cents.

April—By Apr. 4 the market stood at 14.55c., where the advance halted. A reaction in the London price at about this time permitted arbitrage business to be done at a profit. Europe continued to buy right along, and reports from abroad were that consumption over there continued at an excellent rate, the heavy shipments from this side going directly into consumers' yards, which was quite contrary to some of the absurd rumors which were finding currency here. With a check in demand and the uncertainties produced by the trouble arising between the United States and Mexico, the market declined to a trifle under 14c. on Apr. 23. On Apr. 27, however, there was a distinctly better feeling because of the improvement in the Mexican situation and Europe became a substantial buyer, which rallied the market, the month closing with copper at 14.15 cents.

MONTHLY AVERAGE PRICE OF COPPER

	New York Electrolytic				London Standard			
Month	1911	1912	1913	1914	1911	1912	1913	1914
Jan..	12.295	14.094	16.488	14.223	55.600	62.760	71.741	64.304
Feb.....	12.256	14.084	14.971	14.491	54.974	62.893	65.519	65.259
Mar.....	12.139	14.698	14.713	14.131	54.708	65.884	65.329	64.276
Apr....	12.019	15.741	15.291	14.211	54.034	70.294	68.111	64.747
May.....	11.989	16.031	15.436	13.996	54.313	72.352	68.807	63.182
June.....	12.385	17.234	14.672	13.603	56.365	78.259	67.140	61.336
July....	12.463	17.190	14.190	13.223	56.673	76.636	64.166	60.540
Aug.....	12.405	17.498	15.400	*	56.266	78.670	69.200	*
Sept.....	12.201	17.508	16.328	*	55.253	78.762	73.125	*
Oct......	12.189	17.314	16.337	*	55.170	76.389	73.383	*
Nov.....	12.616	17.326	15.182	11.739	57.253	76.890	68.275	53.227
Dec......	13.552	17.376	14.224	12.801	62.068	75.516	65.223	56.841
Year...	12.376	16.341	15.269	......	55.973	72.942	68.335	......

New York, cents per pound, London, pounds sterling per long ton of standard copper. *No quotations.

AVERAGE MONTHLY PRICES OF COPPER MANUFACTURES

(In Cents per Pound)

	1912		1913		1914	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
January..........	15.75	19.50	19.09	23.50	15.94	20.75
February.........	15.25	19.50	16.38	22.50	15.88	20.50
March............	16.03	20.30	16.39	21.50	15.60	20.35
April............	17.06	21.50	16.50	21.50	15.25	20.25
May..............	17.30	21.63	16.50	21.50	15.23	19.90
June.............	18.68	22.50	16.18	21.10	15.03	19.56
July.............	19.13	22.50	15.88	20.50	14.88	19.38
August...........	19.13	22.75	16.60	21.50	14.63	18.80
September......	19.13	23.50	17.84	22.50	14.34	18.00
October..........	19.13	23.50	17.75	22.50	13.34	17.38
November.........	19.13	23.50	17.28	21.15	12.50	17.50
December.........	19.13	23.50	15.79	20.50	14.25	18.88
Year...........	17.96	22.02	16.85	21.69	14.74	19.24

May—The market became extraordinarily dull and the price fell to 13.90@14c., remaining there until about the middle of the month when a moderately large business developed which put the price up to about 14.10c.; but again it fell away and the month closed with the market at 13.95@14 cents.

June—At the beginning the price was 13.85c. At the close it was 13.25c., the decline having been steady during the month.

July—Some hopeful tendencies apparent during the last few days of June began to materialize and July opened with the price at 13.30@13.35c. Around this figure consumers became interested and during the first week of the month a big buying movement developed. It was estimated that the business of this week amounted o nearly 100,000,000 lb., the bulk being done with European buyers, who purchased for shipment over the next hree months. With the stimulus of this large buying he price naturally advanced, but the upward movement was not quite so impressive as was heralded on the tickrs. This buying movement advanced the price to 13.60c., ut the publication of the June statistics, showing an ncrease of about 22,000,000 lb. in stock, cast a chill ver things and producers became anxious to sell for whatver they could get, and soon after the middle of the month the market became distinctly weak. During the st 10 days of the month the disturbances in Europe roduced an immediate effect. The outbreak of the war etween Austria and Servia, bringing with it a financial risis and a general desire on the part of the European erchants to reduce their commitments to a minimum, ractically stopped all buying over there. It also inreased the pressure to sell here. In the last two days f the month there was turmoil, but some domestic conumers were sufficiently courageous to contract for some und lots. The last reported sale on July 31 was at 2½ cents.

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*On any given day copper is apt to be sold at a range of price even when the market is stationary, such range exhibiting the competition among sellers and the shopping among buyers; also there are differences in price according to conditions of sale. In periods of activity there are, moreover, changes in price between the beginning and end of a day. In quoting figures in this annual review we have reference to what we have in our weekly market reports during the year computed as the daily average price

August—During this month there was practical paralys, production was curtailed at the mines and to a less xtent at the refineries: but although the output that as in transit and process of refining, which could not e checked, was daily swelling the accumulation of stock, e producers exhibited a unanimity in refraining from rying to sell their copper. Manufacturers were, of urse, supplied with what they needed, but they naturally onfined themselves to hand-to-mouth purchases. The OURNAL suspended its regular quotations of the market n Aug. 1. Toward the end of August there was a little ncouragement in the resumption of exports to England, ut what went thither was chiefly the filling of old conracts or the shipment of copper on consignment.

September—During this month the situation remained nchanged, no effort being made to reëstablish a competiive market of buyers and sellers. Europe took copper ore freely on the old contracts, but the demand from doestic manufacturers appeared to be reduced by a real iminution in the rate of consumption. Producers bean to exhibit a little more nervousness. While during ugust they had been unwilling to let consumers have opper at less than 12¼c., by the end of September they ere willing to supply it at as low as 11.60c. The exortation of a surprisingly large quantity of copper durng September contributed toward the relief of the situaion, but the British seizure of copper at Rotterdam and he closing of that inlet into Germany, which happened bout the end of September, increased pessimism and led o considerable talk about the necessity for a further curailment of production.

October—During the second week of this month there as some hopefulness about the development of a good estic demand, but this petered out and everything gain was shrouded with doubt and pessimism. There was growing tendency among producers, however, to feel ore free in their efforts to make sales and the market ended to become less one-sided than it had been. About ct. 22 there developed some substantial buying by doestic consumers and it looked as if the market had egained approximately normal conditions upon the basis of the curtailed production. The level of price was then about 11c. After a few days of activity, however, the interest waned and there was uncertainty and confusion again when on Oct. 28 came the news of the detention by the British of five ships carrying copper to Italy and Scandinavia.

November—Within a few days, however, it was apparent that the market was going to take the further hampering of export business without flinching, and this was regarded as a very satisfactory test. The JOURNAL resumed quotations on Nov. 2 at 11.05@11.15c. Up to Nov. 7 the market remained at that level. Then began very excellent buying, chiefly by domestic manufacturers whose business had been slowly increasing. Once more they were willing to enter into contracts for forward deliveries and to resume business with the producers in the old way. There was no relaxation of interest during the remainder of the month, which closed with copper at 12½c., which was just where it closed in July.

December—The buying movement carried the price up to about 13.2c., but it came to an end about the middle of this month, and the market then relapsed to about 12.70c., New York.

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Butte

BY B. B. THAYER*

Mining operations in Butte in 1914 were impeded by interruptions, which naturally caused a reduction in output on the part of all companies and lessened materially the development of the district.

The year opened auspiciously, with all the companies working practically to full capacity, a fair demand for copper, and a fair price being obtained for it. Before the middle of the year was reached, however, labor trouble between two factions of the miners' union, which had given no warning whatsoever before its appearance, became active and the general condition became so acute that the local authorities were unable to cope with the situation, and the Governor of Montana found it necessary to send the militia to Butte to curb the lawlessness which had arisen. The troops were withdrawn during the latter part of November and affairs assumed a normal aspect.

As the European war caused a serious decline in the exports of copper from the United States, all of the operating companies in Butte deemed it good policy to curtail their output by 50%, and after the early part of August the monthly output of copper from the Butte district was practically but one-half of the rate in the first six months of the year.

The East Butte, Pilot Butte, Tuolumne and Alex Scott properties ceased operations pending an improvement in general conditions. The Butte & Superior properties were operated fairly continuously, as the price for zinc was less affected than the price for copper, but toward the latter part of 1914 this company was compelled to shut down in order to make necessary repairs to the hoisting shaft. The zinc concentrator owned and operated by W. A. Clark was worked continuously on ores from the Elm Orlu mine, and, it is stated, with excellent results. The officials of the Butte Duluth company expressed themselves as being well satisfied with the results of the leaching operations, which were carried on continuously

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*President, Anaconda Copper Mining Co.

The Anaconda Copper Mining Co. operated about one-half of its properties after August and made about one-half of its normal output. The smeltery, concentrating works and electrolytic refinery at Great Falls were closed early in August, while the output from the Washoe works for the remainder of the year was about two-thirds of normal, or 12,000,000 lb. per month, including custom ore.

The Anaconda, however, made normal progress with the new 2000-ton leaching plant and sulphuric-acid works, and also maintained the work of installing the coal-dust-fired reverberatory furnaces.

On account of local and foreign conditions, the development work of the district suffered.

The Copper-Smelting Works of North America

The accompanying table, corrected up to Dec. 1, 1914, gives the names of the companies engaged in copper smelting in the United States, Canada and Mexico, the situation of their works, the number of their smelting furnaces and the estimated annual capacity in terms of tons of charge, meaning ore and flux, but not including fuel. In most cases the data have been communicated to us by the operating companies. However, the figures should be taken as only approximately correct. Some companies may have figured their annual capacity on the basis of the year of 365 days, and others on the basis of 350 days, or something else. Anyway, annual capacity is a rather variable figure. In modern practice a rather large quantity of ore is reduced directly to copper by charging it into the converter along with matte.

COPPER SMELTING WORKS OF NORTH AMERICA

Company	Situation of Works	No. of Blast Furnaces	Annual Capacity	No. of Reverberatory Furnaces	Annual Capacity	No of Converters	Annual Capacity in Ore (a)
American Smelting & Refining Co.	Aguascalientes, Mex	8	730,000			4	(b)
American Smelting & Refining Co	Perth Amboy, N J	3	111,000			2	(b)
American Smelting & Refining Co	Omaha, Nebr					3	
American Smelting & Refining Co	El Paso, Texas	3	250,000	3	420,000	3	(b)
American Smelting & Refining Co	Matehuala, S L P, Mex	3	325,000				
American Smelting & Refining Co	Hayden, Ariz			2	290,000	3	(b)
American Smelters Securities Co	Garfield, Utah	4	800,000	6	875,000	6	(b)
American Smelters Securities Co	Tacoma, Wash	2	420,000			6	(b)
American Smelters Securities C	Velardeña, Dgo, Mex	3	227,500				
Anaconda Copper Mining Co	Anaconda, Mont....	3	1,800,000	8	800,000	12	85,000
Anaconda Copper Mining Co	Great Falls, Mont..	5	800,000	3	250,000	3	34,500
Arizona Copper Co	Clifton, Ariz.......			3	360,000	3	
Balakala Consolidated Copper Co (h).	Coram, Calif	3	630,000	1	52,500	2	
Compagnie du Boleo...........	Santa Rosalia, Mex	8	650,000				
British Columbia Copper Co........	Greenwood, B. C....	3	700,000			2	
Calumet & Arizona Mining Co......	Douglas, Ariz	2	634,900	4	471,700	6	40,500
Canadian Copper Co...............	Coppercliff, Ont..	6	940,000	2	300,000	5	(g)
Cananea Consolidated Copper Co	Cananea, Son.	8	868,000	2	153,000	6	35,000
Consolidated Arizona Smelting Co...	Humboldt, Ariz....			1	50,000	1	3,000
Consolidated Mining & Smelting Co..	Trail, B. C.........	5	450,000				
Copper Queen Consolidated Copper Co	Douglas, Ariz.....	10	1,225,000	3	275,000	7	34,160
Detroit Copper Mining Co	Morenci, Ariz.	1	132,657			3	7,578
Ducktown Sulphur, Copper & Iron Co	Isabella, Tenn	2	171,500				
East Butte Copper Mining Co........................	Butte, Mont.	2	310,250			3	7,300
Granby Consolidated Mining, Smelting & Power Co....	Grand Forks, B. C	8	1,440,000			6	7,000
Granby Consolidated Mining, Smelting & Power Co	Anyox, B. C.	3	700,000			3	
International Smelting Co	Tooele, Utah....			5	456,250	5	25,450
International Smelting Co	Miami, Ariz (d)			3	262,500	5	
Mammoth Copper Mining Co..	Kennett, Calif	5	730,000			2	18,250
Mason Valley Mines Co..	Thompson, Nev	2	800,000			2	22,000
Mazapil Copper Co (h).	Saltillo, Coah., Mex	4	350,000	1	52,500	4	
Mond Nickel Co......	Coniston, Ont	3	630,000			3	70,000
Mountain Copper Co.......	Martinez, Calif......			3	125,000	2	(g)
Nevada Consolidated Copper Co	McGill, Nev	1	175,000	5	900,000	4	40,000
Nichols Copper Co......	Laurel Hill, N. Y.	2	94,500			2	
Old Dominion Copper Mining & Smelting Co	Globe, Ariz	5	562,500			3	8,400
Orford Works, International Nickel Co...	Constable Hook, N. J	2	94,500			3	
Ouray Smelting & Refining Co	Ouray, Colo.........	2	350				
Penn Mining Co	Campo Seco, Calif.	1	50,000	2 (e)	48,000		
Pioneer Smelting Co	Corwin, Ariz	1	60,000				
Santa Fe Gold & Copper	San Pedro, N. M.	1	52,500				
Shannon Copper Co....	Clifton, Ariz	3	500,000			2	8,000
Swansea Consolidated Gold & Copper Mining Co	Bouse, Ariz	1	190,000			2	
Tennessee Copper Co	Copperhill, Tenn....	7	1,000,000			4	15,700
Teziutlan Copper Mining & Smelting Co (h)	Teziutlan, Puebla, Mex	2	350,000			3	
Cia Metalurgica de Torreon	Torreon, Coah., Mex.	2	175,000			2	
Tyee Copper Co (h)	Ladysmith, B. C...	2	175,000				
U. S. Metals Ref. Co..	Chrome, N. J.	2	200,000			2	
U. S. Smelting Co (h)	Midvale, Utah.	6	670,000	1	40,000	4	36,000
Virginia Smelting Co	West Norfolk, Va (f)	1	200,000				
United Verde Copper Co (c)	Jerome, Ariz	4	427,300			4	37,600
United Verde Copper Co	Clarkdale, Ariz (d)	4	720,000	3	285,000	5	75,000

a Raw ore melted as flux. *b* Included in [illegible]. *c* To be abandoned by Jan. 1, 1915. *d* Plants building. *e* Penn Min. Co. has 2 reverberatories, each with capacity of 18,000 tons per annum, but only one is run at a time. *f* Operated by Norfolk Smelting Co., Inc. *g* No raw ore charged. *h* Not in operation.

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Copper in Arizona

By James Douglas*

During 1914 Arizona shared the fate of the world at large. The preliminary statistics for 1914, as compared with 1913, show that prior to the breaking out of the war the state was fully maintaining its standard production. In fact, it probably exceeded the production of the first seven months of 1913, which was 220,000,000, by about 30,000,000 lb. Subsequent to July the sudden cessation of shipments abroad and the stagnation of business in this country forced upon the copper companies a reduction of production which, compared with a similar period of last year, amounts probably to 75,000,000 or 80,000,000 pounds.

The vacillating demands during the past few months, of both the home and the foreign market, make it impossible to forecast the future, and therefore to predict the resumption of work at full speed. But the large companies have adjusted themselves to the altered conditions, and at the principal centers of the copper industry in the state there does not seem to be either distress or confusion. Fortunately, the sudden reduction in production, with its inevitable discharge of labor, occurred at a period when in California, Kansas and Colorado there was urgent demand for labor, which therefore dispersed and was absorbed elsewhere.

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*President, Phelps, Dodge & Co., 99 John St., New York.

The suddenly arrested activity, and the relief, therefore, of the strain and high pressure under which the officers of the companies were working, enabled the operating staffs in most cases to study improved methods with deliberation and calmness, which in the long run will compensate, in diminished costs of production, for the temporary relaxation of output.

As even prior to the breaking out of the war there was no much exhilaration in the copper trade, no inducement to expand existed. The United Verde company was already reconstructing its works on a larger scale in a more convenient situation. They are now approaching completion. The Inspiration is still erecting its magnificent mining and milling equipment, and the neighboring plant of the International Smelting & Refinng Co., which will probably smelt all the concentrates made in the Globe district, is being pressed toward completion, and should be in blast before the end of 1915.

The only new large project in contemplation is the development of the property of the New Cornelia Copper Co., in the Ajo district. It is controlled by the interests prominent in the Calumet & Arizona Mining Co., and as the mining and metallurgy will be conducted under the able staff of that organization, some interesting departures from recognized methods may be anticipated. The ores are of low grade and are partly oxidized and partly sulphureted, and as the companies have in their Calumet & Arizona mines ores whose ingredients can be applied to the extraction of the Ajo copper, the investigations and experiments are therefore being made along more or less original lines. An experimental plant is also being operated by the Copper Queen at Douglas in the interest of Phelps, Dodge & Co.

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES

Works	Situation	1911 Capacity, Pounds	1912 Capacity, Pounds	1913 Capacity, Pounds (c)	1913 Capacity, Pounds (c)
Nichols Copper Co.	Laurel Hill, N. Y.	(b) 330,000,000	(a) 400,000,000	400,000,000	400,000,000
Raritan Copper Works	Perth Amboy, N. J	(a) 320,000,000	(b) 360,000,000	400,000,000	400,000,000
Baltimore Copper Smelting & Rolling Co	Canton, Md.	(b) 288,000,000	(a) 312,000,000	348,000,000	336,000,000
American Smelting & Refining Co.	Perth Amboy, N. J	(b) 180,000,000	(a) 192,000,000	216,000,000	216,000,000
U. S. Metals Refining Co	Chrome, N. J.	(a) 180,000,000	(a) 180,000,000	200,000,000	200,000,000
Balbach Smelting & Refining Co	Newark, N. J	(a) 48,000,000	(a) 48,000,000	48,000,000	48,000,000
Anaconda Copper Mining Co	Great Falls, Mont	(b) 65,000,000	(a) 65,000,000	65,000,000	65,000,000
Tacoma Smelting Co.	Tacoma, Wash	(b) 28,000,000	(a) 36,000,000	36,000,000	48,000,000
Calumet & Hecla Mining Co	Buffalo, N. Y	(a) 55,000,000	(a) 55,000,000	55,000,000	(d)
Calumet & Hecla Mining Co	Calumet, Mich				(e) 65,000,000
Total	....	1,494,000,000	1,648,000,000	1,768,000,000	1,778,000,000

a Official figures furnished by the respective companies. b Estimated. c All of the figures for 1913 and 1914 were officially furnished. d Buffalo works of Calumet & Hecla dismantled in fall of 1914. e New works put into operation in 1914.

The mill problem everywhere is to save the copper carried away in the very fine slimes from the tables and its solution is sought in a combination of electrolytic deposition with leaching. This has revived interest in the hydrometallurgy of copper; but the choice will probably lie between leaching and flotation, both of which must be considered to be still in the experimental stage.

The Copper Queen company has, after relying exclusively for 31 years on its smelting ores, to resort to concentration. It is developing what once would have been considered a fairly large body of concentrating ore in the porphyries of Sacramento Hill, but today, when quantities of ore are counted by the tens of millions of tons instead of hundreds of thousands, it is of insignificant size. Nevertheless, it warrants the construction of a concentrator, whose general features are under consideration.

The most interesting novelty introduced of late in some of the mills has been the National riffle, applied to the Wiltley tables. They have even displaced in some places both jigs and trommels. The large production of the International reverberatories, when they are lighted, will still further throw into the background the cupola, on which for so long the Arizona smelter exclusively relied. Another innovation has been in the substitution of the basic lining of the bessemer converter for the acid lining. It has reduced the cost of smelting and has had a notable influence on mining by diminishing the demand for certain classes of siliceous ores.

Miami Copper Company in 1914

By J. Parke Channing*

During the first seven months of the year there was treated [illegible]19,269 tons of ore, from which, after allowing for losses in smelting and refining, 22,126,898 lb. of refined copper was produced. In the early part of August, on account of the war in Europe, the production was materially decreased, the figures for the last five months, however, not yet being available.

The ore mined during the year was all obtained above the 120-ft. level, a large proportion coming from the northwest orebody, where mining was originally started on the room-and-pillar system. Actual work in this section was confined to breaking the pillars; this was completed early in the year and the ore produced was obtained almost entirely by drawing the broken ore. In the eastern portion of the mine, the ore was extracted by means of slicing and considerable improvement was made in the methods of doing this work by dividing the ore into areas 200 ft. square, with a well protected supply raise in the center, from which the block was opened up by drifting and the ore extracted by retreating from the outside boundaries back to the central raise. This method has resulted in a considerable reduction in the cost of this class of work.

Development work during the year amounted to 22,850 ft. and consisted entirely of opening up the Captain orebody, preparatory to actual stoping operations. It is planned to take this ore out in two lifts, the upper one consisting of the ore above the 270-ft. level, which will be used as a transfer level, from which the ore will be sent to the main tramming level. Development work consisted of opening out this level and sublevels above, and of putting up transfer raises from the 120-ft. tramming level to the transfer level. The work was advanced sufficiently to start the actual stoping in the month of May, and one room was completed up to the time the curtailment of output took place early in August, at which time the work was discontinued. In mining this orebody narrow rooms and pillars will be used.

During the first half of the year plans were made for further prospecting the orebody in depth, but on account of the reduction in output the work was not undertaken and ore reserves will therefore show no increase. The tonnage opened up at the end of the year amounted to approximately 20,000,000 tons of ore, averaging 2.45% copper; 17,000,000 tons of low-grade ore, averaging 1.21%, and 6,000,000 tons of mixed oxide and sulphide ore, averaging 2% copper. In opening up the Captain orebody for mining work, the original estimate of tonnage based on churn drilling have so far been exceeded, and it is also found that the grade will average better than the original estimate.

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*Vice president Miami Copper Co., New York.

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The Lake Superior Copper District, 1914

By C. L. C. Fichtel*

The year 1914 was a most trying one for the Lake Superior copper district. The companies and employees were just getting nicely squared away from the effects of the strike of the Western Federation of Miners, when the European war broke out, demoralizing the copper market and forcing a general curtailment of the working forces and a lowering of wages.

The strike was officially called off in April. Although the mines had been working at full force for some months previous to this, it had cost a lot of money, and during the early part of the year production was practically suspended, so that at the outbreak of the war, the companies were not in good financial condition to withstand this serious handicap. A general reduction of 10% was made in wages, and the Calumet & Hecla Mining Co. and subsidiaries went on three-quarter time Sept. 1, and the Copper Range mines on half time, working two weeks and shutting down completely for the remaining two weeks in each month. A number of the smaller companies suspended operations completely and as a result there were a number of unemployed men throughout the district. Production was reduced in about direct proportion with the exception of a possible slight increase in the efficiency of the working force and a little larger production per man employed.

The Keweenaw Copper Co. carried on development work at the Phenix property on the Ashbed lode; the shaft was put down several hundred feet and drifts extended from the various levels. The formation is flat and comparatively wide and the copper contents most encouraging. The Wolverine and Mohawk properties were operated full time during the latter part of the year when the other mines were working at reduced time. This was consistent because the output of these mines is taken for trade in the United States.

The Tamarack Mining Co. suspended operations at the mine completely with the exception of pumping. Plans were laid for working over of the tailing piles and a large structural-steel building is about completed, which will be used for a regrinding and concentrating plant. This plant when completed will contain 32 Hardinge mills.

The Calumet & Hecla Mining Co. put into commission its electrolytic plant at Hubbell and discontinued the Black Rock smelting works at Buffalo, and is treating all the electrolytic copper for its mines and subsidiaries at this plant.

The first portion of the No. 2 regrinding plant consisting of 16 Hardinge mills together with their complement of tables went into commission during the summer. The 20-in. hydraulic dredge that will be used in the reclamation of the tailing piles was completed and given a trial run and worked well. All construction work was stopped at the outbreak of the war and nothing further was done toward the completion of this plant. The company laid plans for a leaching plant and the excavations were started, but this also was stopped and the contract for the structural steel was canceled. A central employment bureau was established through which all the men for the Calumet & Hecla plants and all subsidiary companies will be handled.

The Osceola company started work on the foot-wall formation at the main mine and had a new shaft house nearly completed at the No. 3 shaft, which has been idle for a number of years, when the curtailment went into effect. Nothing was done at the Laurium property during the year and the La Salle company suspended operations, as did also the Hancock, with the exception of pumping.

The Superior Copper Co. lost the boiler and compressor house at its No. 1 shaft through fire, which necessitated the shutting down of the mine for about three weeks.

The Copper Range Consolidated Mining Co. carried on normal operations until about Sept. 1, when it went on half time. During the year, one of the largest masses of copper discovered in the district has been uncovered in the Trimountain mine; it was first encountered between the 24th and 25th levels and has been uncovered down to the 27th level and extends along the lateral for about 40 ft. with an average thickness of about 8 inches.

The Winona company suspended operations, but a party of former miners worked the property on tribute and succeeded in making a fairly good showing, shipping the rock to the No. 2 mill of the Lake Milling, Smelting & Refining Co.'s plant.

The White Pine Copper Co. in Ontonagon County, which is under the control of the Calumet & Hecla Mining Co., carried on operations throughout 1914 in a consistent manner. Two shafts were opened and the formation developed was rich. A 1000-ton mill is in course of erection and will go into commission in 1915.

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World's Consumption of Copper

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

Europe	1911	1912	1913
Germany	222,500	231,700	259,300
Great Britain	159,100	144,700	140,300
France	95,700	98,500	103,600
Austria-Hungary	38,500	48,200	39,200
Russia	32,800	40,000	40,200
Italy	29,400	31,200	31,200
Belgium	13,500	15,000	15,000
Netherlands	1,000	1,000	1,000
Other European countries	10,000	10,200	*a* 13,300
Total consumption in Europe	602,500	623,500	643,100
America			
United States	321,900	371,800	348,100
Others in America	3,000	3,000	3,000
Total consumption in America	324,900	374,800	351,100
Asia, Australia, Africa			
Production Japan and Australia	95,000	111,900	119,000
Imports from Europe	500	1,400	1,000
Imports from America		500	80
Total	95,500	113,800	120,100
Exports to Europe and America	68,800	73,400	69,800
Consumption in Asia, Australia and Africa	26,700	40,400	50,300
World's consumption	954,100	1,038,700	1,044,500
World's production	893,800	1,018,600	1,005,900

a Estimated.

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*Electrical engineer, Calumet & Hecla mines, Houghton, Mich.

Lead

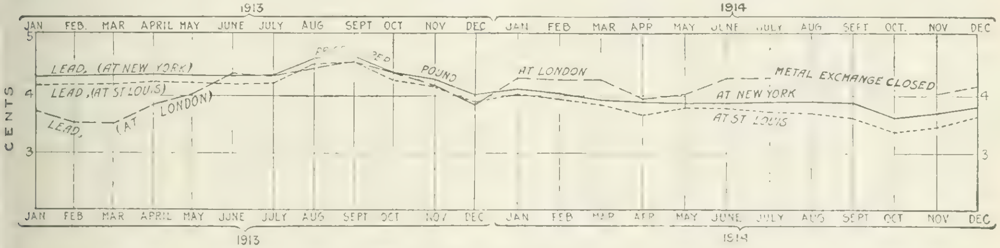
The outstanding feature in the American lead industry in 1914 was the unparalleled exportation, which was, in fact, the only thing that saved the lead producers from disaster. Production increased both in Idaho and Missouri, and was maintained at undiminished rate in spite of unsatisfactory domestic consumption. However, troubles in Mexico had deprived Europe of her supply of lead from that source and in the early part of 1914 Europe was a large buyer of American lead to make good the deficiency, about 20,000 tons being exported during that period. In the latter part of 1914 the war created a new demand for American lead, there being a very large exportation to Russia, which had lost its normal supply from Germany. In spite of those saving conditions the price for lead declined to $3\frac{1}{2}$c. per lb., New York, and would have gone lower had not the Idaho and Missouri producers finally curtailed. The natural explanation of their previous reluctance to curtail is that they were realizing large profits even at the low prices, and, indeed, there is reason to believe that the Idaho and Missouri lead costs only about $2\frac{1}{2}$ to $3\frac{1}{2}$c. to produce.

PRODUCTION OF LEAD (REFINERY STATISTICS) (a)

(In Tons of 2000 Lb.)

Domestic: Class	1911	1912	1913	1914
Desilverized	211,041	236,207	261,616	318,286
Antimonial	8,916	9,239	16,345	15,642
S. E. Missouri	155,008	145,366	133,203	177,320
S. W. Missouri	25,993	19,224	22,312	22,125
Totals	400,958	410,036	433,476	533,373
Foreign:				
Desilverized	89,487	82,715	54,774	24,624
Antimonial	4,929	5,003	2,300	543
Totals	94,416	87,718	57,074	25,167
Grand totals	495,374	497,754	490,550	558,540

(a) These figures include the lead derived from scrap and junk by primary smelters.



LEAD PRICES IN 1913 AND 1914

WORLD'S PRODUCTION OF PIG LEAD

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Spain (a)	175,[illegible]	186,700	203,000
Germany	164,400	176,600	181,100
France	23,500	31,100	28,000
Great Britain	[illegible]	29,200	30,500
Belgium	44,300	51,200	50,800
Italy	16,700	21,500	21,700
Austria-Hungary	19,600	[illegible]	21,100
Greece	14,300	1[illegible],500	18,400
Sweden and Norway	1,100	1,300	1,500
Russia	1,000	c 1,000	1,000
Asiatic Turkey	12,100	12,[illegible]00	13,900
Total Europe b	498,500	547,000	574,000
United States	377,900	387,300	407,800
Mexico	124,600	c 108,000	c 62,000
Canada	10,700	16,300	17,100
Total North America	513,200	511,600	486,900
Japan	4,200	3,600	c 3,600
Australia	99,600	107,400	116,000
Other countries	20,500	12,200	6,200
Total world's production	1,136,000	1,181,800	1,186,700

a Exports. b Including Asiatic Turkey. c Estimated.

The Mexican producers of lead were idle during the most of 1914, because of the internal troubles of that country, but late in the fall the plants of the A. S. & R. Co. and of the Peñoles company were put in operation.

WORLD'S CONSUMPTION OF LEAD

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
Germany	232,900	232,100	223,500
Great Britain	[illegible]	196,300	191,400
France	99,600	104,700	107,600
Russia	42,900	45,600	58,800
Belgium	43,000	44,900	42,900
Italy	[illegible]	33,000	a 32,600
Austria-Hungary	36,200	37,800	35,500
Holland a	6,800	6,300	9,500
Switzerland	5,000	6,400	5,800
Other European countries	3,500	4,400	6,300
Total Europe	704,500	711,500	713,900
United States	364,400	398,400	401,300
Canada	21,100	30,000	22,900
Japan	18,900	21,800	a 18,500
Australia	9,100	10,100	9,600
Other countries	31,200	30,000	a 30,000
Total world's consumption	1,149,200	1,201,800	1,196,200

a Estimated.

The small importation of lead in bond and reëxportation thereof in 1914, as compared with 1913 and previous years, was due especially to the cessation of mining and smelting in Mexico. The deficiency in European supply was made good by the exportation of domestic lead, the total exports of the year being about 60,000 tons. The large increase in the domestic production permitted this to be done.

The Lead Market in 1914

First Quarter—The market opened with lead 4.15c., New York, following an advance by the A. S. & R. Co., on Dec. 29, 1913. The advance proved, however, to be premature and on Jan. 9 the price was reduced to 4.10c. This stimulated buying and on Feb. 2 the price was advanced again to 4.15. Something wrong with the market was apparently discovered, inasmuch as immediately after this second advance the independent producers began to shade the price and take the business, recognizing which the A. S. & R. Co. made a reduction to 4c. on Feb. 11. At the lower level an increased business was done. Through this period the London market, where the absence of Mexican supplies had become keenly felt, was persistently strong, and early in March the disparity of prices permitted the sale of some tonnage of Missouri lead for export. This was the beginning of a very important export business. Domestic demand having failed to improve and some pressure to sell Missouri lead having developed, the A. S. & R. Co., on Mar. 25, reduced its price to 3.90c., New York, and on Mar. 30 reduced it again to 3.80c., New York. The lower figures interested buyers and some round tonnages were turned over.

Second Quarter—During April the market was without special features until nearly the end of the month, when consumers apparently made up their minds that the threatening conditions in Mexico tended to strengthen the positions here and that the price for lead was low anyway. The extent of their buying induced the A. S. & R. Co. to raise its price to 3.90c. on Apr. 27. May and June passed without any especially noteworthy features. A large export trade in domestic lead was done right along.

Third Quarter—Early in July a rather pronounced weakness began to develop in the lead market and it became more clearly recognized that something was radically wrong, viz., the maintenance of a huge production. Had it not been for the large exportation to Europe the danger signals would have been flying earlier. However, even in the face of this subtraction from our supply, the unsold stocks in the hands of producers were accumulating rapidly.

MONTHLY AVERAGE PRICE OF LEAD

	New York			St Louis			London		
Month	1912	1913	1914	1912	1913	1914	1912	1913	1914
Jan.	4.435	4.321	4.111	4.327	4.171	4.011	15.597	17.114	19.665
Feb.	4.026	4.325	4.048	3.946	4.175	3.937	15.738	16.550	19.606
Mar.	4.073	4.327	3.970	4.046	4.177	3.850	15.997	15.977	19.651
Apr.	4.200	4.381	3.810	4.118	4.242	3.688	16.331	17.597	18.225
May	4.194	4.342	3.900	4.072	4.226	3.808	16.509	18.923	18.503
June	4.392	4.325	3.900	4.321	4.190	3.810	17.588	20.226	19.411
July	4.720	4.353	3.891	4.603	4.223	3.738	18.544	20.038	19.051
Aug.	4.569	4.624	3.875	4.452	4.550	3.715	19.655	20.406	*
Sept.	5.048	4.698	3.828	4.924	4.579	3.658	22.292	20.648	*
Oct.	5.071	4.402	3.528	4.894	4.253	3.384	20.630	20.302	*
Nov.	4.615	4.293	3.683	4.463	4.146	3.585	18.193	19.334	18.500
Dec.	4.303	4.047	3.800	4.152	3.929	3.662	18.069	17.798	19.097
Year	4.471	4.370	3.862	4.360	4.238	3.737	17.929	18.743	

New York and St. Louis, cents per pound. London, pounds sterling per long ton. * London Exchange closed.

It is understood that overtures were made to the Idaho producers to curtail at an early date, but that they were unwilling. During July the tone of the market weakened steadily, owing to the desire of many holders to liquidate their stocks, and this was reflected in the St. Louis price, although the A. S. & R. Co. maintained the New York price unchanged. The war cloud in Europe had no particular effect upon the American lead market, the situation having previously been bad, and when the general war was declared there was no such upset in lead as there was in copper. On the contrary, there was a feeling that the situation might be improved, both by increased demand for export and adverse effect upon production by the decline in silver. In fact the tone of the market for several weeks was rather stronger, but by September all faith in an advance on account of the war had been lost and some urgent desire to liquidate was exhibited. The fact was that not only the leading interest had a large unsold stock, but nearly all of the independent producers were in a similar position. The subsequent declining tendency of the market was simply explained by the desire of some producers to have money rather than lead. On Sept. 24, the A. S. & R. Co. bowed to the inevitable and reduced its price to 3.75c., New York, thus coming more nearly into step with the open market at St. Louis, which had previously stood at a price whereof the New York parity was 3.80c.

Fourth Quarter—The independent producers immediately began to undercut again, whereupon the A. S. & R. Co., reduced to 3.60c. on Oct. 5 and to 3.50c. on Oct. 7, these successive reductions temporarily producing something like demoralization in the market. The bald fact was that a price level had to be found that would move the unsold stock, or curtail production, or both. About the middle of October, the principal producers of Missouri and Idaho read the signs and curtailed production by 25 to 50%. This drastic curtailment impressed the minds of consumers, who began to buy largely and continued so to do right through November.

The extent of that buying justified an advance of the price to 3.60c. on Nov. 12, and to 3.70c. on Nov. 17. On Nov. 19, it was raised to 3.90c., but this was carrying the thing a little too far and on Nov. 27 the price was reduced to 3.80c. In September and October, there was a considerable export business not only to England, but also to remote countries like Japan and Russia, the last being a large buyer.

The prices for lead at New York, named by the A. S. & R. Co. during 1914 were as follows:

	Lb		Lb
Opened	4.15c.	Oct. 5.	3.60c
Jan. 9	4.10	Oct. 7	3.50
Feb. 2	4.15	Nov. 12	3.60
Feb. 11	4.00	Nov. 17.	3.70
Mar. 25.	3.90	Nov. 19	3.90
Mar. 30	3.80	Nov. 27	3.80
April 27	3.90		
Sept. 24	3.75		

White Lead and Oxides in 1914

Weather conditions over a large section of the country were unfavorable for painting during the winter and early spring months of 1914, and the result was that sales of all paints up to Apr. 1 were considerably below normal. The later improvement, however, was sufficient to offset the early losses, and so far as lead pigments are concerned the year showed a fairly satisfactory aggregate movement. The general depression in business has had no marked effect upon white lead, but the demand for oxides from some of the large consuming industries has been curtailed by a falling off in the sales of their products.

Prices did not follow closely the fluctuations in pig lead, although the marked decline on the latter in September and October gave a weak tone to the whole line of lead products.

Business in dry white lead was on the basis established prior to the opening of the year of 5¼c. to the largest buyers, until October, when a reduction of ¼c. was made and this promises to be the base price for 1915, unless there should be some violent fluctuations in pig lead. Neither buyers nor sellers are disposed to enter into long-time contracts, but such contracts as are made for any period are on the 5c. basis.

The price of white lead in oil was fixed in November, 1913, at 6¾c. to the largest buyers on all of the standard brands. This was a decline of ½c. from the highest prices of that year and was made following a break in pig lead and partly in anticipation of a further decline in the latter. This occurred later, but it had no effect upon white lead until the abnormally low figures were reached in October, when there were evidences of a disposition on the part of corroders to reduce the margin between their products and the metal, if there was any assurance of the latter remaining on its present low level. Their doubts upon this point were confirmed, however, by an advance of $8 per ton in the price of pig lead between Nov. 12 and 20.

A slight reaction occurred later, but apparently manuacturers hesitated to change the price of white lead in oil until there was some more definite development in regard o the probable course of the metal market.

Prices on oxides have been sagging for the last six months, the earliest depression having come as much from he apparent probability of competition from abroad, which has been made possible by the new tariff, as from he low price of pig lead here. Ordinary powdered litharge old early in the year at 5¼c. in a large way, and later on c. was made the bottom figure, and at the close the range or large packages is 5 to 5¾c. as to quantity.

Red lead has sustained a more marked decline and is now quoted as low as 5½c. for the ordinary grades and up to 6¼c. for the high standards for structural or other pecial purposes. The European war has removed any mmediate danger of foreign competition, and while the present low prices are based chiefly on the cost of pig ead, they are also influenced by a diminished demand rom the large consuming industries and an excessive domestic production.

The practical closing of European sources of supply has resulted in an increased demand for white lead and he oxides for export, not only to neutral countries, but also to the belligerent nations which are unable to draw upon their usual sources. There is reason to hope that ome of this trade will outlive the war, but manufacturers here do not feel confident of their ability to compete with foreign labor and other costs, under normal conditions.

Linseed oil has not reached extremes which have affected the price of lead in oil either way. To large consumers the price during the first half of the year was rom 50 to 52c., with a considerable advance in July n the prospect of a short seed crop. This was more than offset by the subsequent depression, however, and the close s at about 46c.

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The Coeur d'Alenes during 1914

By Stanly A. Easton*

The Cœur d'Alene lead, silver, zinc and copper district of Shoshone County, Idaho, as a whole undoubtedly suffered less from disturbed conditions during the latter part of 1914 than any other base-metal mining field in the Northwest or in British Columbia. The mines at Mullan, wo of them copper producers, had to close early in the all, but all the other producers of the district continued, some, however, on a more or less restricted production. So that while profits were badly cut into by the soft metal markets, industrial conditions, while not good during the latter half of 1914, were better than in nearly all other neighboring districts.

New production and ore development have come from he important operations of the Consolidated Interstate-Callahan, Tamarack & Custer Consolidated in the Sunset and Nine Mile country, and the Caledonia Mining Co. in the Wardner field, the last beginning a splendid production in June because of the completion of arrangements for milling and transportation through the Kellogg tunnel, former production having come solely from shipments of high-grade crude ore and the products of close sorting and hand jigging.

The treatment of slimes from the concentrators of the district for the recovery of the lead, silver and zinc formerly wasted has continued to receive systematic study and carefully organized investigation by all the producing companies and the results secured by flotation and its adaptations to the conditions to be met here are a notable metallurgical achievement. The Bunker Hill & Sullivan company has supplemented these improved wet concentration methods by further electro-chemical work, both on a laboratory and on a working scale, designed to produce metallic lead, silver and zinc, or the salts of these metals. The results are not yet conclusive, but are a distinct new development and of much interest and promise.

Deep development in all the older mines continues favorable and the new production and development noted above from virgin ground assures the importance of the Cœur d'Alenes as a producing field for the immediate future and probably for very many years to come.

From present estimates the banner year 1913, which gave 148,370 short tons of lead from the district, 36% of the United States domestic yield, has been exceeded by the 1914 production, curtailed as it was by partial closure and restriction, which shows: Gold, 4500 oz.; silver, 13,349,000 oz.; lead, 336,107,000 lb.; copper, 2,776,000 lb. and zinc, 18,472,000 lb.

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*Manager, Bunker Hill & Sullivan M. & C. Co., Kellogg, Idaho.

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The Silver-Lead Smelting Works of North America*

The accompanying list gives the several silver-lead smelting works of the United States, Mexico and Canada, together with the number of their furnaces (in all cases, blast furnaces), and their estimated annual capacity in tons of charge. By "tons of charge" we mean ore and flux, but exclude coke. The ton of charge is manifestly the correct unit. In the case of a self-fluxing ore, the ton of ore smelted and the ton of charge smelted is the same thing. In other cases, fuel and labor have to be used in smelting the flux as well as in smelting the ore, and the economy of smelting depends largely upon the percentage of ore in the charge. The management of this question is about the highest exercise of the metallurgist's skill.

SILVER-LEAD SMELTING WORKS

Company	Place	Furnaces	Annual Capacity (*a*)
American Smelting & Refining Co	Denver	7	511,000
American Smelting & Refining Co	Pueblo	7	380,000
American Smelting & Refining Co	Durango	4	146,000
American Smelting & Refining Co	Leadville	10	509,000
American Smelting & Refining Co	Murray	8	657,000
American Smelting & Refining Co	East Helena	4	306,600
American Smelting & Refining Co	Omaha (*c*)	2	82,000
American Smelting & Refining Co	Chicago (*c*)	2	60,000
American Smelting & Refining Co	Perth Amboy(*c*)	3	140,000
American Smelting & Refining Co	El Paso	7	380,000
Selby Smelting & Lead Co	Selby	3	210,000
Ohio & Colorado Smelting Co	Salida, Colo	4	345,000
U. S. Smelting Co	Midvale, Utah	6	500,000
Needles Smelting Co	Needles, Cal (*d*)	2	70,000
Pennsylvania Smelting Co	Carnegie, Pa	2	60,000
International Smelting Co	Tooele, Utah	5	500,000
Totals, United States		76	4,856,600
American Smelting & Refining Co	Monterey	10	475,000
American Smelting & Refining Co	Aguascalientes	2	100,000
American Smelting & Refining Co	Chihuahua	5	274,000
American Smelters Securities Co	Velardena	3	140,000
Compania Metalurgica Mexicana	San Luis Potosi	11	385,000
Compania Metalurgica de Torreon	Torreon	8	360,000
Compania Minera de Peñoles	Mapimi (*d*)	6	325,000
Total, Mexico		45	2,059,000
Consolidated Mining & Smelting Co	Trail, B. C	3	110,000

a Tons of charge. *c* Smelt chiefly refinery between products. *d* Not operated in 1914.

The figures in the accompanying table are from official communications of the respective companies. Estimated capacity is, however, always a matter of more or less uncertainty, and for this reason, if for no other, the figures that we give ought to be accepted only as approximations. Our figures have been corrected from last year, but the totals remain about the same. There was in fact no new construction of consequence in 1914.

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*Corrected to Dec. 1, 1914.

The total capacity of the Mexican works is a little over 2,000,000 tons per annum; of the American works, a little over 4,800,000 tons. With respect to the American works, at least, such capacity has never been in use at one time. More or less of it represents capacity that has become idle because of changes in the conditions of ore supply.

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The Southeastern Missouri Lead District in 1914

By H. A. Wheeler[*]

The Southeastern or disseminated-lead district of Missouri produced about 163,000 tons of lead in 1914 with an approximate value of $13,000,000. This is a new high record and reëstablishes the consistent growth that this premier lead camp has shown for many years and which was only interrupted in 1913 as the result of a strike. The 1914 output exceeds that of 1913 by about 26,000 tons and that of 1912, the prior record output, by 16,000 tons, or about 10 per cent.

That the 1914 output should show an important increase is especially noteworthy, as the leading producers curtailed their output 20 to 25% during the last quarter of the year, on account of the severe depression, while no new mines were opened—in fact, fewer shafts than usual were operated. This growth is mainly due to improved operating efficiency, in which the flotation process has been an important factor. The district has just passed through the most trying year in its history as regards profits, as the lead market was abnormally depressed, especially in the latter half of the year, while labor was paid the highest rates that ever ruled in this district. These conditions had a highly stimulating effect in improving the working efficiency, one of the results of which is that lower-grade ores are being worked than ever before. The lack of walls or defined limits to the disseminated orebodies has always imposed a big responsibility on the mining captain as to when to cease mining, as the ore gradually dies out in the surrounding dolomite, and it is largely a matter of experience and conditions as to where to draw the line between pay ore and rock that is too low-grade. With the improved operating efficiency, many abandoned stopes are being successfully reworked, in spite of the low grade tenor of the ore, and the average lead yield of the ore now being mined probably approximates 3%, as compared with former averages of 3.4 to 4%. While all the mines have runs or shoots that assay from 5 to 15%, there is now such a large amount of ore being extracted that will yield about 2%, that the average of the district may be estimated at 3% lead, after deducting milling and smelter losses.

An important feature of 1914 was the successful introduction of the flotation process, which has now been adopted by all the large producers. While there is considerable variation in the recovery at the different mills, they are all effecting a marked saving from the slimes tha hitherto have been largely or entirely lost. The proces was introduced at the Federal mill, under the guidanc of H. A. Guess, the concentration specialist, and subsequently adopted and modified by the other companies Oil of creosote is employed as the selective medium, an the concentrates assay about 50% lead after drying.

The labor situation, aside from being at maximun wages, was otherwise satisfactory during 1914, as it wa plentiful and much more efficient. Many of the outlyin shafts were closed down and the ore tonnage maintaine by concentrating at the more central mines. This resulte in many of the men being laid off with resulting increas in the efficiency of those remaining at work, besides th ability to weed out the "lame ducks." As wages wer forced up about 10% by the strike of 1913, it is quit likely that they will be reduced at least that much thi winter.

The depressed condition of the lead market was fel in a total cessation of prospecting and only a few diamond drills were operated to maintain the development o the present orebodies. Even the important discovery o disseminated lead near Potosi, in Washington County made at the close of 1913, was not followed up by th local parties who did the drilling, although it is said tha they have materially increased their acreage.

The output of "shallow-lead" from the innumerabl "diggings" in Washington, Jefferson and Franklin counties, which adjoin St. Francois County on the west an north, was almost negligible, as "gophering" is only activ under the stimulus of good prices.

Over 95% of last year's output was produced by fiv companies in St. Francois County, which still retains it paramount importance as the main producer of the disseminated lead belt (as also of Missouri). There are several other small companies that are in the prospectin stage, but they did not attempt any development worl last year.

The year 1914 was one of the most eventful in th history of the St. Joseph Lead Co., and its close finds i in a stronger, healthier, more promising condition tha for a long time. The internal storms that started th previous year resulted in many salutary changes, not th least important of which was a complete reorganizatio in the technical department that resulted in greatly improved efficiency. The closely affiliated Doe Run Lea Co. was taken over and absorbed by the St. Joe compan on a stock basis, which now makes this company by fa the largest lead-producing unit in the country, whil marked economies resulted from the consolidation.

Most of the outlying shafts of the St. Joe were shu down and mining has been concentrated at old No. shaft at Bonne Terre, and at the Leadwood shaft. As th old mill is at the former and the new 2000-ton mill at th latter, this has dispensed with the ore trains, besides temporarily annulling the small outlying mining units. Similarly, the mining has been concentrated in the Doe Ru department to three shafts, all of which are close to th new mill.

The old mill at Bonne Terre has again been remodele and equipped with Hancock jigs, while the "chats" o tailings are now loaded mechanically. With its new flotation equipment, this veteran mill would no longer be recognized by its design; so completely has it been al ered. It was built in 1883 as a 500-ton unit on lines hat were unique and largely evolved from local deas and experience. At that time it was the argest concentrator in the country, outside of the Lake copper mills, and with its Parson jigs and Parson-Rittinger side-bump tables, it was a great success from the start. It has been enlarged and remodeled several times since then, and today it is a modern 1500-ton mill in its equipment, although greatly handicapped by a building that was designed for a radically different system of concentration.

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[*] Mining engineer, 510 Pine St., St. Louis, Mo.

The new Doe Run mill has been enlarged to 4000 tons daily capacity and now treats the output from all the Doe Run mines, as the two older mills have been abandoned. At the smelting works at Herculaneum, the extensive series of dust-chambers and baghouse were completed and are in successful operation, after being delayed by a fire. Part of the output will be desilverized this year and put on the market as a "corroding" lead for which it is admirably adapted, as it is free from bismuth. An excellent description of this plant, illustrated by photographs, was recently published in the JOURNAL of Nov. 21, 1914.

The Federal Lead Co. continues to be a large producer, being only exceeded by the new combined output of the former St. Joseph and Doe Run companies. Since the introduction of the flotation process for treating the slimes, the canvas tables that were formerly employed have been abandoned. The central power plant has been increased by three new boilers that are equipped with chain grates and a 800-kw. Allis-Chalmers horizontal turbine. This enables the pumping at Nos. 4 and 7 mines to be done with electric pumps, and three triplex Aldrich pumps have been installed at No. 7 shaft that have an individual capacity of 1250 gal. per min. An interesting test was made last year with a mechanical mine shoveler that was operated by electricity, to try to reduce the high cost of hand shoveling. With its high maintenance cost, large percentage of time lost by delays and the relatively small size of the stopes and consequently limited tonnage, it did not prove a financial success. It was an important pioneer test and after the machine has been remodeled, it has much promise where the conditions are favorable.

The Desloge Lead Co. operated its mining and milling departments to full capacity until the latter part of 1914, when the output was reduced about 20% to meet the depression. The flotation process was successfully introduced, and an important recovery was effected from the slimes that had hitherto been lost. The new mine, No. 6, at Leadwood, was drowned out for about a month by the record-breaking cloudburst that did so much damage throughout the district last October.

The National Lead Co. had an active year, as in addition to its own output, it is milling and smelting the "Jake Day" ore from the St. Francois Lead Co. The flotation process was added to the slime department, with an important recovery of clear milling water beside the "floated lead." The lease on the extensive Mine la Motte estate was surrendered and its operation was taken over by another company.

The St. Francois Lead Co., which purchased the frequently condemned Jake Day land, had a successful year, as the ore averaged unusually high, while the increased development augmented the tonnage. Daily mill samples assayed from 7 to 12% and averaged over 9%. This company has not yet been provided with a mill, and its ore is being milled and smelted by the National Lead Co., after being hauled about 12 miles over the Missouri River & Bonne Terre Railroad.

MADISON COUNTY

Madison County, which adjoins St. Francois on the south, had only one active producer last year, the famous old Mine-la-Motte property, which turned out more lead than usual under a lease held by a new operating company.

The North American mine, at Fredericktown, is still closed down. When last operated, all the metals—lead, copper, nickel and cobalt—were recovered as sulphides. They are said to have aggregated 6% in metal contents and were worked into marketable products on the premises. The lead and copper predominated and as much as five tons per diem of ingot copper was produced. The Catherine mine, as also the adjoining Fleming property, have not been operated since the Federal Lead Co. surrendered its lease on same last year.

Molybdenum

At the beginning of 1914 molybdenum sold at about $1.45 per lb. After the war as high as $6 per lb. was realized for spot material. When the sudden war inquiries came in high prices were temporarily paid for spot ore. After that things quieted down, and the course of prices is now very difficult to foretell. Everything depends upon sudden inquiries for immediate shipment, and prices are made only from week to week.

In December there was a good market for wulfenite ore, providing it were free from injurious elements. This ore should contain at least 25% molybdenum oxide and should be free from copper, vanadium, tungsten, and chromium. Ore of such specifications brought about 60c. per lb. of molybdenum oxide.

Generally speaking, there appears to be an increasing demand for molybdenum, ferromolybdenum and molybdenum ore. It is said that, for certain purposes, molybdenum steel has been found to be decidedly superior to tungsten steel.

The Primos Chemical Co., which is a leading factor in this business and is the largest producer of tungsten ore in Colorado, is now engaged in developing a molybdenum mine near Georgetown, Colo. An old occurrence of mineralization was known at that place by a widespread yellowish stain of the rocks. This was lately found by representatives of the Primos Chemical Co. to be due to molybdenum, and that company acquired the property and is now going to build a concentrating mill of 50 tons daily capacity.

Selenium in 1914

The selenium market has been practically dead during 1914, owing to too fierce competition and overproduction in 1912 and 1913. It is believed that production has been carried on by only two companies and those at a reduced rate. Exports, so far as can be learned, have been about 11,000 lb.; the production of the United States we estimate at about 30,000 lb. Prices opened at $3@3.25 for large lots, and close nominally at $2@3. There seems to be no demand whatever for the metal at present and all deliveries being made are on old contracts.

Zinc

All of the American zinc-smelting companies reported their production to us, with the exception of one small company; estimating its output, the production in 1914 was about 360,000 tons, an increase of 2000 over the previous year.

Fifteen smelting companies reported by telegraph stocks on Dec. 31 aggregating 19,500 tons. Six companies reported works idle. Three operating companies, one very small, failed to report their stocks. Estimating 4000 tons for them, the total stock in the hands of smelters on Dec. 31 was 23,500 tons.

The zinc-smelting works in operation had 120,494 retorts at the end of 1914, compared with 110,218 at the end of 1913. Furnaces comprising the following number of retorts were under construction at the end of 1914: Matthiessen & Hegeler Zinc Co., 912; American Zinc & Chemical Co., Langeloth, Penn., 2592; Granby Mining & Smelting Co., E. St. Louis, Ill., 3240.

At the end of 1914 the active works were in many cases operated at only partial capacity. Thus, 20 plants reporting upon this subject showed an aggregate of 71,500 retorts in use on Dec. 15, out of a total of 85,592.

The zinc industry of the world was put at sixes and sevens by the outbreak of the war. Some of the consequences of this were the putting of most of the Belgian smelters out of business, the depriving of the German smelters of their foreign ore supply, the inability of the Broken Hill producers to market anything but a trifling proportion of their output, most of the Broken Hill mines being thereby compelled to suspend operations. The important zinc mines of Sardinia were similarly affected, but to a less extent, inasmuch as they were able to deliver ore to the French and British smelters as usual.

PRODUCTION OF ZINC

(In Tons of 2000 Lb.)

By Ore Smelters (a)

States	1911	1912	1913	1914
Colorado..	7,477	8,860	8,637	7,792
Illinois.	88,681	94,902	111,551	130,788
Missouri and Kansas..	106,173	111,761	85,157	53,087
Oklahoma..	46,333	76,837	83,230	91,593
East..	47,172	56,278	69,687	77,429
Totals.	295,836	348,638	358,262	360,689

(a) Includes some works that smelt dross and scrap as well as ore, but does not include works that smelt dross and scrap only. Discrepancies among statistical reports of the spelter production of the United States arise largely on account of the difference in the dividing line that is drawn in this respect.

At the beginning of 1914 the smelters of the United States had about 40,000 tons of unsold stock, while the International Convention in Europe had about 52,000 tons of 2000 lb. At the mid-year the stock in the United States had increased to 64,000 tons, and in Europe to 100,000 tons, most of the European stock being held in Germany. The inability of Great Britain to obtain its usual supply of spelter from Germany, together with the relative smallness of the stock held in England, compelled English consumers to turn to the United States for their supply, which developed an unparalleled export business in this country and averted the disaster that was threatening the American zinc industry previous to the war.

The course of prices is related in a subsequent article and need not be repeated here. A study of the market conditions, together with the production statistics, compels us to revise our previously held opinions that an average price of less than 5c. per lb. would be restrictive of ore supply in this country. Without any doubt 1914 was a bad year for the zinc smelters. The survivors of the old-time coal smelters were generally compelled to suspend smelting. The old plant at Nevada, Mo., was scrapped. Certain of the plants in the Kansas gas field were shut down. The new East St. Louis plant of the Granby company was completed but was not put in operation. The only new plants to go in operation in 1914 were the Sand Springs works of the Tulsa Spelter Co. and the Langeloth works of the American Zinc & Chemical Co., the latter going into operation too late in the year to cut any figure in the production. With the exceptions noted most of the smelters operated pretty nearly at full tilt.

It is manifest that a price of less than 5c. is not restrictive of ore supply, inasmuch as we witnessed in 1914 an increased production in spite of the absence of the former large Mexican supply. The fact is that Butte, Mont., has created an enormous addition to the domestic zinc-ore supply, and the flotation process that has been so successful there is finding important employment in other districts. The production of floated blende concentrates in 1914 was nearly 100,000 tons. In this connection let it be noted that the mills employing the flotation process produce a large proportion of jig and table concentrates, as well as the floated froth.

WORLD'S CONSUMPTION OF SPELTER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States....	251,600	312,900	313,300
Germany	219,300	225,800	232,000
Great Britain	175,700	185,200	194,600
France	82,000	82,000	81,100
Belgium	73,700	77,200	76,400
Austria-Hungary	43,500	46,800	40,400
Russia	28,900	27,900	33,300
Italy	10,100	10,700	10,900
Spain	4,800	4,700	5,900
Holland (estimated).......	4,000	4,000	4,000
Other countries (estimated)...	17,800	19,700	20,900
Total	911,400	996,900	1,012,700

WORLD'S PRODUCTION OF SPELTER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

Germany	1911	1912	1913
Rheinland Westphalia ..	81,458	86,619	92,852
Silesia	156,174	169,088	170.119
Other districts	12,761	15,357	20,142
Belgium	195,092	200,198	197,703
Holland.	22,733	23,932	24,323
Great Britain...	66,956	57,231	59,146
France and Spain ..	64,221	72,161	71,023
Austria and Italy	16,876	19,604	21,707
Russia..........	9,936	8,763	7,610
Norway	6,680	8,128	9,287
Sweden			
Europe	632,887	661,081	673,912
United States	267,472	314,512	320,283
Australia	1,727	2,296	3,724
Total	902,100	977 900	997,900

Of the American zinc smelters, Chanute, Pittsburgh, Dearing and Nevada were idle throughout 1914. Collinsville (Illinois), Caney and Altoona were operated during only a part of the year. The Tulsa Spelter Co. began operations in September. Pueblo, Palmerton, Bartlesville, Clarksburg and Meadowbrook made zinc dust.

The war cut off the exportation of New Jersey willemite, and from all parts of the world there was a keen demand for American high-grade, intermediate and brass special spelters, high-grade realizing 10c. per lb. and upward. There was also a sharp demand for American sheet zinc, of which our rolling capacity is relatively small.

probably not more than 35,000 tons per annum. Previous to Aug. 1 even that small capacity was only partially in use, but the European demand swiftly changed that condition and before the end of August the two manufacturers withdrew their regular price lists and subsequently quoted only in a private way. In the early part of 1914 there were some importations of sheet zinc from Germany, which alarmed Lasalle and Peru very much, but the war demand removed that fear. On the other hand, America's chief supply of zinc dust was cut off and the price of that article rose from about 6c. per lb. to 15 or 16c., but several additional American smelters engaged in the manufacture of it and the price declined to about 9 to 10c. per pound.

The International Zinc Convention presumably exploded with the declaration of war. This was a more or less loose organization, the essential feature of which was the agreement among three groups of smelters to curtail production in certain circumstances. The Belgo-German group itself was a hard and fast pooling of issues, the selling of the product being done under definite auspices. This union continued to exist after the outbreak of the war, but late in the year there were reports of internal friction.

ZINC SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation	1913	1914
Altoona Zinc Smelting Co	Altoona, Kan.	3,300	(b)3,840
American Zinc & Chem. Co	Langeloth, Penn		864
American Zinc Co. of Ill.	Hillsboro, Ill.	3,200	4,000
American Zinc, Lead & Smg. Co	Dearing, Kan	3,840	(a)3,840
American Zinc, Lead & Smg. Co.	Caney, Kan.	3,648	(b)3,648
Bartlesville Zinc Co	Bartlesville, Okla	5,184	5,184
Bartlesville Zinc Co.	Collinsville, Okla.	8,064	8,064
Chanute Zinc Co	Chanute, Kan	(b)1,280	(a)1,280
Clarksburg Zinc Co	Clarksburg, W. Va	2,712	(d)2,712
Collinsville Zinc Co	Collinsville, Ill	(b)1,536	(a)1,536
Edgar Zinc Co.	St. Louis, Mo.	2,000	1,100
Edgar Zinc Co.	Cherryvale, Kan.	4,800	4,800
Granby Mining & Smg. Co.	Neodesha, Kan.	3,760	3,840
Granby Mining & Smg. Co.	E. St. Louis, Ill.		3,240
Grasselli Chemical Co.	Clarksburg, W. Va.	12,672	5,760
Grasselli Chemical Co	Meadowbrook, W. Va		6,912
Hegeler Zinc Co.	Danville, Ill.	1,800	(d)1,800
Illinois Zinc Co.	Peru, Ill	4,640	(d)4,640
La Harpe Spelter Co.	La Harpe, Kan.	1,856	(d)1,856
Robert Lanyon Zinc & Acid Co	Hillsboro, Ill	1,600	1,840
Lanyon-Starr Sm. Co.	Bartlesville, Okla.	3,456	3,456
Matthiessen & Hegeler Zinc Co	La Salle, Ill	5,256	5,256
Mineral Point Zinc Co.	Depue, Ill.	6,800	9,080
National Zinc Co.	Bartlesville, Okla.	4,480	4,260
National Zinc Co.	Springfield, Ill.	3,200	3,200
Nevada Zinc Co	Nevada, Mo	(a) 648	(c)
New Jersey Zinc Co	Palmerton, Penn	5,760	5,760
Pittsburg Zinc Co.	Pittsburg, Kan.	(b) 910	(a) 910
Prime Western Spelter Co.	Gas City, Kan.	4,768	4,768
Sandoval Zinc Co	Sandoval, Ill	896	896
Tulsa Fuel & Manufacturing Co.	Collinsville, Okla.	6,232	6,232
Tulsa Spelter Co.	Sand Springs, Okla.	......	4,000
United States Zinc Co.	Pueblo, Colo.	1,920	1,920
	Totals	110,218	120,494

(a) Inactive throughout year. (b) Inactive during latter part of year (c) Plant being dismantled. (d) No report received; entered the same as last year

According to the latest advices, the zinc smelters along the Meuse in Belgium are idle, but the plants in the Campine district are operating on a reduced scale. In Germany the Rhenish, Westphalian and Silesian works are understood to be operating on a reduced scale.

The zinc industry of the world is undergoing revolutionary changes whereof the full effects cannot yet be clearly perceived. The Zinc Corporation contracted its ore to German interests up to 1919. This company united with other Broken Hill producers and with the American Smelting & Refining Co. to build new smelting works either in Wales or in the United States, it being assumed that the war had terminated the German contracts. The German interests in the latter protested, however, and, pending the termination of the question as to whether these contracts were automatically terminated by the war or merely suspended, the plans have been delayed, but it is certain that sooner or later the Zinc Corporation will begin smelting on its own account.

In the meanwhile the same interests directing the Zinc Corporation are developing enormous ore deposits—the Bawdwin mine in Burma and the Ridder mine in Siberia—for each of which smelting works will be erected. In fact, the plant for the Ridder mine is already in course of construction.

The Russo-Asiatic Corporation has developed about 2,000,000 tons of ore in the Ridder mine in the Altai Mountains, Siberia, about 1,000,000 tons being solid sulphide ore, assaying about 27% zinc, 18% lead and 1 oz. gold per ton; and 1,000,000 disseminated ore assaying 8 to 9% zinc and 4 to 5% lead. This mine, together with a coal mine at Ekibastus, were lately transferred to the Irtysh Corporation as an operating concern. That company is going to build a zinc-smelting works at Ekibastus, about 50 miles west of Semipalatinsk, on the Irtysh River. The ore will be taken by railway from the mine to the river, then floated about 7000 versts down the river and then taken by rail to the coal field. The spelter and lead will go by rail to the river and then down the river to the Omsk, on the Trans-Siberian railway. A zinc smeltery of 140 tons capacity and a lead smeltery of 40 to 50 tons are planned. Grading has already been begun. The European war is not interfering with mining and industrial operations in Siberia, but inability to obtain machinery from Germany is troublesome in new construction.

It is evident, therefore, that Russia is soon going to become a large producer of spelter, and will make an output far in excess of that of the two works in Poland, which are in a district occupied by the Germans since the early days of the war.

At the same time the zinc-smelting industry in Japan is undergoing an important development. The Amagasaki works have been brought to a capacity for producing about 3000 tons of spelter per annum, and further expansion is contemplated. Japan will doubtless supply all of her own spelter in the not very distant future.

All these things are going to add greatly to the zinc supplies of the world. During the time of the war we shall see disturbances of the usual channels of commerce, acting favorably upon the interests of one country and *vice versa* in another country, but nothing is happening to check the original supply, and as soon as the war terminates the means for smelting may become immediately available again.

The Spelter Market in 1914

At the beginning of 1914 spelter stood at 5.10c., St. Louis, and the market was under the cloud of the 10,000 tons of unsold stock reported at the end of 1913, a larger quantity than ever before recorded in the history of this industry in the United States. In Europe also there was a large unsold stock, the International Convention being estimated to have about 52,000 tons of 2000 pounds.

AVERAGE PRICE OF ZINC SHEETS

(In Cents per Lb.)

	1913	1914		1913	1914		1913	1914
January	9.00	7.44	May	7.63	7.00	September	8.00	8.50
February	8.63	7.25	June	7.25	7.00	October	7.63	8.07
March	8.20	7.10	July	7.13	7.00	November	7.50	8.00
April	7.88	7.00	August	7.90	7.38	December	7.25	8.5[illegible]

Average for the year 1913, 7.833; year 1914, 7.524 cents.

Note—These are base prices for ordinary size sheets, in carload lots, f.o.b. Lasalle-Peru, Ill., less 8% discount.

For three months the spelter market was dull and uninteresting, the price fluctuating between 5c. and 5¼c., but generally standing at 5.10 to 5⅛c. In April more emphatic pressure to sell was exhibited, and the price fell to 4⅞c. The producers were lugging uncomfortable loads, stocks being on the increase rather than on the decrease, yet everybody was reluctant to cut prices, it being figured that all of the unsold spelter had actually cost more than 5c. per lb. The situation was bad in Europe also, where ever since the beginning of the year the unsold stock in the hands of the convention had been increasing, and at the end of April was estimated to amount to about 90,000 short tons, a larger quantity than was reported at any time in 1913. Effective May 1, the convention ordered a curtailment of output at the rate of about 18%.

MONTHLY AVERAGE PRICE OF SPELTER

Month	New York 1912	1913	1914	St. Louis 1912	1913	1914	London 1912	1913	1914
Jan.....	6.442	6.931	5.262	6.292	6.854	5.112	26.642	26.114	21.533
Feb.....	6.499	6.239	5.377	6.349	6.089	5.228	26.661	25.338	21.413
Mar....	6.626	6.078	5.250	6.476	5.926	5.100	26.048	24.605	21.460
Apr.....	6.633	5.641	5.113	6.483	5.491	4.963	25.644	25.313	21.569
May....	6.679	5.406	5.074	6.529	5.256	4.924	25.790	24.583	21.393
June....	6.877	5.124	5.000	6.727	4.974	4.850	25.763	22.143	21.345
July....	7.116	5.278	4.920	6.966	5.128	4.770	26.174	20.592	21.568
Aug.....	7.028	5.658	5.568	6.878	5.508	5.418	26.443	20.706	†
Sept....	7.454	5.694	5.380	7.313	5.544	5.230	27.048	21.148	†
Oct.....	7.426	5.340	4.909	7.276	5.188	4.750	27.543	20.614	†
Nov....	7.371	5.229	5.112	7.221	5.083	4.962	26.804	20.581	25.016
Dec.....	7.162	5.154	5.592	7.081	5.004	5.430	26.494	21.214	27.369
Year.	6.913	5.648	5.213	6.799	5.504	5.061	26.421	22.746	

New York and St. Louis, cents per pound. London, pounds sterling per long ton

† Not reported

Conditions in the United States remained without material change until July, when the market became distinctly weaker. It was realized by everybody that the unsold stock had increased over the figures of Jan. 1, but few persons supposed that it amounted to any more than 50,000 tons. When, therefore, the official statistics showed the existence of 64,000 tons at the mid-year, the trade experienced a disagreeable surprise. This resulted in pronounced selling pressure, and the market declined to 4¾c. At this time, the spelter-producing industry was steeped in profound pessimism. There was a sincere expectation that the price for spelter would go down to 4c. per lb. In fact, some large blocks were tentatively offered to the principal consumer at a very low price, but when it appeared that those offers might be accepted, the producers promptly withdrew them and took courage again. This was only a few days before the outbreak of the war. Domestic consumers, learning that they were not going to find spelter on the bargain counter right away, made some purchases, and there was a rally in the price to about 4⅞c.

Immediately following the outbreak of the war, a large business was done at steadily advancing prices, the governing condition being the anticipation that England would shortly have to buy large quantities of American spelter, owing to the loss of her usual supply from Belgium and Germany. The stock of spelter held by the International Convention was estimated to amount to 100,000 short tons at the mid-year, but this was chiefly held on the Continent and especially in Germany, wherefore Great Britain was rendered nearly destitute.

About the middle of August the expected sales o American spelter for export began, and then followed one of the most foolishly crazy movements in spelter that we have ever seen. On Aug. 25 one producer sol spelter for export at 6.10c., St. Louis, but at the sam time it was willing to let domestic consumers have al they wanted at 5⅞c. American consumers, however, wer at no time active buyers on this wild upward movement We made sales in August to England, Russia, Japan South Africa, and other countries ordinarily unusual i our trade. High-grade, intermediate, and brass specia spelters were especially in demand and realized fanc prices. The sheet-zinc rollers, whose business had bee dull for many months, immediately experienced a deman taxing their capacity to the utmost, and on Aug. 20 the withdrew their open quotations and thereafter made sale only on private terms.

The foreign demand culminated about the end o August, and then petered out with amazing rapidity. I appeared that England had temporarily overbought herself and that speculation had played a very unhealthfu part in the recent movement. A little later it turned ou that England was able to obtain some supplies of spelte from Rotterdam, which became available at about 5½c., a figure below our parity, and cutting us off from immediat possibility of selling any more spelter for export.

The decline in the price for spelter was about as rapi as the August rise had been. In the early part of Octobe our market was at 4¾c. and spelter was not easily sal able even at that price. Pessimism again reigned every where. Then came the news that the Butte & Superior the largest producer of ore, was going to shut down fo several months to make repairs, and immediately ther was a small recovery in the market. During Novembe the price hung around 4⅞ to 5c. A renewal of the de mand from abroad had been experienced, but this tim the business was done in a sensible and orderly way American consumers were right along conspicuous by their absence, but in December a further expansion of th demand for export carried the price up to about 5½c It was the common opinion in December that the statistic at the end of the year would show a noteworthy decreas in the unsold accumulation, as compared not only with the mid-year, but also as compared with the beginning o the year.

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The Joplin District in 1914

By Jesse A. Zook[*]

As indicated in the review of 1913 sheet-ground mines were gradually abandoned, weeding out all but the best. The extreme low level of prices during May, June, July and early August extended over a period of too great length for the thinner ones to withstand.

Three areas increased production, Alba-Neck in Missouri, Lawton in Kansas, and Miami-Commerce in Oklahoma. The two former are known as "free-ore" deposits The latter is largely a free horizontal vein, with dips, chimneys and pockets equaling free-ore deposits.

Variations in Prices

The range in high prices of blende was: January opened $15, closed $14; February opened $15, closed $16; March opened $13.50, closed $13; April and May saw nothing er $13; but June closed $41; July opened $42, closed 41.50; August opened $42.50, closed $53; September ened $50, closed $44; October opened $45, closed $49; ovember declined to $47, rising to close $48.50; weekly

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[*] Joplin, Mo.

JOPLIN DISTRICT ORE SHIPMENTS, IN POUNDS

	Blende	Calamine	Lead	Value
Missouri				
sper County	375,804,640	1,807,100	60,383,410	$9,112,450
wton County	25,263,270	33,439,290	4,860,770	955,110
wrence County	391,500	4,062,770	250,740	61,050
her counties	679,000	116,000		15,570
Total	402,138,410	39,425,170	65,494,920	$10,153,790
Oklahoma				
awa County	63,430,820		16,898,880	1,566,950
Kansas				
erokee County	43,506,660		4,860,200	1,001,470
tal 1914 (*)	509,075,490	39,425,170	87,254,000	12,722,210
tal 1913	554,162,910	43,383,770	95,779,640	15,272,330
Decrease	45,155,420	3,958,600	8,525,640	2,550,120

(*) December estimated for each county

creases during December brought the year to a close ith blende very strong around $50 to $52—$5 to $7 per n higher than the year's opening.

January, February and March brought a comparatively en high price level of $51.50 to $54; April opened $53, osed $47; May, June, July, August and September ice level was between $47 and $48.50; October opened 48, closed $42; November opened $43.50, closed $49; A wer pig-lead market came with December, but galena as not changed in price.

ORE PRICES IN JOPLIN DISTRICT

(14 Years)

Year	Zinc Ore High	Zinc Ore Aver	Lead Ore High	Lead Ore Aver
01	$34.00	$24.21	$47.50	$45.90
02	42.00	30.33	50.00	46.10
03	42.00	33.72	60.50	54.12
04	53.00	35.92	62.00	54.80
05	60.00	44.88	80.00	62.12
06	54.00	43.30	87.00	77.78
07	53.50	43.68	88.50	68.90
08	47.00	31.36	66.00	54.66
09	55.00	41.08	60.50	54.50
10	52.00	40.12	58.00	51.98
11	51.00	39.90	64.00	56.76
12	67.00	52.15	68.00	56.60
13	53.10	42.62	57.78	52.82
14	59.50	39.43	50.88	[illegible]

All the developed mines in the Carthage area were andoned in October, and low prices retarded prospect- for new ore reserves. Sarcoxie had an intermittent reer, declining until July when a revival came with evelopments that forecast a widening of the developed ea and an increased production. Carl Junction dwined from 750 tons per month in January to 100 tons at e year-end. Oronogo shipments weakened in Septemr but came out stronger at the close than the beginning the year. Wentworth skipped shipments in June, July d August, coming back in September. Aurora operaons are on upper levels and the production principally lamine, with some blende and galena. Quapaw, once omising, is a small factor now from lack of systematic velopment.

The closing of some large mills, with the men out of ployment, resulted in the unemployed seeking shallow andoned workings, a factor preventing a greater decease in the production. Blende-galena revivals in shalw workings extend from Lone Elm hollow across Posm hollow, Chitwood hollow, Leadville hollow, East and West hollows to Zincite, all to the northwest of Joplin. outheast of Joplin came a growth in calamine producon from shallow workings in the north edge of Newton ounty. Across Shoal Creek, farther south, old workings ere revived and new mines developed with a mixed output of calamine and galena.

MIAMI-COMMERCE

With the establishment of a townsite and the rapid building of the town of Commerce, five miles north of Miami, the old mining camp of Hattenville was absorbed in the upspringing of the incorporated town. New developments of this area are mainly to the north of Commerce. A drilling campaign progressed throughout the year, closing with 30 outfits in operation. One mill is in operation and another building three miles northeast of Commerce, on shaft development that predicates an even greater orebody than the older mines.

The Picher Lead Co., of Joplin, holds leases on 2700 acres of land north of Commerce to the Kansas State line, on which nine drilling outfits are continuously at work. While exact records are not at hand current report is that a wide range of the zinc-lead deposit was encountered, carrying 16% blende and 7% galena.

Zinc Mining in Wisconsin in 1914

By J. E. Kennedy*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1914 was 152,186,990 lb., an increase of 15,831,680 lb. over the figures given for the corresponding period of last year. The gross tonnage of zinc ore produced and shipped by mining companies to smelteries and to custom roasters was 239,073,920 lb., an increase of 46,719,690 lb. The tonnage of lead ore shipped was 4,838,890 lb., a decrease of 284,190 lb. while the shipments of sulphur ore, 30,664,650 lb., decreased 22,370,260 lb.

The price of zinc ore was uniformly low throughout the greater part of the year. The average base price paid for 60% zinc ore in the first 11 months was $41 per ton; the high base was $47 and the low base was $37 per ton. The market was on the up turn in December.

A total of 46 mills and 5 roasters were in operation at various times during the year. Eight new and reassembled mills were added, viz., the Champion and Penna-Benton at Benton, the Kistler and West Hill at Platteville, the Coker No. 2 and Biddick at Mifflin, the Lawrence Hazel Green and the North Unity at Galena. The Kittoe at Benton, and the Thompson at New Diggings were in course of construction at the year-end by the Vinegar Hill and Field Mining companies. The Champion mill can handle 100 tons of dirt in 10 hr.; the Thompson will concentrate 250 tons in 10 hr. The larger operating companies continued prospect and development work throughout the year and opened up several good properties particularly in the Benton-New Diggings camp. Surveys have been made for an electric railway to run from Lancaster southeast through the mining district to Warren, Ill., and continuing via Stockton to Chicago, Ill.

The Wisconsin state legislature of 1913 passed a law assessing mineral lands for taxation upon the computed value of "ore in the ground." W. L. Uglow, representing the state tax commission, made an investigation and report upon the value of mineral lands of this district lying within the state.[1] In the case of operating mines he based his estimate of value upon production, profits and drill-hole records as revealed by operators. In the case of undeveloped properties he relied upon drill-hole records obtained second-hand from operators and land owners. The tax commission submitted Mr. Uglow's table of valuations in Benton Township to the local board of review in May, 1914. After discussion of the subject, an adjournment was taken to allow the tax commission to reduce its estimates, at the same time eliminating the figures placed upon undeveloped properties based upon their mineral value. In the final analysis, assessments were made by the supervisors based upon general knowledge of production and profits. No disparagement is made of the work of Mr. Uglow. The tax commission has practically conceded that the system proposed cannot be scientifically or practically applied to conditions obtaining in this district and there is little doubt but that the law will be repealed or materially revised at the coming session of the state legislature. There is now in effect in Wisconsin a state income-tax law which taxes both the operator and the land owner on profits derived. If the law is inadequate it should be amended and a rate established that would tax the mining industry as a whole proportionately to the other industries of the state. To increase the land tax of a mining property by placing thereon an assumed and arbitrary assessment based upon a future and fictitious value is unjust, unsound and discriminatory. If such a system is applied to zinc mines why not include rock quarries, gravel pits, clay deposits, peat, etc., all of which are in the mineral class.

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*Platteville, Wis.

SHIPMENTS OF WISCONSIN ZINC ORES IN 1914

(First 11 Months)

	Net to Smelteries		Gross from Mines	
	1913	1914	1913	1914
Highland	2,613,020	5,097,650	2,613,020	5,097,650
Linden	4,701,520	7,570,190	17,207,210	11,612,280
Harker	2,565,230	6,855,120	5,807,170	11,316,200
Mineral Point	31,268,750	36,996,820	2,223,650	1,095,480
Dodgeville	227,100	1,254,290	407,100	1,516,270
Montfort	1,272,000	1,906,000	2,301,980	1,906,000
Livingston			22,730,460	29,427,020
Rewey	1,374,740		1,145,740	
Platteville	23,075,270	12,781,940	23,319,110	5,287,560
Cuba City	12,762,280	19,640,100	6,331,830	5,370,430
Benton	24,538,590	31,740,910	41,451,090	69,563,720
Hazel Green.......	14,202,000	14,222,200	29,186,440	31,625,100
Shullsburg	14,086,410	2,096,070	17,025,810	19,209,800
Potosi........	244,000	......	244,000	
Galena	3,424,400	12,025,700	20,059,620	46,046,410
Totals..............	136,355,310	152,186,990	192,354,230	239,073,920

(Shipment from the Crahall mine at Scales Mound is credited to Benton.)

The Wisconsin liability and compensation law which was looked upon with ill favor when first enacted is working out satisfactorily to both operators and miners. Two amendments, however, are desired by operators; (1) Foreign dependents should receive no more as compensation for the death of a relative killed here than a foreigner would receive under like conditions in the particular country involved, at least no more than such dependents would receive if their relative were killed at home; (2) the burden of proof should be placed upon the foreign claimants to prove dependency.

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Zinc in Oklahoma in 1914

By R. J. Tuthill.[2]

The principal zinc mines in Oklahoma are all located in Ottawa County and the Miami is the only active camp at present, although some mining is being done at the Lincolnville and Peoria camps.

The first part of 1914 witnessed lower ore prices than for several years and was the cause of extensive curtailment of production, but since the rise in the price of spelter in August the operators have been able materially to increase their earnings and have also increased the production.

When mining first started in the Miami camp, the grades of zinc ores were low and the ore carried considerable iron pyrites, which reduced the value considerably. This year has witnessed the production of ore grading as high as 63% with less than 1% iron pyrites, and several of the producing mines have raised their grades to an average of about 60% zinc.

None of the ore contracts that were made and in force in 1913 were renewed in 1914, and with few exceptions all the mines are now selling on the open market. A good many sales are made on what is called a "metal base," as follows: No penalty or deduction for iron and $1 off the base price for each point the grade is below 60% Zn.

During the year a great amount of prospecting by drilling has been done, especially on the northeast of the present camp, with satisfactory results. The Picher Lead Co. and the Commerce Mining & Royalty Co. have led in this work and at the present time five different shafts are being put down to the orebodies that have been proved. In this same vicinity the Cornfield Mining Co. has just completed a modern mill which will be in operation the latter part of December and will materially increase the production of the camp. The Zinc Issues Co. has also done some drilling and has developed the fact that there is a run at 380 ft. depth. This means that the life of the present mines will be continued for an indefinite time.

While there has not been the amount of exploration on the southwest of the present main camp as on the northeast, still the work done has proven some very rich runs of ore, both lead and zinc. The zinc from this part of the camp is all grading better than 61%.

Another feature of interest during the year is the opening up of an orebody directly below the old upper run in the Newstate and King Jack mines. This orebody is very rich, as the average recovery of concentrates is over 10%.

The report of the production from the Miami camp shows an increase over 1913, as will be seen from a comparison of the following statements:

PRODUCTION FOR 1913*

	Lb	Value
Blende	46,914,325	$755,152.15
Lead	14,773,400	103,650.98
Total		$1,158,803 13

PRODUCTION FOR 1914*

December Estimated

	Lb	Value
Blende	63,591,115	$1,115,266 08
Lead	20,339,834	501,296 88
Total		$1,616,562 96

*The above does not include shipments from Lincolnville and Peoria camps.

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Tin

Tin production in the United States showed no change in 1914, being limited to a few tons of concentrates, so far as primary output is concerned. The secondary production amounts to about 6000 tons of metal recovered from scrap; this is largely used in making tin salts and for chemical purposes.

As usual, the figures for production and consumption are based chiefly on the market reports of shipments and

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[1] "Eng. and Min. Journ.," Nov. 28, 1914.

[2] Miami, Okla.

eliveries. Most of the production, about 75%, is included in what are known in the trade as "The Statistics," . which shipments and deliveries are carefully and closely ecorded. The estimated production outside of this is ccepted as going directly into consumption. According to the figures given, the production in 1914 decreased y about 4000 tons, and the consumption by 4540 tons he excess of production over deliveries in 1914 was 950 ons only.

The war, while it did not touch any producing country irectly, did interfere considerably with the transportaion and delivery of the metal. In a large proportion of the European Continent the deliveries were cut off, while shipments from the East were delayed, and in one case a loss was caused of 700 tons on board of a British vessel, sunk by a German cruiser. The most serious trouble has been in the case of Bolivian tin, which has been nearly all shipped to Europe in the form of concentrates, from 60 to 70% going to Germany to be smelted and refined The German works are unable now to take this, and a new outlet is being sought. Negotiations have been in progress for the erection of smelting works in the United States, but so far no definite conclusion has been reached.

WORLD'S PRODUCTION OF TIN

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
raits Settlements	57,944	61,528	65,640
reat Britain:			
From home ores	4,950	5,338	c 5,300
From other ores *a*	13,850	13,600	16,700
ermany *a*	11,378	11,000	c 11,500
rance	500	500	1,200
nca (sold in Holland)	15,147	16,111	15,173
lliton (sold in Holland and Java) . .	2,240	2,243	2,243
ustralia	5,150	5,130	4,870
hina (exports)	6,050	8,782	c 6,000
olivia *b*	400	500	300
	117,600	124,700	128,900

a Mainly from Bolivian ores *b* Importation of Bolivian crude tin into reat Britain *c* Estimated

WORLD'S CONSUMPTION OF TIN

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
reat Britain	21,900	21,800	24,400
ermany	18,300	20,200	19,300
rance	7,400	7,500	8,300
ustria-Hungary	4,000	3,800	3,200
elgium	1,700	1,500	2,300
ussia	1,900	2,600	2,700
aly	2,400	2,500	2,900
witzerland. . .	1,200	1,400	1,400
pain	1,200	1,300	1,300
candinavia	1,400	1,500	1,600
olland	*a* 250	*a* 250	*a* 250
ther European countries	1,200	1,100	1,200
Total Europe	62,800	65,500	68,900
nited States	48,000	51,700	45,000
ther America	2,300	3,300	3,400
ustralia	*a* 900	*a* 1,200	*a* 1,400
frica	*a* 500	*a* 600	*a* 500
hina (imports)	1,993	2,427	*a* 2,400
ther Asia	3,000	3,000	3,300
orld's consumption	119,500	127,700	124,900
orld's production. . .	117,600	124,700	128,900

a Estimated.

TIN PRODUCTION AND CONSUMPTION

(In Long Tons)

	1913	1914
xports, Straits and Malay Peninsula	62,242	61,986
xports, Australian	3,253	4,771
anka and Billiton sales	17,142	10,975
hinese exports and production*	8,200	8,255
olivian exports*	22,719	24,844
outh African production*	1,900	2,276
igerian production*		1,962
ornwall production*.	4,900	4,500
Total	120,356	116,569
S imports and consumption	45,900	42,995
reat Britain, imports and consumption	28,736	30,531
olland, imports . .	16,573	15,810
ther Europe, imports.	21,250	18,633
ustralian consumption	4,000	4,050
hina and India consumption. .	6,500	6,400
Totals . .	119,959	115,419
isible stocks, Dec 1	16,045	13,432

*Not in "Statistics"

While there are few changes in the uses to which tin is applied, there is in normal years an increase of about 5% in the consumption, with the growth of population and industry. The larger part of the growth is in the use of tinplate for containers of oil, vegetables and other preserved provisions. While the war on the one hand should mean an increased consumption of tinplate for such purposes, on the other it interferes with the distribution, so that it is hard to say whether the demand for tin is increased or not.

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Monthly Lead and Ore Prices

The accompanying table gives the average prices of lead and zinc ore as determined from actual transactions in the field, and reported by the Journal's correspondents.

AVERAGE MONTHLY ORE PRICES

	Zinc Ore						Lead Ore			
	Joplin base		Joplin all ores		Platteville		Joplin		Platteville	
	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914
	$	$	$	$	$	$	$	$	$	$
Jan.	53.30	40.63	52.22	38.71	53.10	50.00	52.55	50.00	51.00	51.38
Feb	46.88	42.50	44.34	41.15	46.63	42.63	52.66	50.76	52.38	51.50
Mar	46.50	38.88	44.62	38.51	46.38	40.13	53.22	50.00	52.50	49.90
April	42.50	38.55	40.92	36.75	42.20	39.25	52.71	45.71	52.70	47.40
May	43.60	39.31	41.76	36.68	42.25	39.25	51.84	46.62	52.63	48.00
June	41.75	39.63	40.30	38.41	42.49	39.75	52.22	46.40	52.50	48.00
July	43.55	38.95	40.88	35.58	43.35	39.20	52.39	45.76	52.50	46.70
Aug	47.06	43.75	44.51	41.02	46.13	44.00	55.79	45.75	55.25	45.00
Sept	46.13	43.10	44.30	41.33	46.75	43.80	56.59	45.70	58.00	44.50
Oct	42.10	40.38	40.07	38.46	42.20	40.50	52.94	40.84	54.60	41.50
Nov	41.81	43.13	39.99	41.63	41.50	44.00	51.49	43.99	52.75	45.50
Dec.	39.19	48.25	37.50	44.95	38.50	47.75	49.46	46.93	48.00	45.62
Year.	44.54	41.42	42.62	39.43	44.26	42.53	52.82	46.55	52.90	48.75

Joplin base and Platteville zinc prices are on standard ores, 60% zinc Second Joplin price is average for all zinc ores sold.

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The Tin Market

At the beginning of 1913 the price of tin in New York was about 50c. per lb., and it had begun to look as if even a higher price might be realized, owing to shortage in the supplies, but contraction in consumption more than offset any shortage, and the general tendency throughout 1913 was declining, the price at the end of that year being about 37½ cents.

MONTHLY AVERAGE PRICES OF TIN IN 1912, 1913 AND 1914

	New York			London		
Month	1912	1913	1914	1912	1913	1914
January	42.529	50.298	37.779	191.510	238.273	171.905
February	42.962	48.766	39.830	195.036	220.140	181.556
March	42.577	46.832	38.038	192.619	213.615	173.619
April	43.923	49.115	36.154	200.513	224.159	163.963
May	46.053	49.038	33.360	208.830	221.143	150.702
June	45.815	44.820	30.577	205.863	207.208	138.321
July	44.519	40.260	31.707	202.446	183.511	142.517
August.	45.857	41.582	*	208.351	188.731	*
September.	49.135	42.410	32 675	223.762	193.074	*
October.	50 077	40.462	30.284	228.353	184.837	*
November	49.891	39.810	33.304	227.619	180.869	139.391
December	49.815	37.635	33.601	226.875	171.786	147.102
Av. year	46.096	44.252		209.322	206.279	

New York in cents per pound. London in pounds sterling per long ton. * No quotations.

In 1914 the general tendency of tin was also declining, although in January and February there was a small rally in common with what was experienced by the other metals. However, by the mid-year tin was down to about 30c. per lb. The outbreak of the war caused a tremendous scare about tin supplies, all of which come by sea and were thought likely to be cut off entirely. The price rose to fancy prices for the small quantity of tin actually in stock in New York, 75c. per lb., even, being realized. This represented, however, what was merely picayune business—1-

tons to 5-ton lots and was in no wise representative of a broad commodity price.

During August there was no wholesale market, for the simple reason that there was no wholesale supply. By the end of that month supplies began to come in, and the fancy prices immediately disappeared. In September tin was down to the basis of about 32½c. per lb., and in October it was about 30¼c. In November and December it was a few points higher. The position of tin seems to be that the high prices of two years ago stimulated production, while consumption has diminished along with the general contraction of business experienced in the United States in 1913 and 1914.

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Quicksilver

The production of quicksilver in the United States in 1914 was about 16,300 flasks, compared with about 20,000 flasks in 1913. The production of California in 1914 was 11,279 flasks, compared with 15,600 flasks in 1913. The production outside of California is chiefly derived from Texas and Nevada, the Chisos mine, in the Terlingua district of Texas, the Mercury Mining Co., of Ione, Nev., and the Gold Banks mine, of Nevada, being important producers. Several other mines were operated on a small scale in Nevada and in Arizona.

WORLD'S PRODUCTION OF QUICKSILVER

(Metric Tons)

(From statistical report of the Metallgesellschaft, Frankfurt am Main)

United States:	1911	1912	1913
a California *a*	578	701	578
b Texas	116	154	136
c Other states	37		
United States.	731	855	714
Spain *b*	1,186	1,490	1,490
Austria-Hungary...	793	783	855
Italy...............	931	986	988
Mexico (estimated).	150	150	150
Total	4,100	4,300	4,200

a "Eng. and Min. Journ." *b* Exports.

The principal producers in California were the New Idria, Oceanic, New Guadalupe and New Almaden, these being the only producers credited with more than 1000 flasks each.

There was a large importation of quicksilver into New York in 1914, and for some time during the fall the market was considerably disturbed by a large unsold stock of Italian quicksilver. Considerable supplies of Mexican quicksilver also were received here. The effect of these large introductions of quicksilver were to make New York a primary market instead of being merely a reflection of San Francisco.

AVERAGE MONTHLY PRICE OF QUICKSILVER

(Per Flask of 75 Lb.)

Month	New York	San Francisco Domestic Sales	San Francisco For Export	London
January..	$38.75	$38.63	$36.63	£7 50
February	39.00	38.50	36.50	7 50
March	38.60	38.30	36.39	7 30
April.......	38.00	38.00	36.25	7 00
May	37.90	37.60	35.60	7 00
June	38.00	37.13	35.13	7 00
July	36.75	36.50	34.50	6 75
August	83.00	90.00		
September	71.38	71.00		
October	53.75	53.50		
November	50.30	51.00		
December	51.25	51.00		
Year 1914	$48.31	$48.68		
Year 1913	39.54	39.28	$36.81	£7 38
Year 1912	42.16	42.05	39.65	8 11
Year 1911	46.51	46.01	43.62	
Year 1910	47.96	46.51	44.54	

Quicksilver was steady at about $36@39 up to August, which was a shade less than in 1913, although there was a rather remarkable contraction in the domestic production. Upon the outbreak of the war, the price advanced, and in a single week jumped from about $45 to $90@100. This seems to have been a foolish extravagance, based on the suspension of the quicksilver business in London and the theory that all the quicksilver of the world would be wanted for military purposes, it being employed in the manufacture of explosives. Instead of this being the case, the high price in this market attracted importations from Italy, a previously unheard of movement, while we also obtained some supplies from Mexico, and the price for quicksilver in New York declined rapidly to about $40 per flask, from which there was recovery to about $52.50.

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Quicksilver in California in 1914

By Lewis H. Eddy

Quicksilver production in California in 1914 is estimated at 11,200 flasks of 75 lb., a decrease from 1913 of about 4400 flasks. Decline in production was due in some measure to low prices in the first half of the year and to the fact that the increase in price due to the effects of the European war came with a suddenness that did not permit of preparation for an increased production by the more important mines. In fact, some of the larger producers showed the greatest percentage of decrease. In the early part of the year prices went as low as $34 and $35 per flask, and the rise in the middle of August to $75 did not last long enough to be largely taken advantage of. There were some large shipments from the larger mines at the advanced prices; and some of the smaller producers sought to take advantage of what they believed would be a permanent price during the remainder of the year. But the price declined steadily to $55 and $52.50 in November. Decrease in production was no doubt due also to the lack of development of new orebodies. The producing counties in the southern part of the state were San Benito, San Luis Obispo, Monterey and Fresno. In the northern part of the state the chief production came from Santa Clara, Solano, Napa and Lake Counties. The New Idria decreased production by approximately 3000 flasks; the Oceanic increased by 200 or 300 flasks. There was a decrease in Santa Clara County, and Lake County made but small showing. The St. Johns mine in Solano County was reopened and made a creditable showing. The Alpine in San Benito County reopened and made a good start, but closed down after a short run. The Pacific in Fresno County, which was reopened and put on a producing basis in 1913, closed down in October, 1914. The Kings Quicksilver Mining Co. opened the Francis mine at Parkfield, Monterey County, installed a 10-ton Scott furnace and a concentrating plant and placed Monterey in the list of producing counties. The concentrating plant at the Oat Hill mine, installed in 1913 for working the waste dumps, was increased in capacity and improved in method of moving the material to the Standard tables. The Aetna mine in the same district also made some improvements in the concentrating plant, but early in the year was extracting high-grade ore and retorting it direct. It was reported that a concentrating plant was contemplated at the Cloverdale mine in Sonoma County. A small initial concentrat-ng plant was installed at the Oceanic mine for the treatnent of wet ores, but not with the purpose of substitution 'or furnace treatment of dry ores. Development at the New Idria contemplated driving lower tunnel levels. New \lmaden production came from ores extracted by leasers. Company operations have not been resumed. With fair rices the production of the state in 1915 should be at east normal, as there is a disposition to advance quickilver mining.

Petroleum in the United States in 1914

The petroleum industry experienced a remarkable adance in production in 1914, but the year was an unsatisactory one for producers on account of the reduced prices btained for their output. The production for 1914 was pproximately 290,000,000 bbl., or about 40,000,000 bbl. reater than in 1913. The principal increases were in 'alifornia, Oklahoma, Texas, Louisiana and Wyoming. ost other fields having declined in production. California passed the 100,000,000-bbl. mark for the first me, this being brought about by the gushers in the Midav fields, the most noteworthy of which was that brought by the Lakeview No. 2 Oil Co.; this produced approxiately 3,000,000 bbl., after which the hole collapsed; the ell was out of control during its life. In the Gulf field, e increased production was brought about by deep drillg in the Sour Lake pool and the opening of four new ools, De Soto and Edgerly in Louisiana, and the Moran nd Orange pools in Texas; the output from the De Soto ool was over 5,000,000 bbl. The increased production the Mid-Continental field was principally in Oklaoma, the Cushing and Healdton pools leading in the new roduction. The Royal Dutch-Shell company increased holdings both in Oklahoma and in California. The eneral Petroleum Co. in California was unable to pay s bond interest and hence its plan for acquiring the 'nion Oil Co. was not consummated. Nearly 20,000,000 bl. of fuel oil were imported from Mexico in 1914, the isturbed condition of that country not having interfered seriously with the oil production near the coast, a ith the metal mining conducted farther inland

RODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES

(In Barrels of 42 Gal.)

Field	1912	1913	1914
alifornia	84,823,992	96,881,967	100,093,568
olorado	200,000	220,000	(f) 200,000
xas (a)	11,778,324	15,544,046	20,586,377
uisiana	9,791,896	12,901,703	16,860,235
linois	28,400,000	(e) 23,893,899	21,500,000
ma { Indiana.	1,200,000	4,750,000	2,900,000
Ohio.	3,000,000		
d-continental (b)	52,771,603	64,556,000	(d) 97,400,000
entucky-Tennessee	500,000	500,000	580,000
ppalachian (c)	26,000,000	25,673,000	23,800,000
yoming	500,000	2,354,000	4,100,000
thers	5,000	50,000	(f) 50,000
Total	218,970,815	247,321,615	288,070,180

(a) Includes Panhandle field of Texas. (b) Kansas and Oklahoma, only Pennsylvania, New York, West Virginia and eastern Ohio. (d) Estimate of r David T. Day, in "Oil, Paint and Drug Reporter", Jan. 2, 1915. (e) U. S. al Survey. (f) Estimated.

The developments of 1914 in the important oil fields ill be treated in detail in a subsequent issue.

Cement

Business in cement was poor throughout 1914, owing the contraction of building operations. Among the Lehigh Valley mills the price was steady at 95c. per bbl., in bulk, f.o.b. mill, but in the Western markets there were considerable fluctuations. At Chicago the price was $1.05 in January, $1.15 in March, $1.17 in August, $1.15 in September, and $1.10 in October. In May the mills of the country were estimated to be operating at 60% of capacity and in June at 50%.

After the outbreak of the war the cement manufacturers expected that South America, Asia and Africa would turn to the United States for the supplies that they had previously been obtaining from Belgium and Germany. Inquiries from those markets were, indeed, received, but no considerable business appears to have developed as yet, owing to difficulties about freight and exchange, which will probably be overcome sooner or later.

According to the United States Geological Survey, the production of portland cement in the United States in 1914 was approximately 88,514,000 bbl., compared with 92,097,131 bbl. in 1913. The estimated shipments of portland cement during 1914 were 86,715,000 bbl., compared with 88,689,377 bbl. in 1913. Stocks of cement at the mills increased from 11,220,328 bbl. in 1913 to 12,818,000 bbl. at the close of 1914.

The Lehigh district showed a decrease of more than 9% in both production and shipments. The Illinois and northwestern Indiana district showed a slight decrease, and the Pacific Coast district (California and Washington) showed a decrease of about 12%. Important increases in production and shipments were shown by New York, the Iowa-Missouri district, the Maryland-Virginia-West Virginia district, and the Rocky Mountain district.

Important Books of 1914

Among the more important books on mining and metallurgy published during 1914 were the following:

Brunton, David W., and Davis, John A. "Modern Tunneling, with Special Reference to Mine and Water-Supply Tunnels." (450 pp., $3.50).

Eckel, Edwin C. "Iron Ores; Their Occurrence, Valuation and Control." (430 pp., $4.)

Emery, George D. "The Miners' Manual." A Handbook of the Law of Mines and Mining, with Forms. (436 pp., $3.50.)

"Engineering and Mining Journal" Editorial Staff. "Handbook of Milling Details." (425 pp., $4.)

Gowland, Wm. "The Metallurgy of the Non-ferrous Metals." (500 pp.)

Hofman, H. O. "Metallurgy of Copper." (556 pp., $5.)

Hoover, T. J. "Concentrating Ores by Flotation." Revised edition. (270 pp., $3.75.)

Jones, E. Horton. "Smelter Construction Costs." (152 pp., $2.)

Krusch, P. "Die Untersuchung und Bewertung von Erzlagerstatten." Second edition. (569 pp., 17 marks.)

Lindley, Curtis H. "A Treatise on the American Law Relating to Mines and Mineral Lands, Etc." Third edition. (Three volumes, 2813 pp., $25.)

Megraw, H. A. "Details of Cyanide Practice." (215 pp., $2.)

Paine, Paul M. and Stroud, B. K. "Oil Production Methods." (239 pp., $3.)

Ries, Heinrich, and Watson, Thos. L. "Engineering Geology." (672 pp., $4.)

Stansfield, Alfred. "The Electric Furnace." Second edition, revised. (415 pp., $4.)

Wilson, Alfred W. G. "The Copper Smelting Industries of Canada." (184 pp.)

Iron and Steel

By Frederick Hobart

The year 1914 will be remembered as one of those in which the iron and steel production and prices reached what appears to us now a low-water mark, although not very long ago the figures of the year would have represented a boom. The production decreased nearly 25% from the high record set in 1913. Prices worked down to a low point chiefly on account of small demand and a certain degree of competition. It must be remembered that under the new tariff there would be a limit to the point to which prices would rise, even under strenuous demand; that is, under ordinary circumstances. The conditions of 1914, however, were not ordinary, and the prices seemed to be hunting for the minimum rather than the maximum points. The falling off in demand was met, as a rule, by reducing production, and, at the end of the year, there seems to have been comparatively little accumulation of unsold stocks to weigh down makers. The rate of steel production at the mills was, at times during the year, as low as 30% of the nominal capacity, taking a general average. Full capacity, however, that is, the total productive capacity of which a mill is capable when run at the highest speed, is a point very seldom reached, and then only for a very few days, so that it would be, perhaps, safer to put the real capacity of the mill at somewhere between 80 and 90% of its nominal capacity.

The year opened with a falling off in production which had commenced near the close of 1913. The depression was due at that time to a reaction from the very heavy work of 1913, when the country undoubtedly over-bought and over-traded. For several months the declining condition continued; there was no heavy slump, as in 1907 and the early months of 1908, but a continued decline in purchasing and in production. As the middle of the year approached, there seemed to be an improvement; the manufacturing and financial conditions were somewhat better, so that there was hope for a return to normal prosperity later on. The breaking out of the war in Europe, however, at the close of July, changed all this immediately. The unprecedented extent of the contest there disorganized all financial conditions and for a time the iron trade halted, apparently in total uncertainty of what was coming. A few people anticipated a rush of prosperity for us, resulting from the stoppage of manufacturing abroad. The greater number, however, realized that in the present condition of the world's trade, no nation can hope to profit for any considerable time or to any large amount by its neighbor's troubles.

Buying of iron and steel by the railroads was, for the most part of the year, on rather a limited scale. The financial conditions prevented most railroad companies from raising money freely for improvements and additions to their property. Moreover, for several months, the companies had pending before the Interstate Commerce Commission requests for authority to increase rates on freight, claiming that the established rates were not sufficient to enable them to to spend the necessary amount on the maintenance and improvements of their properties. While such a question was being argued, it is perhaps natural that they should seek to support their claims by limiting their expenditures. Indeed, many roads were really not able to spend money as freely as they have been doing for several years. At a comparatively late period of the year, permission to increase rates to some extent was granted; but the relief so given was not sufficient to bring the companies into the field to any great extent. In the coming year, however, many of them will be compelled to invest considerable sums for new tracks and equipment.

As the year closes, there is a notable improvement in sentiment, and a greater disposition to confidence in the future. This has been supplemented and supported by an increase in actual purchasing and manufacture, which seems to be decidedly encouraging. As 1914 opened with a depressed and gloomy outlook, it closed with decidedly brighter prospects for its successor.

IRON ORE

The production and consumption of iron ore, which reached a record figure in 1913, showed a material reduction in 1914. Approximate figures are given in Table I herewith:

I. IRON ORE PRODUCTION AND CONSUMPTION

(In Long Tons)

	1912	1913	1914
Lake Superior shipments	48,211,778	49,947,116	33,721,897
Southern ore mined	7,500,000	7,950,000	6,175,000
Eastern and other local ores	3,485,000	3,950,000	3,015,000
Total production	59,196,778	61,847,116	42,911,897
Imports	2,104,576	2,594,876	1,455,000
Total supply	61,301,354	64,441,992	44,366,897
Exports	1,195,742	1,042,151	660,000
Approximate consumption	60,105,612	63,399,841	43,706,897

Exports and imports are estimated for two months, November and December. No account has been taken in Table I of changes in stocks at the end of the respective years. In 1914 there was no material change in visible stocks. It is impossible to estimate the ore in furnace yards, owing to the absence of available data.

Deliveries of Lake ore to Lake Michigan ports in 1914 were 6,109,019 tons; the larger deliveries being 3,606,587 tons at South Chicago; 1,431,564 tons at Gary; 661,054 tons at Indiana Harbor.

The increased use of Eastern ores continued in 1914, though limited, of course, by the smaller demand for ores generally. The Southern output of ores follows rather closely the needs of the furnaces. In 1914 there was little work done on new mines or on the development of old ones.

Cuba, Sweden and Newfoundland were the chief sources of foreign ores. A beginning was made of imports from the Tofo iron mines in Chile, acquired by the Bethlehem Steel Co. in 1913, but the ore from those mines did not reach this country until late in 1914, and then only in moderate quantity.

Exports in 1914, as in the previous year, were chiefly of Lake ore to Canadian furnaces, some of them being large buyers, as at Midland and Hamilton.

Table II gives the total shipments from the Lake Superior region in 1913 and 1914, the rail shipments in 1914 being estimated. The dock statistics, which are collected by the *Marine Review*, give the figures in long tons.

II LAKE IRON ORE SHIPMENTS

	1913		1914	
	Tons	Per Cent	Tons	Per Cent.
Escanaba.. .	5,399,444	11 0	3,664,451	11.5
Marquette..............	3,137,617	6 4	1,755,726	5 5
Ashland .	4,338,230	8 9	3,363,419	10 5
Two Harbors.	10,075,718	20 6	5,610,262	17 5
Superior ..	13,788,343	27 9	11,309,748	35 3
Duluth................	12,331,126	25 2	6,318,291	19 7
Total water	49,070,478	100 0	32,021,897	100 0
Rail shipments	876,638		700,000	
Total	49,947,116		32,721,897	

This table shows that the shipments for 1914 were the mallest in ten years, except those of 1908; though they were only 108,514 below those of 1911. The changes in he port shipments show that the Steel Corporation directed its efforts toward making up its minimum on the Hill leases, doing comparatively little on its other mines. This is plainly shown by the increase in the proportion shipped from Superior, coupled with the decreases at Duluth and Two Harbors. From the Minnesota ranges, he Mesabi and the Vermilion, the proportion did not change greatly, being 73.7% of the total in 1913 and 72.5% in 1914. These figures are approximate only, he production not being apportioned by ranges as yet. The shipments to furnaces from lower Lake ports were well up to receipts, and the stocks on docks Dec. 1, 1914, were less than 100,000 tons greater than at the close of he preceding season.

Pig Iron

The production of pig iron by half years for four years has been as in Table III; the first half of 1914 being he corrected figures of the Iron & Steel Institute, the second half estimated from the monthly statements of he furnaces:

III. PIG IRON PRODUCTION BY HALF-YEARS

	1911	1912	1913	1914
First half	11,665,796	14,072,274	16,488,602	12,536,094
Second half	11,983,548	15,654,873	14,477,699	10,720,000
Year	23,649,344	29,727,147	30,966,301	23,256,094

The total for 1914 shows a decrease from 1913 of 7,710,058 tons, or 24.9%; it was less than the small make of 1911 by 393,250 tons; and only the entirely exceptional year 1908 shows a smaller make in recent years. In Table IV the production for 12 years is given, in long ons, which are used in all the tables of iron production.

IV. PIG IRON PRODUCTION FOR 12 YEARS

903	18,009,252	1907	25,781,381	1911........	23,649,344
904	16,497,003	1908........	15,936,018	1912........	29,727,147
905	22,992,380	1909........	25,711,846	1913........	30,966,301
906	25,307,391	1910........	23,649,344	1914........	23,256,094

The increase in capacity for making pig iron is shown by the fact that in 1914, which is considered a lean year by comparison with its predecessors, the total make was only about 2,000,000 tons less than in 1906 and 1907, which were boom years, when furnaces were run up to heir capacity under the stimulus of active demand and high prices. In the seven years from 1907 to 1914 the blast-furnace capacity of the country has been increased about 25%; and a lean year now is almost equal to the the boom year of seven years ago.

The various classes of pig in the second half probably differed little from those made in the first half in proportion. Assuming that the division was the same, the production of pig iron for the year, classified according to intended uses, is given in Table V:

V. PIG IRON PRODUCTION BY GRADES

	1913		1914	
	Tons	Per Cent	Tons	Per Cent.
Basic.....	12,537,746	40 5	9,298,647	40 0
Bessemer................	11,593,385	37 4	8,130,098	35 0
Foundry	6,213,654	20.1	5,249,079	22 6
Forge, etc........	391,682	1.3	405,756	1.7
Spiegel and ferro...	229,834	0.7	172,514	0.7
Total ..	30,966,301	100 0	23,256,094	100 0

In Table V, low phosphorus is included with bessemer pig; ferrosilicon with foundry; a small tonnage of miscellaneous with forge pig.

The consumption of pig iron for two years past is shown in Table VI, exports and imports for the last two months of 1914 being estimated.

VI. CONSUMPTION OF PIG IRON

	1913	1914	Changes
Production..........................	30,966,152	23,256,094	D. 7,710,058
Imports	156,435	147,200	D 9,235
Total supply	31,122,587	23,403,294	D 7,719,293
Exports	277,648	117,000	D 160,648
Increase in stocks	500,000	750,000	I 250,000
Total deductions........	777,648	867,000	I. 89,352
Approximate consumption	30,344,939	22,536,294	D 7,808,645

There are no very reliable figures as to stocks unused or unsold; but it is believed that in 1914 decreased demand was met rather by blowing out furnaces than by piling up iron. The imports of pig iron have shown a decrease, notwithstanding the removal of the duty.

The complete returns of foreign trade to the end of October, as made up by the Bureau of Commerce, are given in Table VII:

VII. VALUES OF FOREIGN TRADE
(10 Months to Oct. 31.)

	1912	1913	1914
Exports..........................	$238,971,131	$251,676,318	$169,232,670
Imports..........................	23,885,776	28,292,118	24,947,236
Excess, exports..............	$215,085,355	$223,384,200	$144,285,434

The closing months of the year have probably made a better showing; but a large decrease in exports is certain.

Steel

While there are no published or completed figures as to the production of steel, it is fair to estimate that the decrease from 1913 to 1914 was 25%, or about the same as that in pig iron, which would indicate a total of 23,475,000 tons of ingots, and some 22,000,000 tons of finished steel. It appears probable that the completed statistics will show about 25% decrease in structural steel, bars and plates, somewhat smaller losses in sheets and wire, and a loss of over 1,000,000 tons, or 30%, in rails.

United States Steel Corporation

The Steel Corporation, with other producers, felt the stress of reduced demand, and after paying the common-stock dividend for the second quarter of 1914 from accumulated surplus, reduced the dividend for the third quarter from $1\frac{1}{4}$ to $0\frac{1}{2}$%. It was reported that a general reduction in wages would be made on Jan. 1, 1915, but recently it was announced that no reduction would be made; and this action will be followed by the leading independent producers.

Foreign Countries

Great Britain has furnished no statement for any part of the year. In 1913 the make of pig iron was 10,479,171 tons, and that of steel was 7,663,876 tons. It is believed that 1914 will show decreases of about 10% from these figures.

For Germany we have figures up to Sept. 30. In the nine months ended on that date, the production of pig iron was 11,996,652 metric tons, a decrease of 2,459,434 tons from 1913. The production of steel was 12,223,486 tons. The effect of the war is shown by the fact that pig-iron production in September, 1913, was 1,590,849 tons, while in September, 1914, it was 518,184 tons. The production of steel decreased from 1,627,345 tons in July to 663,223 tons in September.

Pittsburgh Iron and Steel Markets

By B. E. V. Luty*

There was a general decline in prices and in activity in the iron and steel trade in 1914, but as the year opened with conditions decidedly unsatisfactory, and as, furthermore, there were at intervals periods of slight improvement, the total ground lost during the year was not great. The market had weakened almost continuously in 1913, but in the closing days of the year a slight improvement was manifested, and this improvement became more marked in January, but the recovery proved to be only a slight one and the downward trend was soon resumed. Again, about the beginning of June the market started to recover, and definite ground was gained in that month and the next. The shock of the war breaking out at the beginning of August halted business for a few days, this being followed by a slight burst of feverish activity, it being assumed in some quarters that the war would make certain raw materials scarce and would at the same time develop a large demand for export steel, both in war material and in business with neutral countries, whose supplies from the warring countries would be shut off.

This delusion did not prevail generally and was soon dispelled. The trade dropped to a greater depth of inactivity than had ever before obtained in its history, the middle of November seeing steel-mill operations averaging not over 35% of capacity. In November trade sentiment generally changed from hopelessness to expectancy, and in December a slight increase in buying occurred, the decline in prices being at the same time practically arrested; but the improvement was not sufficient to effect a noticeable increase in mill operations.

According to the precedents, 1914 should have been a year of recovery in the iron and steel trade. The feverish and unreasonable burst of buying which characterized 1909 required nearly two years of liquidation, 1910 and the major part of 1911; the buying movement of 1912 was of much more moderate proportions and the slight excesses of that period should have been fully made up for in 1913; but conditions at the beginning of 1914 were particularly inauspicious, and the great European war came later to give the industry a fresh and serious setback.

On account of the largely reduced tariff which became effective Oct. 4, 1913, the iron and steel trade was greatly unsettled. While actual imports were so light as to be practically negligible, the usual incentive to buyers, fear of a rapidly-advancing market, was practically removed. A further unfavorable influence was the condition of the railroads. They had been prosecuting an almost continuous contest with the Interstate Commerce Commission for leave to advance rates, meanwhile curtailing their expenditures, largely because no other course was open, but in some part probably for the purpose of influencing public sentiment. During the second quarter of the year there were hopes that a favorable decision in the "Eastern Rate Case" would stimulate buying both by the railroads and by others who commonly followed the example of the railroads, but the partially favorable decision was not rendered until Aug. 1 and then the war prevented the improvement that might otherwise have followed.

The war exerted a serious adverse influence upon the iron and steel trade by making everyone extremely conservative and by tieing up funds, so that banking accommodations for ordinary commercial operations were greatly restricted and the financing of new projects was almost entirely prevented. As to the railroads, the question whether they would be able to obtain funds for extensions yielded to the question whether they would be able to obtain money for ordinary refunding. As projects that were in course were completed mill activity had to decrease for fresh projects did not take their place.

AVERAGE PRICES AT PITTSBURGH, 1914

	Pig Iron				Steel					Nails	
	Bessemer	Basic	No. 2 Foundry	Ferro-manganese	Bessemer Billets	Beams	Plates	Bars	Black Sheets No. 28	Wire per Keg	Cut per Keg
January	$14.94	$13.23	$13.90	$45.58	$20.00	1.20c.	1.20c.	1.20c.	1.86c.	$1.53	$1.60
February	15.13	13.96	14.11	40.49	21.00	1.25	1.21	1.22	1.95	1.60	1.60
March	15.07	13.94	14.15	40.56	21.00	1.21	1.18	1.20	1.95	1.60	1.60
April	14.90	13.90	14.15	40.16	20.75	1.18	1.15	1.15	1.90	1.60	1.60
May	14.90	13.90	14.07	40.16	20.00	1.15	1.14	1.14	1.85	1.58	1.60
June	14.90	13.90	13.90	40.16	19.50	1.12	1.10	1.12	1.82	1.50	1.58
July	14.90	13.90	13.90	39.66	19.50	1.12	1.11	1.12	1.80	1.52	1.55
August	14.90	13.90	13.90	110.00	20.17	1.18	1.18	1.18	1.88	1.57	1.55
September	14.90	13.90	13.75	85.00	20.75	1.20	1.19	1.19	1.98	1.60	1.55
October	14.84	13.75	13.75	70.16	20.00	1.16	1.14	1.15	1.96	1.60	1.55
November	14.59	13.43	13.50	70.16	19.25	1.11	1.09	1.11	1.88	1.59	1.55
December	14.70	13.45	13.60	70.16	18.50	1.05	1.05	1.05	1.85	1.50	1.55
Year	14.89	13.76	13.89	57.79	20.03	1.16	1.14	1.15	1.89	1.57	1.57
Year 1913	17.10	15.55	15.78	60.03	25.55	1.42	1.41	1.37	2.21	1.70	1.66

Prices of pig iron, ferromanganese and billets are per ton, 2240 lb; of steel products, per lb; of nails, per 100 lb., base.

Pig-iron prices suffered an average decline during 1914 of about 50c. a ton, even though there was a slight recovery in February. Finished-steel prices experienced an average decline of about $2 a ton during the year, with no material recovery at any time.

Pig-iron production in 1914 was about 23,250,000 gross tons, a decrease of 25% from the record production of 30,966,301 tons made in 1913. Steel production decreased by a still larger percentage, for during the major portion of the second half of the year the steel works were accumulating pig iron, not deeming it economy to blow out blast furnaces to the same extent that steel works operations were curtailed. In the latter part of the year curtailment to the full extent of the decreased demand was necessary since it is impossible to make finished steel for stock.

The war completely stopped German and Belgian exports of steel, such exports having previously constituted more than one-third the total exports to the neutral markets of the world, but on account of financial conditions ccasioned by the war the buying power of neutral countries was decreased in still greater measure, so that the xports of both England and the United States suffered harp decreases. Largely by reason of a special demand or war material, the export trade of the United States egan to improve after August, the October exports of onnage products being 147,000 gross tons or a trifle reater than the monthly average of the seven months of t year prior to the war. The rate was still far below the erage in 1912 and 1913, the best foreign trade in years, en exports were 225,000 to 250,000 tons a month.

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Vanadium

The situation of this metal was about the same in 14 as in the previous year, but prices were a little aker. There has been an over-production of vanadium, d since the war the continental demand has dropped practically nothing, shipments even to neutral coun es being impossible without a special permit of the ernment of the country of destination. In the United tes, buying is but from hand to mouth, and nat ally the smelters are able to buy ore only in the same w.

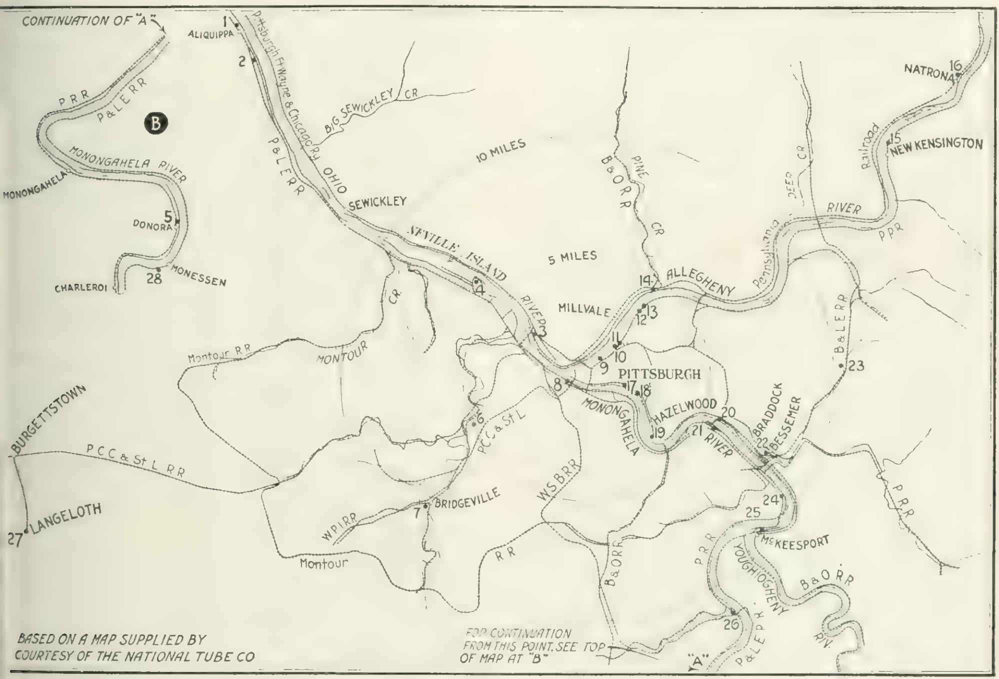
Lake Superior Iron Ranges

The 1914 season on the iron ranges more than bore out the doleful prospects of the fall of 1913. Total shipments were reduced by 34 or 35% from 1913, and whereas the latter year was a record breaker, nevertheless the reduction was so heavy as to make 1914 the worst since 1908. Of the several ranges, the region around Crystal Falls and Iron River probably suffered the most. The Marquette and the Mesabi ranges bore more than their share of the reduction, while the Vermilion and Gogebic ranges certainly, and the Iron Mountain district probably, did better than the average; the Cuyuna range even made a slight gain.

MESABI RANGE

The Mesabi shipments suffered a reduction from about 31,000,000 tons to 21,362,056. Of this, about 13,250,000 tons was shipped by the Oliver company, about 60% of the total. The proportion of total Lake shipments made by the Mesabi remained about the same as for 1913, 66%. The mines leased from the state suffered severely. The 1913 shipments were 2,871,940; those for 1914 were only 804,722. The state's tonnage reserves, as estimated for May 1, 1914, were as follows: School lands, 105,635,410; swamp lands, 30,470,666; university lands, 5,438,047.

While shipments decreased severely, activity in general



PITTSBURGH AND VICINITY THE IRON DISTRICT

1, Vulcan Crucible Steel Co.; 2, Jones & Laughlin Steel Co.; 3, Carnegie Steel Co. (Edith furnace); 4, Carnegie Steel Co. Neville furnace); 5, American Steel & Wire Co. (Donora works); 6, Carbon Steel Co. (Carnegie plant); 7, American anadium Co., 8, Clinton Iron & Steel Co., 9, American Steel & Wire Co., 10, Carbon Steel Co., 11, Crucible Steel Co. (Park orks), 12, Crucible Steel Co. (Crescent furnaces); 13, Carnegie Steel Co. (Lucy furnaces), 14, Carnegie Steel Co. (Isaella furnaces); 15, Aluminum Co. of America; 16, Pennsylvania Salt Mfg. Co.; 17, Jones & Laughlin Steel Co. (Soho rnaces), 18, Jones & Laughlin Steel Co. (Eliza furnace), 19, Pittsburgh Smelting & Refining Co.; 20, Carnegie Steel Co. arrie furnace), 21, Carnegie Steel Co. (Homestead works), 22, Carnegie Steel Co. (Edgar Thompson works), 23, Unirsal Portland Cement Co., 24, Carnegie Steel Co. (Duquesne works), 25, National Tube Co., 26, Carnegie Steel Co. (Clairton orks); 27, American Zinc & Chemical Co.; 28, Pittsburg Steel Co. (Monessen plant).

was not restricted in proportion. This is due to the fact that the Oliver company was engaged in opening up new mines to take the place of those turned back to the Hill interests, while the Hill interests were also busy developing, since many of the mines relinquished by the Oliver are either pretty well worked out or require extensive development work before being capable of any great production. The Dale, North and South Uno, Harold and Mississippi mines, however, will be in a position to operate actively in 1915. At least a dozen new properties controlled by the Steel Corporation started to operate during 1914, and while some of the Corporation properties were idle, most of the suspensions, for part or all of the season, were made by independent operators.

The Oliver company did a good deal of drilling during the year under contracts calling for early completion of exploration. At one time 120 machines were at work. Part of the drilling was in the nature of check work, or for extension of exploration, but on the eastern part of the range it is understood that extensive ore was opened up.

On this end of the range the Vivian continued operations on a small scale, the Graham increased its production from the openpits, and the Weed completed installation of equipment. The Miller, the Mohawk, the Hudson, the Meadow, the Adriatic, and the Knox continued operations at no great reductions over the scale of 1913. Around Biwabik the Bangor, the Biwabik, the Ruddy, and the Monica shipped at a reduced rate, while the Holland and the Belgrade, idle last year, made small shipments. The Williams did not ship.

In the Gilbert district the Corsica and the Elba curtailed operations, while the Malta was idle. The Oliver company completed dismantling the Gilbert. The Republic company increased shipments from the Pettit, but the Schley produced only a little ore.

In the Eveleth district Genoa shipments were cut in half. The work here is largely scramming, for which there is employed a Marion revolving shovel, the first used by the Oliver company. It has given excellent satisfaction. The Fayal openpit operated on a small scale during the shipping season; at No. 2 underground work was about as usual; No. 1 was closed down in April at the expiration of the lease; it is not known whether an extension has been granted. The Adams and the Spruce produced at a reduced rate, as did the Virginia. The Troy and the Morrow were idle.

Around Virginia the Norman is about exhausted. It is the first large openpit to come to this point, and in its present condition exhibits splendidly the nature and shape of a typical deep-trough Mesabi orebody. The Union, the Franklin, the Missabe Mountain, the Fay, the Sliver and the Commodore shipped less than in 1913; the Minorca and the Lincoln shipped about the same as in 1913; the Larkin was idle and the Onondaga was abandoned; it is understood that the orebody was exhausted. The Alpena shipped over 1,110,000 tons and stocked a large tonnage as well. Operations were pushed here, as in 1913, on account of the approaching termination of the lease. The Oliver started three new mines in the district, namely, the Prindle, the Sullivan and the Minnewas. Operations at the Commodore have been suspended and this deep pit allowed to fill with water. Early in the season water broke through into the Lincoln and operations were suspended for several weeks. Butler Bros. completed its stripping contract on the Sliver in May.

In the Mountain Iron district the Hanna, of the Consumers Ore Co., did not ship, but mined out underground workings adjacent to the pit and stocked the product in the pit. The Hanna B mined about 100,000 tons and passed it through the Brunt drier. The Brunt did not ship, but carried on stripping. The drying plant had a successful season, marked by an absence of breakdowns. The Iroquois did not operate but shipped a stockpile.

In the Buhl district the Whiteside drier sent about 200,000 tons of product to the docks, although the mine did not operate. The Helmer and the Eaton shipped and the Woodbridge shipped from stockpile. At the Frantz, closed since 1907, active surface construction work was done. The Arthur company now has the Dean ready for production, and it is understod that Tod-Stambaugh will handle it in 1915. The Arthur is sinking a shaft on the Thorne, which will be ready as an underground property in 1915. The Oliver completed equipment of the Shiras and Wanless and sank a shaft on the Deacon.

In the Chisholm district the Shenango operated at about 75% capacity and during the year put down an incline on the south side of the pit, by which about 1,250,000 tons of underground ore will be mined. Surface equipment was installed and underground development begun on the Duncan, a new Oliver mine. Stripping operations on the Dunwoody continued, and the large openpit is about ready for shipment. The Arthur company operated the South Leonard. The Oliver exhausted most of the tonnage of the Leonard, preliminary to turning it back to the Arthur. The Clark and Chisholm increased their shipments in 1913, and the Monroe-Tener operated, but did not ship.

The Hibbing district was probably adversely affected more than any other district along the range. The Sellers pit did not operate at all; the Burt-Day produced less than half of its 1913 production; the Hull-Rust produced only about one-eighth and the Unos operated on a small scale. The Susquehanna produced little more than half its 1913 tonnage; the Scranton did not ship; the Albany shipped about a third; the Webb was idle; the Winifred shipped a little. Only the Mahoning, among the large mines, operated at a normal rate, although the Mace operated at about usual capacity. The Dale produced a small tonnage; the Arthur company started operations on the north bank of this openpit and did some underground mining at the North Uno. It has leased to Tod-Stambaugh part of Sec. 11-57-21. The Eddy property adjoining the Morton of Tod-Stambaugh will be operated in conjunction with the latter. The Longyear will be ready to ship in 1915. The Laura and the Leetonia shipped all season. At the Agnew surface repair work was carried on. The Oliver is opening up the Philbin as an underground mine and is stripping the Sheridan-Fletcher. The Smith property of the Arthur is ready for shipment.

Around Nashwauk, the Wisconsin Steel sent a fair tonnage to its washery and did some surface construction work. The La Rue operated its experimental washing plant on a commercial basis, producing about 25,000 tons of product; Butler Bros. completed stripping this property, and some extensive drilling also was finished in June. Butler Bros. took under lease from the Arthur, the East-Harrison, and began stripping. This lease involves a contract to erect a washery. The Mississippi was turned over to the Arthur by the Oliver. The St. Paul was not operated but did a little stripping. The Bennett shipped and continued stripping.

The Jones-Laughlin interests around Grand Rapids were forced to abandon their dredge, but continued shaft sinking in Sec. 13-55-26. The option on the Buckeye was given up and all operations were suspended early in October, but it is understood that work may be resumed when business conditions warrant. At Coleraine the Canisteo pit operated practically the same as in 1913 and the Trout Lake washery produced over a million tons of concentrates from this mine alone. The Judd and the Hill produced about as in 1913, while the Holman-North Star produced about one-half. On the Hill Annex, A. Guthrie & Co. took the largest stripping contract ever awarded on the range, namely, to remove 8,500,000 cu.yd. Elaborate and heavy equipment is being used for this job. Shaft sinking on the Hill Annex and the driving of drainage drifts have been completed by the Arthur company. Eventually, this property will require a washing plant.

THE CUYUNA

The Cuyuna has the distinction of being the only iron range to exceed its 1913 production. Shipments were approximately 873,000 tons. The heaviest shipper was Armour No. 2 with 288,000 tons. The cutting off of foreign manganese supplies directed renewed attention to he Cuyuna deposits of maganiferous material, but interst abated suddenly on the publication of the Minnesota State Tax Commission's opinion that the material was of loubtful value, and that there was no commercial manganese ore on the range. Nevertheless, the Cuyuna-Mille Lacs, the leading producer of this material, shipped over 1,000 tons.

There was little in the line of new discovery during the ear, and the limited exploration work was confined mostly to land adjacent to the known deposits. Some tonnage was opened up near Emily, at the extreme northern end f Crow Wing County, but actual results are not known. n Aitkin County, at the eastern end of the range, some igh-manganese iron ore was disclosed.

The South range had a bad setback following the abanonment of the Barrows mine, although this was the reult rather of trade conditions and of initial mismanagement. The Brainerd-Cuyuna is the only other active enterprise in the vicinity. It about completed getting its rop shaft, the third sinking attempt, to the ledge. Water nd quicksand make sinking on the South range exceedingly difficult. East of Brainerd the Wilcox mine of the Canadian-Cuyuna sunk a shaft; this company has Caadian affiliations and is expected to ship ore outside the country in 1915.

The large consuming interests still stand aloof from the range, and Jones & Laughlin, late in the year, dropped ll options after some exploration work. John A. Savage, however, is sinking a concrete drop shaft on the Jamison & Peacock forty, north of Crosby, the only known deposit f bessemer ore on the range.

Stripping the Thompson pit was completed and stripping operations planned for the Hill Crest, the Cuyuna Iron & Manganese, and the Cuyuna-Sultana, all near the Pennington, during 1915. The possible stripping area now generally conceded to be restricted to an area extending west from Crosby to Riverton. The partial success of the hydraulic method of removal at the Rowe mine has led to the decision to employ it for part of the overburden on the Hill Crest. The Armour No. 2, Barrows, Cuyuna-Duluth, Cuyuna-Mille Lacs, Iron Mountain, Kennedy, Rowe and Thompson shipped during the year. The Armour No. 1, Pennington, Duluth-Brainerd, Meacham and Adams could have shipped, but did not.

Late in the year the State Tax Commission applied the same system of taxation to the Cuyuna as has been used on the other Minnesota ranges, and published its tonnage estimate, namely, 86,179,791 tons, of which 70,357,865 tons was classed as merchantable ore.

The Soo line still handles the bulk of the tonnage, about 85%. Next year the N. P. will handle the product of the Croft, Wilcox and Brainerd-Cuyuna, as well as the Duluth-Brainerd if that is shipped. Railroad construction and the struggle for tonnage went on during the year. The announcement of the projected building of a concentrator for the Rowe mine was a matter of great importance to the range.

Considering the disadvantages under which the range labors, namely, the absence of the larger companies, the difficulties of sinking, the exaggeration of the stock companies, the lack of bessemer ore, etc., the increase in production by 20% over 1913 is a matter of congratulation.

VERMILION RANGE

Relatively speaking, the Vermilion had a successful season, its reduction in shipments being only between 32% and 33%, that is, the shipments were 1,017,019 tons, as against 1,512,399 for 1913. As usual, the Oliver Iron Mining Co. produced the bulk of the ore, namely, 931,077 tons. The remainder came from the Section 30 mine, now operated by St. Clair interests.

The old Minnesota mine was closed for repairs during part of the year. Recent developments indicate that the deposit is still far from exhausted. None of the several prospects on which work has been done during the last few years has yet entered the shipping list. The Onahman has developed a little ore, however. A noteworthy event was the closing down of the North American. This property has been exploited at various times for iron, gold, silver and graphite, but in November the pumps were shut down and the mine allowed to fill.

THE MARQUETTE

The Marquette range and the tributary districts suffered severely in 1914, the total shipments, partly estimated, being 2,471,000 tons, a reduction of 37% to 38% from 1914. As usual, the Cleveland-Cliffs headed the list of shipments with 1,365,000 tons.

A notable event of the year was the passing of the control of the Republic mine from the Cambria company to the Cleveland-Cliffs. The latter carried on a good deal of surface construction work, including building a concrete dam at Lake Michigamme. It did drilling on the Barnes land, west of Ishpeming, and unwatered the old Dexter mine. The Volunteer also drilled on its lands at Palmer, locating some ore.

The No. 7 Hard Ore mine, the Breitung Hematite and the Mary Charlotte were closed down during the year. The Milwaukee-Davis and the Barron were abandoned. The Cleveland-Cliffs reduced forces, closed mines and cut wages, and wage cuts were general with the other companies.

Jones & Laughlin continued sinking at Iron Mountain

Lake, and the Breitung Hematite is opening a new mine at Negaunee to be called the Lucky Star. Cleveland-Cliffs continued sinking its Athens shaft and did development work at the Mackinaw and Gardner. The Cascade completed its shaft and started drifting in the ore. The American-Boston closed its American mine for repairs, but reopened. The Jones & Laughlin Lake Angeline is about to be definitely abandoned.

GOGEBIC RANGE

Complete shipments from the Gogebic for the year were 3,363,419 tons, a reduction of only about 26% from 1913, probably the best showing of any range except the Cuyuna. The Asteroid, Castile, Colby, Ironton, Mikado, Windsor, and Yale were shut down altogether on account of the poor state of the market, but it is expected they will be opened again as soon as business conditions improve.

The Wakefield, of the M. A. Hanna Co., was stripped to the producing stage this year, and about 350,000 tons of ore shipped. Additional stripping is still required. This is the only steam-shovel openpit in Michigan. Construction and development work was continued at the Palms-Anvil property of the Newport mine, and late in the year announcement was made of a new shaft to be sunk at the Newport proper.

Luther Brewer, of Ironwood, and some Milwaukee people did some drilling in the Wakefield district, but the results are not obtainable. Oglebay-Norton found a new deposit of ore in the Ottowa mine and expects to sink a shaft in 1915.

IRON RIVER-CRYSTAL FALLS

While figures on shipments are not available, it seems probable that the Iron River-Crystal Falls region suffered more than any other, due to the fact that its characteristic high phosphorus ore is the first to feel a depression in the ore market. A good deal of construction work and some exploration was carried on, nevertheless.

In Sec. 30-43-32 some drilling was done by Minnesota interests, and after these interests threw up the option the Cole & McDonald Exploration Co. took it up and continued drilling. The Bristol Mining Co. did some drilling on a property west of the Bristol mine and is said to have had excellent results. The Longyear company continued drilling between Crystal Falls and Iron River without definite results. The St. Clair Exploration Co. drilled Sec. 26-43-35, and is reported to have cut ore. Some underground and check drilling was done by various companies.

During the year work was done on the Hilltop and Warner mines, but they were later abandoned. The Bates operated to some extent during the year, but did not ship. The Davidson mine operated about as usual and installed some new machinery. Oglebay-Norton had an extremely slack season; the Chatham and Berkshire were scarcely worked at all, the Bristol for less than half the year. Pickands-Mather worked only the Caspian; the Fogarty, Bengal and Baltic were idle. Shipments from stockpile were made from most of these mines, however. Near the village of Amasa the Hemlock has about breathed its last; but the Longyear-Hartley interests have begun active development on the Porter mine, which contains a fair amount of bessemer ore. Of the Wickwire mines, the Cortland, the Homer, and the Wickwire were worked to some extent and small shipments made. The Virgil was idle through the year. Corrigan-McKinney worked out and abandoned the Armenia, worked the Baker for half a year and made shipments, but kept the Tobin and Great Western idle for all of the year. Development work and a little shipment was made from the Dunn; a good deal of development work and surface construction was carried on at the Tully and some shipments made. The Rogers mine of the Rogers-Brown interests made its first shipment this year. The Hiawatha worked at its usual rate for most of the year, but a mine fire in the slate hanging wall required it to be shut down in October. At the Chicagon the work went on about as usual. The Carpenter, of the Hanna company, entered the shipping list in 1914. An electric generating plant installed here furnishes power for the Ravenna, which is electrically equipped, as is the Carpenter. The company abandoned the Hollister.

At the Balkan, Winston Bros. started stripping in April. The use of drag-line excavators is an innovation on this job. Surface construction and the installation of machinery was carried on during the year, and the shaft completed for drainage purposes. At the adjacent Judson the shaft was carried down far enough to permit mining in a small way on the first level. Crosscutting, drifting, and the installation of machinery completed the work for the year. Several thousand tons of ore were hoisted, but no shipments were made.

IRON MOUNTAIN REGION

Twelve mines shipped from the Menominee range proper during 1914, but figures on shipments are not available. Most of the mines operated during part of the year, most of them also closed down later. Among those closing down were the Traders, the Walpole, the Millie, the Penn, and the Monroe. Those that are still working have reduced forces or cut the number of working days. There was no drilling of any importance conducted during the year, and no new mines were opened. An attempt at reopening the Indiana, now controlled by the Thomas Furnace Co., of Milwaukee, was made, and, in fact, unwatering was pretty well completed when orders to cease were received.

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Sulphur in 1914

The principal producer of sulphur in the United States, as heretofore, was the Union Sulphur Co., the production of which, in 1914, was about 375,000 long tons. Some of the largest producing wells ever brought in were pumped in 1914, and, in consequence, steaming operations were much reduced; only three wells were being pumped at the end of the year. The company increased its large stock of sulphur at Sulphur, La., notwithstanding that it operated only half its steaming plants in 1914. The disturbed conditions in Europe interrupted the demand there, and shipping conditions helped to demoralize that market. At its four European distributing stations, the company had fair stocks at the end of 1914, though hardly sufficient to supply the demands that arise at this time. The company's refineries at Cette and at Marseilles were the subject of much suspicion in France at the outbreak of the war, owing to the fact that sulphur is still contraband of war and to the fact that the local managing officials were Germans. The Germans fled and the plants were hreatened with seizure by the French government; howver, after some negotiations, this was averted by satisactory representation of American ownership being iade.

No report of production was obtained from the Freeort Sulphur Co., which operated the Bryan Heights roperty at Freeport, Tex. The company placed its second steaming plant in operation in the autumn, and at ie end of the year was supposed to be producing at the ite of about 200 tons per day. There was no other roduction of consequence in the United States, as most f the sulphur deposits are not conveniently situated with spect to the principal markets. Some exploration took lace in Texas, but most of the deposits under consideration were too far from the seaboard to compete in the eneral market.

Markets of the Minor Metals

Antimony

Antimony was spectacular in its antics. Practically ie whole of our supply comes from foreign countries. ome of this, like the Hungarian, was completely cut off, hile some, like the Chinese and Japanese, was temporary suspended by transportation difficulties. At the beginmg of 1914 common brands of antimony were worth iout 6c. per lb. At the mid-year 5¾c. At the first August, 5½c. At the middle of August, 16 to 18c. As inditions righted themselves, the price gradually deined to 9c. in October, but then Russia, needing antiony for military purposes, bought largely in this mart, which was contributory in putting the price up again 15c. At the close of the year it is about 13@14c. his will, without doubt, lead to the reopening of antiony mines in the United States, which are unprofitable low prices, while there is an immense deposit of antiony ore in Mexico which may be exploited if that couny should become reasonably safe.

AVERAGE PRICES OF ANTIMONY

(In Cents per Pound)

	1912			1913			1914		
	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries
nuary	7.53	7.47	6.88	9.94	9.53	8.97	7.388	7.110	6.125
bruary	7.27	7.44	6.83	9.47	9.09	8.25	7.250	7.057	6.100
arch.	7.65	7.56	6.86	9.28	8.85	8.18	7.315	7.073	6.053
ril.	8.65	7.75	6.94	9.13	8.50	7.98	7.363	7.048	6.006
ay.......	8.02	7.75	7.10	8.88	8.37	7.79	7.365	7.020	5.845
ne..	8.09	7.78	7.21	8.79	8.27	7.61	7.250	7.000	5.825
ly.......	8.42	7.96	7.50	8.54	8.08	7.55	7.240	6.940	5.638
gust	8.59	7.98	7.70	8.38	7.91	7.39	17.250	15.800	13.800
ptember	9.12	8.50	8.21	8.37	7.93	7.37	11.830		9.940
tober	10.20	9.62	9.30	7.69	7.27	6.49	14.680		12.060
vember.	10.29	9.86	9.30	7.62	7.30	6.45	17.750		14.450
cember	10.21	9.62	9.18	7.50	7.25	6.13	16.130		13.310
Year	8.90	8.26	7.75	8.73	8.22	7.52	10.732		8.763

The rise in the price of antimony was reflected in the rice of antimony oxide, which gradually rose from 6c. August to about 10c. at the end of 1914. The principal producer of antimony oxide is the Harshaw, Fuller Goodwin Co., of Cleveland, Ohio. Its principal use to reduce crazing in the manufacture of enameled are.

Platinum

Platinum was steady at $43@45 up to August. Then jumped to $55@60, but settled back to $50. The adunce was attributable especially to fear of a suspension supply from Russia. The export from there did cease, t this had no great effect upon the market here, which began to decline in October and soon was back at $43@45. This was rather a surprising development, inasmuch as production in Russia had come practically to a standstill, and much distress among the miners was reported from there, to relieve which the Imperial Bank made advances of 18,000 rubles per pood of crude metal unsalable by the producers.

AVERAGE PRICES OF PLATINUM

In Dollars per Ounce Troy

	New York Refined Platinum	Russia, Crude Metal 83% Platinum	
		St. Petersburg	Ekaterinburg
January	43.38	36.43	36.28
February	43.50	36.36	36.28
March	43.50	36.39	36.28
April	43.50	36.46	36.28
May.	43.50	36.41	36.28
June	43.50	36.09	36.00
July..	43.50	35.72	35.72
August	50.20		
September	50.00		35.72
October...	49.50		33.84
November.	45.45		
December	42.19		
Year	$45.14		
Average for 1913	44.88	$36.54	$36.25
Average for 1912	45.55	37.08	37.05
Average for 1911	43.12	35.21	35.09
Average for 1910	32.70	26.96	26.37

The production of platinum in Russia is estimated at something between 60,000 and 80,000 ounces. The decrease was due at first to some uncertainty as to the course of the Government in permitting exports of crude metal; later to the scarcity of miners, a large number having been called into the army.

Supplies from Colombia, as usual, were rather irregular and uncertain. The production in the United States was about as usual, a few hundred ounces being obtained from gold parted and refined by the Mint, chiefly from northern California. A small quantity is also obtained from complex ores treated by the Balbach Smelting & Refining Co.

Iridium was irregular in price, owing to small supplies. At times as much as $85 or $90 per oz. was paid. It is necessary in making the hard metal used for magneto points in the automobile engine. In consequence of the high prices the differential between ordinary platinum and refined metal has advanced to from $4 to $7 per oz., according to quality.

Imports of platinum into the United States for the 10 months ended Oct. 31, 1914, were 66,544 oz., 28,496 oz. being unmanufactured and 38,048 oz. manufactured forms; in addition, chemical ware valued at $33,337 was imported. For the corresponding period in 1913 the import included 41,669 oz. crude, or unmanufactured, 59,048 oz. manufactured and $82,970 worth of chemical ware.

Cadmium

A small production of cadmium was made in the United States in 1914 by the Grasselli Chemical Co., at Cleveland, Ohio, and by the American Smelting & Refining Co., at its Globe plant at Denver, Colo. The total is probably not very different from that of 1913, which we estimated at 25,000 pounds.

During the first seven months of 1914 the price of metallic cadmium ranged from 95c. to $1.15 per lb., quotations varying according to quantity and quality. During August and September a few sales were made as high as $1.35 per lb., after which the market relapsed to the previous basis of 95c. to $1.15.

New Mine and Metallurgical Construction in 1914

Alaska Gold Mining Co., Juneau, Alaska, is completing the installation of the first 6000-ton unit of their mill.

Alaska-Treadwell, Treadwell, Alaska, added 30 stamps to its Seven-Hundred mill; 300-stamp mill was electrified, and plans made for electrifying the 240-stamp mill.

Delarof Development Co., Unga Island, Alaska, broke ground June 15 for 200-ton cyanide plant to cost $25,000, and to be completed Nov. 1. Plant to treat 400,000 tons tailings of Apollo company, now on the tide flats of Unga Bay.

Arizona Consolidated Gold Mines Co., Kingman, Ariz., broke ground June 1, 1914, for a Nissen stamp mill of 6 to 12 tons daily capacity, which was completed Aug. 1; cost of installation, $7500.

Copper Queen Consolidated Mining Co., Bisbee, Ariz., broke ground Feb. 4 for a test concentrating mill, of 50 tons daily capacity, which cost $40,000, and was scheduled for completion June 1, 1914.

Hermitage Mining & Milling Co., Hereford, Ariz., has completed a two-jig concentrator of 30 tons daily capacity, at a cost of $11,000.

International Smelting & Refining Co., Miami, Ariz., broke ground in December for a copper smelter, which will have capacity for producing 100,000,000 lb. of copper annually. The cost will be $2,000,000, and the plant will consist of four reverberatory furnaces, blast furnace and converters.

Kelvin-Sultana Copper Co., Kelvin, Ariz., built a concentrator of 100 tons daily capacity, to cost $50,000, completed about June 1, 1914.

Pasquale Copper Co., Bellevue, Ariz., broke ground May 1, for a 100-ton flotation plant, which will cost $35,000 and be completed in six months.

R. F. Schaefer, Vulture, Ariz., will build a mill with three to five stamps.

Twin Peaks Mining & Milling Co., York, Ariz., built a concentrator and cyanide plant of 50 tons daily capacity. It was scheduled to be completed Mar. 1, 1914.

Argonaut Mining Co., Jackson, Calif., expects to remove 40-stamp mill to a new site and increase to 50 stamps.

Ash Creek Mining Co., Hornbrook, Calif., broke ground July 1 for a six-stamp mill with capacity of 18 tons, to cost $6000 and to be completed about Dec. 1.

Bishop Creek Milling Co., Bishop, Calif., broke ground Apr. 1 for a $25,000, 10-stamp mill and cyanide plant of 50 tons daily capacity. Completed about July 1, 1914.

Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., is planning to build a mill of 50 tons daily capacity at a cost of $20,000.

California Exploration Co., Ltd., Plymouth, Calif., built an amalgamation and concentration mill of 300 tons daily capacity.

Conzetti Mine, Cecilville, Calif.—Claims bonded to L. E. Spear under agreement to install a 10-ton mill unit every six months until capacity of 100 tons is obtained.

Empire Mines & Investment Co., Grass Valley, Calif., broke ground May 15 for a mill of 240 tons daily capacity, which, it was estimated, would cost $75,000, and be completed by Jan. 1, 1915.

Engels Copper Mining Co., Taylorsville, Calif., broke ground, June 1, for 250-ton Minerals-Separation flotation mill, capable of being extended to 400 tons by small additions to apparatus. Plant was to cost $40,000, and was to be completed Nov. 1, 1914.

Excelsior Gold Mines Co., Forest Hill, Calif., is building a stamp mill of 200 tons daily capacity.

Keane Wonder Mining Co., Keane Wonder, Calif., broke ground in December for a crushing (three sets of rolls) and cyaniding plant of from 300 to 500 tons daily capacity; estimated cost $50,000 and scheduled date of completion, June 1, 1914.

Melones Mining Co., Melones, Calif., broke ground, Aug. 1 for 250-ton cyanide sand-leaching plant to cost $10,000 to $12,000, and to be completed Oct. 1, 1914.

Midas Gold Mining Co., Knob, Shasta County, Calif., is building an all-sliming cyanide plant for stored and current tailings, of 100 tons daily capacity, at a cost of $30,000. Ground was broken in June, 1913, and the plant was to be completed in December, 1914.

Mountain Copper Co., Keswick, Calif., is building a flotation concentrator, for copper ore, of 250 tons capacity.

Mountain King Mining Co., Mountain King, Calif., broke ground Oct. 6 for a 150-ton 30-stamp concentrating plant, to cost $50,000 and to be completed in January, 1915.

R. P. Newcomb, Oat Hill mine, Middletown, Calif., completed a concentration plant for cinnabar ore.

Phœnix Cyanide Co., Johannesburg, Calif., completed Nov. 26 a 15- to 25-ton agitation and cyanide plant, costing $2500.

Royal Consolidated Gold Mines, Copperopolis, Calif., contemplated overhauling old 120-stamp mill and installing new machinery.

Sierra-Alaska Mining Co., Pike, Calif., is building experimental cyanide plant, 10-tons capacity, to be enlarged if process is successful.

St. Francis Gold Mining Co., Moretown, Calif., broke ground Mar. 1, for a 5-stamp mill of 16 to 20 tons daily capacity, which cost $3000.

Tulare Mining Co., Porterville, Calif., contemplates installing machinery to manufacture epsom salts from magnesite waste.

Arnold Concentrating Machinery Co., Lawson, Clear Creek County, Colo., broke ground Mar. 25, 1914, for a concentrator for treating low-grade ores, which cost $10,000 and was completed May 25.

Cariman Mining & Milling Co., Caribou, Colo., broke ground in July for 150-ton concentrating and cyanide plant to cost $6000. To be completed Nov. 1, 1914.

Dorit Mining, Milling, Tunnel & Transportation Co., Idaho Springs, Colo., was to break ground Apr. 15 for an amalgamation and concentration works of 50 tons daily capacity, to cost $25,000, and to be completed Aug. 1; a cyanide plant is to be built later.

El Oro Mining & Milling Co., Elkton, Colo., is building a combination milling plant of 300 tons daily capacity, which will cost $100,000.

Hector Mines Development Co., Westcliffe, Colo., broke ground Aug. 10, for 50-ton cyanide plant to cost $40,000.

Mineral Hill Ore Reduction & Leasing Co., Cripple Creek, Colo., was to break ground May 15, for a cyanide plant of 100 tons daily capacity, which was estimated to cost $30,000 and be completed by Aug. 1.

Mountain Top Mining Co., Ouray, Colo., expects to build a mill.

Standard Chemical Co., Naturita, Colo., completed Nov. 25 a 30-ton concentrating mill, costing $100,000.

Tomboy Gold Mines Co., Ltd., Telluride, Colo., broke ground May 7, 1914, for a cyanide plant of 400 tons daily capacity for the treatment of tailings, which cost $150,000 and was completed Dec. 1.

United Zinc & Lead Co., Leadville, Colo., broke ground May 15, for a zinc oxide plant of 50 tons daily capacity at the start and which was completed in August.

Vindicator Consolidated Gold Mining Co., Independence, Colo., broke ground Dec. 1, 1913, for a screening plant of 200 tons daily capacity, which cost $20,000.

Vindicator Consolidated Gold Mining Co., Independence, Colo., completed Oct. 15 a 500-ton concentrating mill, costing $40,000.

Wanakah Mining Co., Ouray, Colo., broke ground May 1 for a 200-ton copper matting furnace additional to 100-ton plant already in operation. To cost $50,000, and to be completed Oct. 20.

Western Zinc Mining & Reducing Co., Leadville, Colo., broke ground, Mar. 23, for a zinc-oxide plant of 50 tons daily capacity, which it was expected would be completed by Aug. 1.

Virginia Consolidated Gold Mining Co., Sandy Creek, Lemhi County, Idaho, broke ground in May for an amalgamation and concentration mill of 20 tons daily capacity, to cost $25,000, which was to be completed in October. The mill is driven by water power.

Anne Lee Mining Co., Spring City, Mo., broke ground Dec. 10, 1913, for a zinc, lead and silicate concentrator of 250 tons capacity per 10 hr., which cost $50,000 and was completed Apr. 20, 1914

Cumberland Mining & Milling Co., Joplin, Mo., broke ground July 15 for 350-ton concentrating plant to cost $25,000, and was to be completed Oct. 5.

Schoolhouse Mining Co., North Carterville, Mo., broke ground Jan. 20 for a zinc concentrator of 800 tons daily capacity, which cost $20,000 and was completed Apr. 10, 1914.

Tecumseh Mining Co., Thoms Station, Mo., operated by Homer Seals, Joplin, Mo., is building a mill of 150 tons' daily capacity, which will cost $10,000.

White Pine Copper Co., Ontonagon, Mich., broke ground Apr. 15, for a stamp mill of 1000 tons daily capacity, which, it is estimated, will be completed by May 1, 1915.

Cleveland-Cliffs Iron Co., Nashwauk, Minn., expected to break ground Mar. 15, 1914, for a washing plant to treat Mesabi sandy ores, of 2000 tons of concentrates daily capacity.

Anaconda Copper Mining Co., Anaconda, Mont., is building, at the Washoe Reduction Works, a leaching plant of 2000 tons daily capacity, to cost $900,000, and a sulphuric-acid plant of 100 tons daily capacity, to cost $350,000.

Barnes King Development Co., Marysville, Mont., is building a cyanide plant of 100 tons daily capacity, all orders for machinery and equipment having been placed.

Butte Duluth Mining Co., Butte, Mont., is building a mill for treating 1000 tons of ore per day, which will cost $130,000.

Butte Duluth Mining Co., Butte, Mont., broke ground Nov. 1, 1913, for a leaching plant with electrolytic precipitation of 1000 tons' capacity, which cost $250,000 and was completed in July.

King & Queen Mining Co., Keystone, Mont., is building a lead-silver ore concentrator of 125 tons daily capacity, at an estimated cost of $20,000.

Northwestern Metals Co., Helena, Mont., is operating a dry chlorination zinc works of 100 tons daily capacity, which cost $375,000.

Poryphyry Dike Gold Mining Co., Rimini, Mont., broke ground June 25 for 100-ton stamp mill with amalgamating plates, to cost $40,000, and to be completed Sept. 15, 1914.

Timber Butte Milling Co., Butte, Mont., has completed a zinc-ore concentrator of 350 to 400 tons daily capacity, at a cost of $600,000.

Aurora Con. Mining Co., Aurora, Nev., completed construction of its 500-ton all-sliming cyanide mill. Now running.

Boss Gold Mining Co., Goodsprings, Nev., built a cyanide test plant of 25 tons daily capacity this summer.

Bluster, Elko, Nev., is building a small mill, duplicate of that of the Elko Mining Co.

Carrara Mining & Milling Leasing Syndicate, Carrara, Nev., broke ground Dec. 20, 1913, for a $5000 mill, containing three 15-ton chilean mills, scheduled to be completed Feb. 20, 1914.

Commercial Mines & Milling Co. of Manhattan, Manhattan, Nev., made an addition to the old mill, to bring it up to a capacity of 200 tons per day.

Eastern Star Mining Co., Midas, Nev., expected to break ground Nov. 1 for 50-ton all-slime cyanide plant.

Elko Mining Co., Jarbidge, Nev., built a cyanide plant last summer.

Irwin Bros., Current, Nye County, Nev., completed a small stamp mill of 10 to 15 tons' daily capacity, May 1, 1914; it cost $2000.

Legitimate Mines Co., Jarbidge, Nev., is drawing up plans for a small mill.

Metals Recovery Co., Dayton, Nev., has completed a cyanide plant of 200 tons daily capacity, which cost $50,000.

Nevada-Douglas Copper Co., Ludwig, Nev., broke ground Aug. 1914, for 250-ton copper-leaching plant to cost $125,000 and to be completed in January, 1915.

Nevada Packard Mines Co., Rochester, Nev., began grading Oct. 1, for the first 50-ton unit of a cyanide plant.

O'Kelly & Munzberg, Goodsprings, Nev., contemplate erecting a milling plant at the Frederickson property.

Pittsburg-Dolores Mining Co., Rockland via Yerington, Nev., broke ground June 1 for an 80-ton cyanide mill to cost $40,000, to be completed Apr. 1, 1915.

Rochester Consolidated Mining & Milling Co., Rochester, Nev., broke ground Aug. 1, for 100-ton all-slime cyanide plant, using the Dow system, to cost about $100,000, and to be completed Feb. 1, 1915.

Sunset Mining & Development Co., Rhyolite, Nev., is building a stamp mill and cyanide plant of 2000 tons monthly capacity.

George Threlfall, Candelaria, via Mina, Nev., is planning to build a mill of 25 tons daily capacity.

Tonopah Belmont Development Co., Tonopah, Nev., is remodeling the old mill at Millers, operating at half capacity meanwhile.

Tonopah Extension Mining Co., Tonopah, Nev., added 10 stamps to its 30-stamp mill. Addition now running.

Tonopah Mining Co., Millers, Nev., changed its Desert mill from 500-ton double-treatment plant to a 400-ton all-slime mill.

Union Mines Co., Union, via Palisades, Nev., broke ground June 24 for 50- to 100-ton concentrating plant to cost $125,000, and to be completed June 1, 1915.

West End Con. Mining Co., Tonopah, Nev., added 10 stamps and a tube mill to its plant. Addition now running.

Wagner Azurite Copper Co., Luning, Nev., has completed a 100-ton leaching plant for copper ore, the first of several units, which will be built later if the first gives satisfaction.

West End Consolidated Mining Co., Tonopah, Nev., broke ground Nov. 15, 1913, for a 10-stamp addition to its 20-stamp mill, increasing the capacity by 50 tons daily. Addition cost $30,000. Completed Mar. 10, 1914. Mill capacity, 220 tons per day.

Winnemucca Milling & Ore Purchasing Co., Winnemucca, Nev., is about to begin building a 35-ton mill and sampling plant for custom work.

International Smelting Co., Perth Amboy, N. J., is enlarging Raritan refinery from 35,000,000 to 40,000,000 lb. monthly capacity.

Northern Ore Co., Edwards, N. Y., broke ground Oct. 1 for a 50- to 100-ton concentrating mill, to be completed Dec. 1, 1914.

Cossak Mining Co., Bland, N. M., broke ground Jan. 1 for an all-sliming cyanide plant of 100 tons daily capacity, to cost $75,000.

Hill City M. & D. Co., Hill City, S. D., purchased hoisting machinery for its 100-ft. shaft.

Homestake Mining Co., Lead, S. D., is building a boiler plant containing six 600-hp. boilers to drive new hoisting engine at B. & M. shaft, and an electric-generating plant.

Mogul Mining Co., Deadwood, S. D., completed new 150-ton mill near Terry, S. D.

Rattlesnake Jack, Galena, S. D., is building a cyanide plant containing stamps, Trent cyaniding machinery and Merrill precipitation.

Titanic, Carbonate, S. D., proposes to build a cyanide mill

Dome Mines Co., Porcupine, Ont., changed treatment system, added 40 stamps and leaching tanks to the mill.

Hollinger, Timmins, Ont., increased the mill installation and rearranged treatment system.

McIntyre, Porcupine, Ont., is installing a counter-current decantation system for handling slimes tailings. It will soon be in operation.

Schumacher Gold Mines, Ltd., Schumacher, Ont., expects to break ground in April, 1915, for a 100-ton cyanide plant.

Tough-Oakes Gold Mines, Ltd., Kirkland Lake, Ont., is building 100- to 125-ton cyanide plant.

Vipond, Schumacher, Ont., built a cyanide plant to treat ore from its mine which had previously been treated by amlagamation.

Church-Mabon Mining Co., Miami, Okla., is building a lead and zinc mill of 200 tons daily capacity and which will cost $25,000. Ground was broken Dec. 1, 1913, and mill was to be completed Mar. 1, 1914.

Lennan Zinc & Lead Co., Miami, Okla., began the erection of a new concentrator in April.

Ben Harrison Mine, Whitney, Ore., expected to break ground in July for a cyanide plant of 120 tons' daily capacity to cost $40,000 and be completed by October.

Golden Gate Mining Co., Greenhorn, Ore., broke ground July 1 for a 35-ton amalgamating plant, to cost $45,000, and to be completed about Jan. 1, 1915.

Good Hope Mining Co., Keystone, S. D., broke ground Oct. 1 for a 10-stamp mill with a capacity of 40 tons, to cost $10,000 and to be completed Jan. 1, 1915.

Aluminum Co. of America, Maryville, Tenn., broke ground for a reduction plant July 1, 1913, which was completed in March.

Park City Milling Co., Park City, Utah, began remodeling the Grasselli mill Mar. 17, 1914, for treating 50 tons of ore daily, by chlorination, the cost being $21,000 the work was completed early in July.

Utah Minerals Concentrating Co., Eureka, Utah, completed in November a 100-ton centrifugal concentrating plant, to treat Chief Consolidated ores.

Hammond Mining Co., Glacier, Wash., is reconstructing an old milling plant and adding modern cyanide equipment.

Chewelah Copper King Mining Co., Chewelah, Wash., is building a smelter of 100 tons daily capacity, which will cost $50,000.

Metaline Oriole Mining Co., Metaline, Wash., broke ground Oct. 1, 1913, for a concentrator of 50 tons daily capacity, to cost $5000, and which was scheduled for completion June 1, 1914.

Field Mining & Milling Co., New Diggings, Wis., broke ground in December for a 450-ton zinc concentrating mill to cost $30,000 and was to be completed in April, 1915.

Lawrence Mines Co., Hazel Green, Wis., completed entire mining equipment and mill of 150 tons' capacity per 9-hr. shift.

Mineral Point Zinc Co., New Diggings, Wis., will soon complete, a Joplin-type mill of 250 tons' daily capacity at a cost of $12,000.

Wisconsin Zinc Co., New Diggings, Wis., broke ground May 1, 1914, for a hoisting plant and mill of 300 tons capacity per 24 hr., at a cost of $50,000; completed in September.

Western Wyoming Mining & Milling Co., Cokeville, Wyo., expected to break ground May 1, for a 50 to 75 tons daily capacity treatment plant, to cost $20,000.

Aguacate Mines, San Mateo, Costa Rica, has completed a cyanide plant of 3000 tons annual capacity.

Broken Hill, Lillooet, B. C., is building a large concentrator.

Braden Copper Co., Rancagua, Chile, is figuring on completing its works of 10,000 tons daily capacity, which will cost $7,000,000, in two and a half years.

Chontalpan y Anexas, Tetepac, Guerrero, Mexico, is reported to have ordered five additional stamps for the mill.

Escorpion Mine, Hostotipaquillo, Jalisco, Mexico, is reported to be planning a 10-stamp mill and cyanide plant.

Mutual Mining & Milling Co., Mexico City, is reported to be building a concentrator.

Mt. Morgan Gold Mining Co., Mt. Morgan, Queensland, Australia, is building a concentrator and smelter of 400,000 tons annual capacity, shops and power plant, at a cost of $1,600,000.

⁂

Aluminum

The aluminum business in 1914 exhibited but few points of interest. During the last quarter of 1913 the consumption of aluminum decreased largely, in common with the reduction of business activity in other lines throughout the United States. The demand for aluminum during 1914 was practically the same as it was during the last quarter of 1913, i.e., small in volume and listless in character. There was a little spurt during March, but it proved to be short-lived, and with the exception of this little show of activity, the market for 15 months has been slow and substantially less than during the first nine months of 1913.

AVERAGE MONTHLY PRICE OF INGOT ALUMINUM
(In New York, in cents per pound)

Year	1911	1912	1913	1914		1911	1912	1913	1914
Jan.	20.13	19.13	26.31	18.81	July	20.20	23.50	23.38	17.66
Feb.	21.25	19.44	26.04	18.81	Aug.	20.02	24.38	22.70	19.88
Mar.	21.15	19.58	27.05	18.50	Sept.	19.34	25.13	21.69	19.94
April	20.75	20.38	27.07	18.16	Oct.	18.75	26.25	20.13	18.50
May	20.55	21.69	26.44	17.95	Nov.	18.79	26.56	19.35	18.00
June	20.03	22.83	24.68	17.75	Dec.	18.85	25.75	18.88	18.96
					Year	20.067	22.01	23.64	18.63

The foil mill of the Aluminum Co. of America was started in the spring of 1914 and has developed a successful and substantial business, although at best the tonnage of foil consumption in this country is not large. The product of this mill is taking the place partly of aluminum foil which was formerly imported and partly of tin foil and is used for wrapping tea, chocolate, tobacco and other such commodities.

The Aluminum Co. of America also started in 1914 its plant at Maryville, Tenn., which, however, is a small plant and has not added substantially to the output of the United States.

WORLD'S PRODUCTION OF ALUMINUM
(Metric Tons)
(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States	18,000	19,500	22,500
Canada (exports)	2,300	8,300	5,900
Germany Austria-Hungary Switzerland	8,000	12,000	12,000
France.........	10,000	13,000	18,000
England	5,000	7,500	7,500
Italy	800	800	800
Norway	900	1,500	1,500
Totals	45,000	62,600	68,200

With the above exceptions, the Aluminum Co. of America and its interests did not do anything new in 1914, but it is getting ready to start next spring on an important plant at Edgewater, N. J., the land for which has been purchased and the plans for the buildings and machinery of which are now being made. The Edgewater plant will be a sheet mill and stamping factory, making sheet for the trade, cooking utensils and other finished goods.

WORLD'S CONSUMPTION OF ALUMINUM
(Metric Tons)
(From statistical report of the Metallgesellschaft, Frankfurt am Main)

	1911	1912	1913
United States[a]	20,900	29,800	32,800
France.....	5,000	6,000	7,000
England	3,000	4,000	5,000
Italy	900	1,000	1,000
Other countries	17,000	22,100	21,000
Totals..............	46,800	62,900	66,800

[a] U. S. Geological Survey.

The Southern Aluminum Co. continued its construction at Whitney, N. C., up to the outbreak of the war, when it found itself embarrassed by the financial tempests of the time and was obliged to suspend operations. Probably the affairs of this company will be adjusted before long and construction will be resumed.

The Aluminum Co. of America continues to be, therefore, the only producer of virgin aluminum in the United States, the remaining production being by concerns that resmelt scrap and junk. The imports of aluminum into the United States during the first 10 months of 1914 were 14,398,031 lb., compared with 20,775,103 lb. in the corresponding period of 1913.

⁂

Tungsten

During the first seven months of 1914 the production of tungsten ore was practically at a standstill, inasmuch as the steel works using the products therefrom—ferrotungsten, etc.—were doing the smallest business on record. Quotations for ore were merely nominal. In fact, for several months there was no production.

After the outbreak of the war the situation improved somewhat, but the use of tungsten products is not yet up to 50% of the normal. The principal orders came from foreign countries that were cut off from the German supply of finished products. This business was done only for immediate shipment and, necessarily, was done at a relatively high price, inasmuch as only such ores could be considered as were actually on hand. During the first seven months of 1914, tungsten prices averaged, probably, about 67c. per lb. Since the war, lots for immediate shipment have been sold as high as $1.35 per lb.

Mining Dividends in 1914

The tables which follow show the dividends paid in 1913, 1914 and to date by the principal mining, metallurgical and holding companies of America. The list includes practically all United States mining companies paying dividends since 1906, except a few which have ceased to have a separate corporate existence.

For the first time in several years the figures show a shrinkage in dividends paid. In 1913 there were 110 mining companies paid $73,440,701; in 1914 there were 90 companies paid $55,563,732. In neither year are the figures absolute, nor can they be. Certain corporations, and those not the least profitable, such as the New Jersey Zinc Co., will make no public report of their dividends. In others, such as Nevada Consolidated and Utah Copper, there is a duplication.

Nor can the dividends of metallurgical and holding companies simply be added to those of the mining companies as a gage of prosperity. The dividends of the Guggenheim Exploration Co. are almost entirely a duplication of the dividends of mining companies whose stocks are owned by the big corporation. However, on a comparative basis, these companies paid $99,740,693 in 1913; $91,782,505 in 1914.

Owing to the fact that most mines produce two or more commercial metals we have attempted no hard and fast distribution of companies into copper producers, lead producers, etc. One lonely quicksilver mine, New Idria, is in the list.

The Canadian list of mines is believed complete. The Mexican mines given are chiefly those in which American capital is interested. Of the Canadian, Mexican and Central American corporations listed, 51 paid $21,654,260 in 1913; 40 paid $15,058,220 in 1914.

These shrinkages need no apologies: The Great War; revolution in Mexico; and the last day of the Michigan strike are enough to explain them.

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES

COMPANY NAME	SITUATION	SHARES		DIVIDENDS PAID						
		Issued	Par Value	1913 Per Share	1913 Total	1914 Per Share	1914 Total	To Date Total	Latest Date	Latest Amount
Acacia, g	Colo	1,438,989	$1					$122,004	Jan. '11	$0.00½
Adams, s.l.c.	Colo.	80,000	10					778,000	Dec '09	0.04
Ahmeek, c.	Mich.	50,000	25	22.00	1,100,000	6.00	300,000	2,400,000	July '14	2.00
Alaska Goldfields	Alas	250,000	5			....		342,500	Jan '10	0.15
Alaska Mexican, g.	Alas.	180,000	5	1.00	180,000	0.80	144,000	3,417,381	Nov '14	0.20
Alaska Treadwell, g	Alas	200,000	25	5.00	1,000,000	5.50	1,100,000	14,885,000	Nov '14	1.00
Alaska United, g	Alas.	180,200	5	2.30	414,460	0.90	162,080	1,738,930	Nov '14	0.20
Am. Zinc, Lead & Sm.	Kan.	167,200	25	1.00	172,420	0.50	85,600	983,320	Jan '14	0.50
Anaconda, c.	Mont	4,662,500	25	3.00	12,997,500	2.50	11,161,250	92,579,375	Oct '14	0.25
Argonaut, g.	Calif	200,000	5			1.80	360,000	1,560,000	Dec '14	0.10
Arizona Copper, pf.	Ariz	1,266,120	1.20	a	119,221	a	119,221	2,009,744	Nov '14	
Arizona Copper, com.	Ariz.	1,519,896	1.20	b	1,292,669	0.24	831,003	16,815,497	July '14	0.24
Bagdad-Chase, g., pf.	Calif.	84,819	5				....	202,394	Jan. '09	0.10
Bald Butte, g.s.	Mont	250,000	1					1,344,648	Oct. '07	0.04
Baltic, c.	Mich	100,000	25	2.00	200,000			7,950,000	Dec. '13	2.00
Beck Tunnel, g.s.l.	Utah	1,000,000	0.10					940,000	Oct. '09	0.02
Benton, z.l.	Wis	196,607	1					10,949	Oct. '08	0.01½
Bingham-New Haven, c	Utah	228,690	5	0.20	45,738	0.20	45,738	385,695	Apr. '14	0.20
Board of Trade, z	Wis	120,000	1					78,000	Jan. '11	0.05
Bonanza Dev., g	Colo	300,000	1				....	1,425,000	Oct. '11	0.20
Boss, g.	Nev.	408,500	1			0.10	40,850	40,850	Dec. '14	0.10
Boston-Sunshine, g	Utah	150,200	1					27,261	Nov. '11	0.03¾
Brunswick, g	Calif	395,284	1	0.06	23,717	0.18	94,869	130,444	Nov. '14	0.06
Bull, Beck & Champ., g	Utah	100,000	10					2,728,400	July '08	0.10
Butte-Alex Scott, c	Mont	74,000	10	1.00	74,000			148,000	Oct. '13	0.50
Bunker Hill Con., g	Calif	200,000	1	0.62½	125,000	0.30	60,000	761,000	Dec. '14	0.02½
Bunker Hill & Sull., l.s	Ida.	327,000	10	2.50	817,500	3.00	981,000	15,710,250	Dec. '14	0.25
Butte & Ballaklava, c	Mont	250,000	10					125,000	Aug. '10	0.50
Butte & Superior, z	Mont.	271,136	5			2.25	610,054	610,054	Dec. '14	0.75
Caledonia, l.s	Ida.	2,605,000	1			0.05	130,250	182,350	Dec. '14	0.01
Calumet & Arizona, c.	Ariz.	617,385	10	5.00	3,059,209	3.00	1,850,475	20,941,524	Dec '14	0.50
Calumet & Hecla, c	Mich.	100,000	25	32.00	3,200,000	10.00	1,000,000	124,250,000	June '14	5.00
Camp Bird, g.s	Colo	1,100,051	4.86	0.24	267,312		....	9,483,524	Jan. '13	0.24
Camp Bird, pfd., g.	Colo.	650,000	4.86	0.34	221,130	0.34	221,130	724,020	July '14	0.17
Centennial-Eur., l.s.g.c.	Utah	100,000	5	3.00	300,000	1.50	150,000	4,050,000	Apr. '14	1.50
Center Creek, l.z	Mo.	100,000	10	0.30	30,000	0.20	20,000	510,000	Oct. '14	0.05
Champion, c	Mich.	100,000	25	9.00	900,000			8,400,000	Oct. '13	1.00
Chief Con., s.g.l.	Utah.	871,384	1	0.20	175,308	0.10	87,662	262,970	Aug '14	0.05
Chino, c.	Ariz.	777,458	5	2.25	1,919,070	2.50	2,162,050	4,081,120	Dec '14	0.50
Cliff, g	Alas.	100,000	1	0.25	25,000			210,000	Dec '13	0.05
Cliff, s.l.	Utah	300,000	1	0.10	30,000			90,000	Jan. '13	0.10
Colo. Gold Dredging	Colo.	100,000	10	1.00	100,000	3.50	350,000	650,000	Sept '14	1.00
Colorado, l.s.g	Utah	1,000,000						2,570,000	Dec '12	0.03
Columbus Con., l.g.s.	Utah	285,540	5					226,832	Oct '07	0.20
Commercial Gold	Ore.	1,750,000	1					43,750	Dec '09	0.00½
Comstock Phoenix, s	Nev	800,000	1					40,000	Nov '11	0.05½
Con. Mercur, g	Utah	1,000,000	1	0.30	30,000			3,445,313	July '13	0.03
Continental, z.l	Mo	22,000	25	1.00	22,000	1.00	22,000	319,000	July '14	0.03
Copper Range Con., c	Mich.	393,714	100	2.75	1,084,490			13,986,746	Oct '13	0.50
Daly-Judge, s.l	Utah	300,000	1	0.60	180,000	0.60	180,000	855,000	Dec '14	0.15
Daly West, s.l	Utah	180,000	20	0.15	27,000			6,606,000	Jan '13	0.15
De Lamar, g.s.	Ida	80,000	5					875,000	Aug '11	0.25
Dr. Jack Pot Com., g	Colo	3,000,000	0.10					45,000	Mar '11	0.00¾
Doe Run, l	Mo	65,782	100	5.00	328,844			3,550,969	Dec '13	0.75
Dunkin, g	Colo.	200,000	1	0.05	10,000			10,000	Oct '13	0.05
Elkton Con., g	Colo	2,500,000	1	0.08	200,000	0.08	200,000	3,479,000	Nov '14	0.02
El Paso, g	Colo	490,000	5	0.12½	61,250	0.10	49,000	1,707,545	Feb. '14	0.10
Eagle & Blue Bell, g.s.l	Utah	893,146	1	0.20	178,629	0.15	133,972	304,601	Oct '14	0.05
Ernestine, g.s	N. M	300,000	5					120,000	Dec '12	0.07
Federal M. & Sm., com	Ida	60,000	100					2,708,750	Jan '09	1.50
Federal M. & Sm., pf	Ida	120,000	100	6.00	719,131	5.00	599,305	8,986,948	Dec '14	1.00
Florence, g.	Nev	1,050,000	1					840,000	Apr. '11	0.10
Frances Mohawk, g	Nev.	912,000	1					516,000	Jan '08	0.05
Free Coinage, g	Colo.	10,000	100					180,000	Dec '09	1.00
Fremont Con., g	Calif	200,000	2.50	0.24	48,000	0.20	40,000	250,000	Oct '14	0.05
Frontier, z	Wis	1,250	100					146,202	Nov '12	2.00
Gemini-Keystone, g.s	Utah	5,000	100	20.00	100,000	15.00	75,000	2,305,000	Dec '14	5.00
Gold Coin of Victor, g	Colo.	1,000,000	1					1,350,000	Feb '09	0.02
Gold Dollar Con., g	Colo.	2,500,000	1					100,000	Dec '12	0.00[illegible]
Gold King Con., g	Colo.	5,750,370	1					1,407,319	Dec '11	0.03
Gold Sovereign	Colo.	1,800,000	1					31,571	Nov '12	0.00½
Golden Cycle, g	Colo.	1,500,000	1	0.27	405,000	0.55	825,000	3,420,000	Dec '14	0.20
Gold Chain, g	Utah	1,000,000		0.06	60,000			130,000	May '13	0.02

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES—Continued

		SHARES		DIVIDENDS PAID						
COMPANY NAME	SITUATION	Issued	Par Value	1913 Per Share	Total	1914 Per Share	Total	To Date Total	Latest Date	Latest Amount
Goldfield Alamo, s.l.....	Nev.	700,000	$1	..	......			$42,000	May '10	$0.03
Goldfield Comb. Fra., g	Nev.	922,000	1	..	...			92,111	Nov. '09	0.10
Goldfield Con., g	Nev.	3,558,367	10	0.70	1,491,403	0.30	1,067,744	27,398,214	Apr. '14	0.30
Grand Central, g	Utah	500,000	1	0.15	75,000	0.15	75,000	1,620,750	Sept. '14	0.05
Granite, g.	Colo.	1,650,000	1					270,000	Nov. '12	0.01
Hazel, g..	Calif.	900,000	1	0.12	108,000		....	971,000	Dec. '13	0.01
Hecla, l.s.	Ida.	1,000,000	0.25	0.32	320,000	0.22	220,000	3,190,000	Dec. '14	0.01
Hercules, l.s.	Ida.	1,000,000	1	1.50	1,500,000			5,500,000	'13	.
Homestake, g	S. D.	250,000	100	7.80*d*	5,422,326	7.80	2,210,208	36,482,174	Dec. '14	1.65
Horn Silver, s.c.z.l.	Utah	400,000	25					5,642,000	Sept. '07	0.05
Insurgent, g...	Wash.	100,000	1					25,000	Dec. '11	0.12½
Iowa-Tiger, g.s.l.	Colo.	3,000	1	1.00	3,250	2.00	6,000	9,250	Dec. '14	1.00
Iowa, g.s.l.	Colo.	1,666,667	1	0.01	16,667	0.00½	8,333	233,499	Aug. '14	0.00½
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	0.40	400,000	0.40	100,000	2,170,000	Oct. '14	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	0.40	200,000	0.20	100,000	4,950,000	Dec. '14	0.10
Isle Royale, c..	Mich.	150,000	25	1.00	150,000			150,000	Mar. '13	1.00
Jamison, g	Calif.	390,000	10					378,300	Jan '11	0.02
Jerry Johnson, g..	Colo.	2,500,000	0.10			0.00½	12,500	187,500	Nov. '14	0.00
Jumbo Ext., g.s.	Nev.	971,657	1			0.05	48,583	145,750	Dec. '14	0.05
Kendall, g	Mont.	500,000	5			0.06	30,000	1,505,000	July '14	0.06
Kennedy, g	Calif.	100,000	100					1,831,000	Apr. '10	0.03
King of Arizona, g	Ariz.	200,000	1					396,000	Aug. '09	0.12
Klar-Piquette, z.l.	Wis.	20,000	1	1.25	25,000			259,000	Apr. '13	0.50
Kennecott, c	Alas.	250,000	10	4.00	1,000,000	4.00	1,000,000	5,000,000	Jan. '14	4.00
Knob Hill, g.	Wash	1,000,000	3	0.02½	25,000			70,000	Oct. '13	0.00
Liberty Bell, g......	Colo.	130,551	5	0.80	106,891			1,559,179	Sept. '13	
Little Bell, l.s.	Utah	300,000	1					75,000	Mar. '11	0.05
Little Florence, g	Nev	1,000,000	1					430,000	Jan '08	0.03
Mammoth, g.s.c	Utah	400,000	25	0.05	20,000			2,300,000	July '13	0.05
Manhattan-Big Four, g..	Nev.	762,000	1					30,480	Aug. '11	0.02
Mary McKinney, g	Colo.	1,309,252	1	0.08	104,740	0.06	78,555	1,169,307	July '14	0.02
May Day, g.s.l.	Utah	800,000	0.25	0.03	24,000	0.03	24,000	156,000	Oct. '14	0.03
Mexican, s......	Nev.	201,600	2.50			0.75	141,750	161,910	June '14	0.75
Miami, c	Ariz.	746,759	5	2.00	1,491,979	1.50	1,120,138	3,712,239	Aug. '14	0.50
Mohawk Min. Co., c..	Mich	100,000	25	5.00	500,000	1.00	100,000	3,275,000	Aug. '14	1.00
Monarch-Madonna, g.s.l.	Colo.	1,000,000	1					40,000	May '11	0.01
Montana-Tonopah, s.g	Nev.	921,865	1					488,588	Dec. '12	0.10
Moscow M. & M., g.s.c.z	Utah	900,000	1	0.03	24,528.	0.03	27,000	67,480	Dec '14	0.03
Modoc, g.s..	Colo.	500,000	1		.			275,000	Dec '11	0.01
Mountain, g.s.	Calif.	250,000	25					4,216,250	May '08	0.44
Napa Con., q	Calif.	100,000	7					1,840,060	July '11	0.40
National, g.	Nev.	750,000	1					570,000	May '11	0.10
Nevada Con., c	Nev.	1,999,457	5	2.00	3,958,924	1.12½	2,249,389	16,976,708	Dec. '14	0.37½
Nevada Douglas, c...	Nev.	1,000,000	5	0.12½	125,000		....	125,000	Feb. '13	0.12½
Nevada Hills, g	Nev.	746,000	5					373,000	Dec.	
Nevada Wonder, g.s.	Nev.	1,400,000	1	0.20	281,548	0.15	211,181	492,729	Nov. '14	0.05
New Century, z.l.	Mo	330,000	1					237,600	Oct. '09	0.01
New Idria, q	Calif.	100,000	5	0.40	40,000	0.10	10,000	1,680,000	Apr. '14	0.10
North Butte, c	Mont.	410,000	15	2.00	820,000	1.50	615,000	11,890,000	July '14	0.50
North Star, g..	Calif.	250,000	10	1.20	300,000	1.80	450,000	4,537,040	Dec. '14	0.70
Old Dominion M. & Sm., c	Ariz.	162,000	25	5.00	10,000	2.75	445,000	3,807,000	Dec. '14	0.50
Ophir, s.g..	Nev	201,600	3					2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	0.02	17,980			80,907	Jan '13	0.02
Optimo, z..	Wis.	490	100	..				26,460	Nov. '12	5.00
Oroville Dredging	Calif.	700,000	5			0.24	170,100	1,553,137	Aug. '14	0.12
Osceola, c...	Mich.	96,150	25	10.50	1,009,575	3.00	288,450	12,179,675	July '14	1.00
Osceola, l.z.	Mo.	98,000	5	....				252,350	Oct. '12	0.07½
Parrot, c..	Mont	229,850	10	0.60	137,908	0.60	137,908	7,428,245	Nov. '14	0.15
Pearl Con., g..	Wash.	1,909,711	0					181,422	Dec. '10	0.02
Pharmacist, g	Colo.	1,500,000	1					87,500	Feb. '10	0.01½
Pioneer, g......	Ida.	1,000,000	1					2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l	Ida	1,000,000	1					216,810	Oct '12	0.04
Pittsburgh-Silver Peak, g.	Nev	2,790,000	1	0.06	167,400	0.04	111,600	771,200	July '14	0.02
Portland, g.....	Colo.	3,000,000	1	0.10	300,000	0.10	300,000	9,757,080	Oct. '14	0.02
Quartette, g.s.....	Nev.	101,000	10					420,000	Sept '07	0.10
Quilip, g......	Wash.	1,500,000	1				....	67,500	Feb. '12	0.01
Quincy, c.......	Mich.	110,000	25	3.75	412,500	0.50	55,000	20,897,500	Dec. '14	0.50
Ray Con., c..	Ariz.	1,482,436		1.12½	1,631,504	1.12½	1,634,692	3,266,796	Sept. '14	0.37½
Republic, g	Wash.	8,500,000	1					170,000	Nov. '12	0.01
Rochester, l.z.	Mo.	4,900	100					190,846	July '12	0.50
Round Mt., g....	Nev.	866,426	1	0.04	34,961			363,365	Aug. '13	0.04
St. Joseph, l....	Mo.	1,464,798	10	0.50	500,000	0.25	361,883	9,422,240	Dec '14	0.05
Seven Tr. Coalition, g	Nev.	1,500,000	1					37,500	July '12	0.02½
Shannon, c...	Ariz.	300,000	10	0.50	150,000			650,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1.50	525,000	1.50	525,000	2,100,000	July '14	0.50
Silver King Coalition, l.s.	Utah	1,250,000	5	0.30	375,000	0.15	187,500	2,534,850	Apr. '14	0.15
Silver King Con., l.s.	Utah	637,582	1	0.50	308,791	0.40	251,032	559,824	Dec. '14	0.10
Sioux Con., l.s.g	Utah	746,389	1					872,097	July '11	0.04
Skidoo, g.	Calif.	1,000,000	5			0.04	40,000	365,000	Oct '14	0.01
Snowstorm, c.g	Ida.	1,500,000	1	0.04½	112,463			1,192,103	Oct '13	0.00
Standard Con., g.s.	Calif	178,394	10	0.25	44,598			5,274,207	Nov '13	0.25
Stratton's Ind., g	Colo	1,000,000	10	0.06	60,750	0.03	30,375	456,625	Dec '14	0.03
Success, z	Ida	1,500,000	1	0.06	90,000		....	930,000	June '13	0.01
Superior & Pitts, c	Ariz.	1,499,792	10	1.52	1,279,688	1.76	2,639,639	8,578,820	Dec '14	1.00
Stewart, s.l........	Ida.	1,238,262	1	0.32½	402,415	0.60	742,956	1,145,373	Dec '14	0.13
Tamarack, c..	Mich	60,000	25					9,420,000	July '07	4.00
Tennessee, c	Tenn	200,000	25	3.75	750,000	2.25	450,000	4,306,250	Oct '14	0.75
Tomboy, g.s	Colo	300,000	4.86	0.96	301,320	0.96	301,320	3,634,065	Dec '14	0.48
Tonopah-Belmont, s.g	Nev	1,500,000	1	1.10	1,650,000	1.10	1,650,000	6,893,003	Oct '14	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	0.07½	70,764	0.25	224,858	636,817	Oct. '14	0.07
Tonopah of Nev., s.g	Nev.	1,000,000	1	1.45	1,450,000	1.00	1,000,000	12,100,000	Oct. '14	0.25
Tri-Mountain, c..	Mich.	100,000	25	2.00				1,450,000	Dec. '13	2.00
Tuolumne, c..	Mont	800,000	1	0.20	160,000			520,000	May '13	0.10
Tom Reed, g	Ariz	909,555	1	0.66	606,306	0.72	654,756	2,264,764	Dec '14	0.06
Uncle Sam, g.s.l.	Utah	500,000	1	.	.			495,000	Sept. '11	0.05
United Copper, com	Mont.	450,000	100					5,962,500	Aug '07	1.75
United Copper, pf	Mont	50,000	100					1,500,000	May '07	3.00
United, z.l., com	Mo	92,400	5					27,490	Oct '08	0.05
United, z.l., pf.	Mo	19,556	25					312,782	Jan. '08	0.50
United (Crip. Ck.), g	Colo	4,000,100	1					440,435	Jan '10	0.04
United, c	Wash	1,000,000	1					10,000	Nov '12	0.01
United Globe, c	Ariz.	23,000	100	30.00	690,000	26.00	598,000	2,127,500	Dec '14	7.00
United Verde, c	Ariz	300,000	10	6.75	2,025,000	3.75	1,125,000	34,597,000	Nov '14	0.75
Utah (Fish Springs), s.l.	Utah	100,000	10	..			..	281,860	Dec '10	0.02
Utah Copper, c	Utah	2,797,182	10	3.00	4,716,615	2.25	4,527,924	25,807,813	Dec '14	0.75
Utah Con., c...	Utah	300,000	5	1.50	450,000	2.00	600,000	8,550,000	Dec '14	0.50
Valley View, g.	Colo	1,000,000	1					240,000	Dec '11	0.04
Victoria, g.s.l..	Utah	251,000	1	.				207,500	Mar '10	0.04
Vindicator Con., g..	Colo.	1,500,000	1	0.12	180,000	0.12	270,000	3,082,000	Dec. '14	0.06
Wasp No. 2, g.....	S. D.	500,000	1	0.11	55,000	0.05	25,000	461,966	Oct. '14	0.01
Wellington, g.....	Colo	10,000,000	1	0.01	100,000		...	350,000	July '13	0.00
West End Con., g..	Nev.	1,868,186	1	0.05	93,424	0.15	280,277	373,701	Aug. '14	0.01

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES—Continued

COMPANY NAME	SITUATION	SHARES		DIVIDENDS PAID					Latest	
		Issued	Par Value	1913 Per Share	Total	1914 Per Share	Total	To Date Total	Date	Amount
Wolverine, c	Mich	60,000	$25	$5 00	$300,000	$4 00	$240,000	$7,980,000	Dec '14	$2 00
Work, g	Colo	1,500,000	1					172,500	July '08	0 00½
ak, s l	Colo	1,000,000	1	0 08	80,000	0 11	110,000	1,847,685	Dec '14	0 02
ankee Con., s l g	Utah	1,000,000	1	0 01	10,000			167,500	Jan '13	0 01
ellow Aster, g	Calif	100,000	10	0 45	45,000			1,154,789	July '13	0 05
ellow Pine, z l s	Nev	1,000,000	1	0 23	219,500	0.11	110,000	453,008	Dec '14	0 03
osemite, g	Calif	24,000	10	1 20	28,800	1 20	28,800	125,983	Dec. '14	0 02
ukon Gold, g	Alas	3,500,000	5	0 30	1,050,000	0 30	1,050,000	6,622,000	Dec '14	0 07½
Total					$73,140,701	..	$55,563,960	$804,403,037		
IRON, INDUSTRIAL AND HOLDING COMPANIES										
malgamated, c	Mont	1,538,879	$100	$6 00	$9,233,274	$5 00	$8,079,115	$90,125,988	Nov '14	$0 50
m Sm & Ref., com	U S	500,000	100	4.00	2,000,000	4 00	2,000,000	27,333,333	Dec. '14	1 00
m Sm & Ref., pf	U S	500,000	100	7 00	3,500,000	7 00	3,500,000	50,458,333	Dec. '14	1 75
m Smelters, pf A	U S	170,000	100	6 00	1,020,000	6 00	1,020,000	9,945,000	Oct. '14	1 50
m Smelters, pf B	U S	300,000	100	5 00	1,500,000	5 00	1,500,000	11,375,000	Oct. '14	1 25
ethlehem Steel..	Penn	149,100	100	5 00	745,400	5 00	745,400	3,018,870	Oct '14	1 25
ambria Steel....	Penn.	900,000	50	2 50	2,250,000	2 50	2,250,000	20,710,000	Nov '14	0 62½
rucible Steel, pf..	Penn	244,365	100	7 00	1,710,552	3 50	855,275	16,883,813	June '14	1.75
eneral Development	U S	30,000	100	1 50	44,982			2,813,982	June '13	1 50
reat Nor. Ore ...	Minn	1,500,000	100	0 50	750,000	0 50	750,000	10,500,000	Dec. '14	0 50
uggenheim Expl....	U S	831,732	25	3 75	2,287,263	3.87½	2,222,969	20,200,227	Oct. '14	0 87½
nter'l Nickel, com...	U S	379,253	100	10 50	3,982,159	10 00	3,792,532	14,846,433	Dec '14	2.50
ntern'l Nickel, pf	U. S.	86,661	100	6 00	534,756	6 00	534,756	8,224,802	Nov '14	1 50
ntern'l Sm & Ref..	U S	100,000	100	8 00	800,000	4 00	400,000	3,000,000	May '14	2 00
ackawanna Steel, pfd	N Y	349,780	100	6 25	2,186,125	7 00	2,448,460	4,634,585	Dec. '14	1 75
ational Lead, com	N Y	206,554	100	3 00	619,660	3 00	619,660	8,415,884	Dec. '14	0 75
ational Lead, pf....	N Y	243,676	100	7 00	1,705,732	7 00	1,705,732	29,266,672	Dec. '14	1.75
ld Dominion, c.......	Ariz	293,245	25	5 00	1,566,764	4 00	1,173,412	5,853,713	Dec. '14	0 25
enn Salt	Penn	100,000	50	3 00	300,000	6 00	600,000	16,658,000	Oct '14	1 50
enn Steel, pf........	Penn	165,000	100	4 00	600,000			13,201,000	Nov. '13	2.50
helps, Dodge & Co....	U. S.	449,346	100	16 50	7,425,000	10 50	6,300,000	36,659,304	Sept '14	2.50
epublic I & S., pf...	U. S.	204,169	100	8 00	1,633,353	5 25	1,171,788	15,322,845	July '14	1.75
Mary's Min Land....	Mich	160,000	25	3 00				5,240,000	Dec. '13	1 00
oss-Sheffield, com	Ala.	100,000	100					2,608,000	Dec '10	1 25
oss-Sheffield, pf......	Ala.	67,000	100	7 00	469,000	7 00	469,000	6,665,650	Oct '14	1.75
S Red & Ref......	Colo.	99,646	100					1,360,294	Oct '07	0.01
S. Steel Corp., pf.......	U. S.	3,602,811	100	7 00	25,219,677	7 00	25,219,677	370,293,337	Nov '14	1 75
S Steel Corp., com.	U. S.	5,083,025	100	5 00	24,415,125	4.25	21,602,856	222,360,439	Dec '14	0 50
S Sm., Ref & Min., com	U. S.	351,073	50	3 00	1,053,315	2.25	789,995	6,362,181	July '14	0 75
S Sm., Ref & Min., pf	U S.	486,269	50	3 50	1,702,120	3 50	1,702,146	14,667,393	Oct '14	0 87½
ulcan Detinning, pfd..	U. S.	15,000	100	24 00	367,500			1,155,000	Nov '13	21 00
arwick I. & S......	U. S.	148,671	10	0 80	118,936	2 42	329,782	1,318,398	Nov '13	0.40
Total.........		..			$99,740,693		$91,782,505	1,055,378,476		
FOREIGN MINING COMPANIES										
mparo, g.s..	Mex	2,000,000	$1	$0 16	$320,000	$0 14	$280,000	$1,520,883	Nov. '14	$0.03
uchitlan, g.s....	Mex.	50,000	5					212,500	Oct. '12	0.25
tonilco, g.s....	Mex.	446,496	20					55,870	Dec. '07	0.01½
eaver Con., s........	Ont.	1,996,490	1	0.93	59,989	0 03	59,989	469,868	July '14	0 03
lanca y Anexas, s.......	Mex.	140,000	10	4.50	315,000	0 90	63,000	1,943,000	Mar '14	0.90
. C. Copper, c...........	B. C.	591,709	5	0 15	88,756			615,198	Jan. '13	0 15
uffalo, s ..	Ont.	1,000,000	1	0 56	560,000	0 28	280,000	2,757,000	July '14	0.05
utter's Salvador, g....	C. A.	150,000	4 86	0 72	109,350			3,802,050	Aug '13	0.36
anadian Goldfields, g..	Can.	600,000	0 10	0 003	120,000	0 002¼	110,000	290,000	July '14	0.001¼
ananea Central, c	Mex.	600,000	10					2,913,020	'12	.
aribou Cobalt, s.	Ont.	1,000,000	1	0 02½	25,000	0 07½	75,000	100,000	Sept '14	0.02½
asey Cobalt, s...	Ont.	244,950	4 86	0 24	59,523	0 36	89,284	148,807	May '14	0.12
hontalpan, g s l z	Mex.	7,000	0 25	4 00	29,750	3 00	21,000	57,750	Apr. '14	0.75
ity of Cobalt, s	Ont	1,500,000	1					139,385	Apr. '09	0.03
obalt Central, s.	Ont	5,000,000	1					188,460	Aug. '09	0 01
obalt Lake, s d	Ont.	3,000,000	1	0 10½	315,000	0 05	150,000	465,000	May '14	0 02½
obalt Lake (holding)	Can.	300,000	4 86	0 60	182,250	0 24	145,800	328,050	May '14	0 24
oniagas, s...	Ont.	800,000	5	1 60	1,280,000	1 20	960,000	6,640,000	Nov '14	0 30
rown Reserve, s	Ont.	1,768,814	1	0.48	849,031	0 24	424,515	5,960,903	Dec '14	0 02
obalt Town Site, s. c...	Ont.	199,282	4 86	0.72	363,188	0 96	484,250	947,700	May '14	0 48
obalt Town Site, s d	Ont	45,000	1	8.25	371,000	0 45	200,000	1,042,259	Apr '14	0 10
on. M. & S. of Can	Can	58,052	100	4 00	232,176	8 00	464,352	1,710,589	Oct. '14	2.00
olores, g s.......	Mex	100,000	5					1,374,866	Jan '11	0.22½
os Estrellas, g s	Mex	300,000	0 50	5 25	2,025,000			10,335,000	Dec '13	1.50
ueño y Anexas, s	Mex.	3,000	10	4 00	12,000	5 03½	15,105	30,105	Mar '14	3 03½
l Favor, g.	Mex	3,500,000	1	0 04	140,000	0 02	70,000	210,000	Apr '14	0.01
Oro, g s..	Mex	1,147,500	4 86	0 34	57,375		..	8,947,260	July '13	0 24
l Rayo, g.s......	Mex.	260,020	2					140,410	Apr. '11	0.15
speranza, s g..	Mex.	455,000	4 86	0 48	331,695	0 24	165,847	11,996,303	Jan '14	0.24
ranby, s l c....	B. C	148,481	100	6 00	890,884	3 00	445,442	5,533,437	June '14	1.50
reene Cananea, c	Mex.	450,642	100	1 20	1,093,143	3 00	1,458,626	4,371,647	June '14	1.00
reene Con., c	Mex	1,000,000	10	0 95	950,000	1 00	1,000,000	9,544,400	May '14	0 50
uanajuato D., pf., s	Mex	10,000	100					274,356	Jan '11	3.00
edley Gold.	B. C	120,000	10	3 00	360,000	2 50	300,000	1,524,000	Dec '14	1.00
ollinger, g...	Ont.	600,000	1	1 95	1,170,000	1 80	1,170,000	2,610,000	Dec '14	0.15
uauleo, c s.......	Mex.	10,000	100	1 00	10,000			985,000	Mar. '13	1.00
err Lake, s	Ont	600,000	5	1 00	600,000	1 00	600,000	5,520,000	Dec '14	0.25
a Rose Con., s...	Ont	1,498,625	5	1 00	1,498,624	1 20	899,176	4,974,998	Oct '14	0.25
e Roi No. 2, g...........	B. C	120,000	24 25	0 36	43,740			1,472,580	Jan '13	0.36
ucky Tiger Com., g	Mex.	715,337	10	0 63	390,663	0 89	634,803	2,698,275	Dec '14	0 09
cK.-Dar.-Sav., s	Ont	2,247,692	1	0 46	1,023,957	0 21	472,014	4,338,040	Oct '14	0.03
exican L., pf	Mex.	12,500	100					1,018,750	Oct '14	0 03
exico Mines of El Oro, g s	Mex.	180,000	4 86	3 36	787,320	1 92	349,920	4,458,745	June '14	0 96
in. Corp. of Can., s	Ont	2,075,000	1			0 12½	259,375	259,375	Nov '14	0 12½
ines Co. of Am	Mex	838,628	10	0 25	210,256			4,958,600	July '13	0.12½
ontezuma, L., pf	Mex.	5,000	100					402,000	Nov '12	3.50
. Y. & Hond. Ros., g....	C. A.	500,000	10	0 90	180,000	1 20	240,000	3,550,000	Oct '14	0.30
ipissing, s.	Ont	1,200,000	5	1 50	1,800,000	1 25	1,500,000	12,390,000	Oct. '14	0 25
ova Scotia, C. & S., com	N. S.	60,000	100	6 00	360,000	4 50	270,000	4,440,000	July '14	1 50
ova Scotia, C. & S., pf	N. S.	10,600	100	8 00	84,800	8 00	84,800	1,189,600	Oct '14	2 00
eñoles, s l g...	Mex.	120,000	15	2 50	300,000		....	6,361,687	June '13	1 50
eregrina M. & M., pf.....	Mex.	10,000	100				..	328,656	Sept '10	3 50
eterson Lake, s.	Ont.	5,600,000	1		....	0 03½	189,000	189,000	Dec '14	0 01½
inguico, pf., s	Mex	20,000	100	3 00	60,000			840,000	Oct '13	3 00
ight of Way Mines, s.	Ont	1,685,500	1			0 01	16,855	543,759	Nov '14	0 01
io Plata, s....	Mex	373,137	5	0 05	18,696			345,745	Feb '13	0 05
orcupine Crown, g.......	Ont.	2,000,000	1	....		0 09	180,000	180,000	Oct '14	0.03
an Rafael, g s	Mex.	2,400	25	0.50	1,200			345,745	Feb '13	0 05
anta Gertrudis, g.s.......	Mex	$1,368,000	$4 86	$0 24	$364,500			$2,090,792	July '13	$0 24
an Toy	Mex	6,000,000	1	0 02	120,000			530,000	July '13	0 01
eneca-Superior, s.........	Ont.	476,830	1	0 52	310,771	$0 70	$335,218	645,903	Dec '14	0 10
orpresa, g s	Mex.	19,200	20					3,979,240	Jan '11	31 00
tandard, s l	B. C.	2,000,000	1	0 32½	650,000	0 23¾	475,000	1,550,000	Sept '14	0 02½

FOREIGN MINING COMPANIES—Continued

COMPANY NAME	SITUATION	SHARES Issued	SHARES Par Value	DIVIDENDS PAID 1913 Per Share	DIVIDENDS PAID 1913 Total	DIVIDENDS PAID 1914 Per Share	DIVIDENDS PAID 1914 Total	To Date Total	Latest Date	Latest Amount
Temiskaming, s	Ont.	2,500,000	$1	$0 03	$75,000			$1,384,156	Apr. '13	$0 03
Tem. & Hud. Bay, s	Ont.	7,761	1	21 00	162,981	9 00	69,849	1,940,250	Nov '14	3.00
Tretheway, s	Ont.	1,000,000	1	0.15	150,000	0 05	50,000	1,061,998	July '14	0 05
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	0.10	141,659			637,465	Oct '13	0 05
Total					$21,654,260		$15,058,220	$164,810,525		

a Two classes. b New series only. c Holding company. d Operating company.

* *

Data of the World's Principal Mines

By S. F. Shaw‡

Compiled from Annual Reports of the Respective Companies

Name of Mine	Situation	Year	Tons	Profit	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Abosso Gold	W. Af.	'12-'13	104,400			266,401		$8 57	.
Ahmeek	U. S.	1913	283,749	176,919	1,100,000				.
Allouez	U. S.	1913	263,663	155,728	None				$2 09
Amalgamated Zinc	Aus.	½-1913	245,064	£82,486	£100,000				.
Anaconda	U. S.	1913	4,651,445	11,323,498	12,997,500				7 10
Anchor Tin	Tas.	'12-'13	86,240	£56					0 99
Arizona Copper	U. S.	'12-'13	936,003	£406,035	£233,516			5 62	3 89
Ashanti Goldfields	W. Af.	'12-'13	153,554	£175,417	£187,507	365,600	18,278	15 60	9 40
Associated Gold Mining	Aus.	'12-'13	125,169	£17,258	£12,384	500,000	3,336	6 43	5 58
Associated Northern Blocks	Aus.	'12-'13	97,639	£38,452	£35,000				.
Balaghat Gold	India	1913	42,700	£2,348		21,886	5,498		.
Baltic	U. S.	1913	333,289	230,211	200,000			3 46	2.76
Blackwater	N. Z.	1913	45,052	£20,631	£12,499	104,727	3,730	8 89	6.67
British Broken Hill	Aus.	½-1913	95,662	£50,968	£52,909				...
British Columbia Copper	B. C.	1913	353,422	58,325	88,756				....
Broken Hill North	Aus.	½-1913	153,680	£155,070	£120,000				....
Broken Hill Block 10	Aus.	½-1913	46,119	£16,860	£20,000	110,800		7 58	.....
		½-1913	47,174	£37,481	£20,000				.....
Broken Hill Block 14	Aus.	½-1913	16,495	£7,305	£16,500				.
		½-1913	23,856	£9,471	£10,000			13 09	10 36
Broken Hill Proprietary	Aus.	'12-'13	120,567	£124,191	£170,000				.
Broken Hill South	Aus.	½-1913	151,836		768,000		5,522	9.49	5 44
Buffalo	Ont.	'12-'13	55,783	$91,192	650,000	57,330		22 77	6 59
Bunker Hill & Sullivan	U. S.	1913	436,663	1,119,961	817,500	3,842,010	2,203	8 91	2 73*
Butte & Superior	U. S.	1913	296,940	937,794	None			11.88	8 71
Calumet & Arizona	U. S.	1913	134,356		3,059,208			33 89	
Camp Bird	U. S.	1913	30,012		£45,500	31,000		22 49	14 61
Cape Copper	Cape Co. 1	'12-'13	72,756	£83,500	£69,000	161,970			.
Carn Brea & Tincroft	Eng.	½-1913	45,537	— £2,785				5 51	5 81
Centennial	U. S.	1913	85,443	31,549	None				2 52
Champion	U. S.	1913	421,849	504,767	900,000			4.27	3 06
Champion Reef	India	'12-'13	220,511	£153,086	£130,000	404,125		11.26	7.88
Chino Copper	U. S.	1913	1,942,700	3,021,887	1,919,070	90,000,000		3.92	2 46
Coniagas	Ont.	'12-'13	55,618		1,640,000	199,025	2,966		.
Con. Goldfields of N. Z.	N. Z.	1913	23,661	£6,292					
Con. Main Reef	Tran.	'12-'13	266,715	£33,748	£92,436	614,470		7 43	4 88*
Con. Mining & Smelting	B. C.	'12-'13	407,124		232,176		38,741		
Copper Queen	U. S.	1913	867,481	6,916,900	5,700,000	2,567,928	101,142		
Creston	Mex.	1913	130,654			306,300	9,570	6 20	
Crown Mines	Tran.	1913	2,483,622	£1,442,473	£1,034,116	10,449,000		6.31	3 94*
Crown Reserve	Ont.	1913	29,543	528,288	795,966	72,472	5,345	35.67	13.80
Daly Judge	U. S.	1913	48,943		180,000		16,481		
Detroit	U. S.	1913	533,563	1,112,870	780,000		24,689		
Dolcoath	Eng.	½-1913	58,304	£27,142	£17,500			8 83	6 86
		½-1913	56,409	£5,165	£8,750			6 86	6 53
Dolores	Mex.	1913	41,952		None	100,932	7,245		
Dome	Ont.	1913	145,305	287,779	None	512,000	6,802	8 29	6 66
East Butte	U. S.	1913	186,815		None			13 23	10 07
El Dorado Banket	Rhod.	'12-'13	87,176	£101,414	£90,000	74,826		12 39	6 89
El Oro Mg. & Ry.	Mex.	'12-'13	253,434 tailing						
			180,274 ore		57,375	448,053		5 05	.
El Rayo	Mex.	1913			None	54,800	5,572		.
Esperanza	Mex.	1913	207,443 tailing						
			85,843 ore	491,232	247,500	113,500			
Ferreira Deep	Tran.	'12-'13	647,550	£631,432	£490,000	1,974,400		9 84	4 88*
Franklin	U. S.	1913	123,179		None	160,162	2,399		
Franklin Furnace	U. S.	1913	490,434					19.00	.
Frontino & Bolivia	Bol.	'12-'13	32,888	£13,443		15,900		12 86	11 29
Gaika Gold	Rhod.	'12-'13	33,549	£989		71,893		8.62	8 05
Giant	Rhod.	'12-'13	131,887	£75,645	£77,125			6.63	3 84
Globe & Phoenix	Rhod.	'12-'13	36,628	£163,369		175,805		....	10 46
Glynn's Lydenberg	Tran.	'12-'13	40,642	£38,216	£34,000			10.22	7 07
Golden Horseshoe	Aus.	1913	280,512	£42,698	£60,000	715,496	9,485	....	5 40
Goldfield Con.	U. S.	1913	349,465	2,731,945	2,491,404	136,000	38,696	14 14	6 38
Great Boulder Perseverance	Aus.	1913	244,841	£6,897	.	516,978	8,065		4 31
Great Boulder Proprietary	Au.	1913	189,469	£301,657	£262,500	614,114	2,525	11 50	5 86
Great Cobar	N. S. W.	'12-'13	288,172	£81,925		2,390,280			
Great Fingall	Au.	1913	64,255	-£12,550	£12,500	.	1,921		.
Great Fitzroy	Aus.	'12-'13	107,098	£549				9 11	9 09
Greene-Cananea	Mex.	1913	673,034		1,093,143		49,505		
Grenville	Eng.	½-1913	22,227	£14,445	£13,117			10 50	7 37
		½-1913	21,770	£5,668	£4,386		.	8 06	6 80
Hecla	U. S.	1913	141,930	292,696	320,000				
Hedley Gold	B. C.	1913	70,796	405,255	360,000			11 31	5 61
Hollinger	Ont.	1913	138,291	1,508,661	1,170,000	845,300		17 84	6 98
Homestake	U. S.	1913	1,540,961		2,146,225		16,999	4 01	2 72
Hutti Gold Mines	India	1913	27,733			30,000		8 26	
Independence	U. S.	'12-'13	104,111 dump						
			25,999 mine		121,500				.
Inspiration	U. S.	1913			None	$9,643,000			.
Iron Blossom	U. S.	1913	39,527	510,617	400,000		6,081	28 15	15 23
Iron Silver	U. S.	1913	47,068					7 47	

Note.—Abbreviations used in above table: Alas., Alaska; Braz., Brazil; Can., Canada; Eng., British Isles (Cornwall); Hon., Honduras; Ind., India; Malay, Malay States; Mex., Mexico; N. S. W., New South Wales; N. Z., New Zealand; Port., Portugal; Rhod., Rhodesia; Sib., Siberia; S. A., South Africa; Tas., Tasmania; Tran., Transvaal; U. S., United States; W. Af., West Africa.

— Loss for the year. *Cable word. All profit and dividends are in dollars except where otherwise noted.

The omission of a figure simply means that the company report gave no information on this subject.

‡Superintendent, Charcas Unit, National Metallurgical Co., Charcas, S. L. P., Mex.

DATA OF THE WORLD'S PRINCIPAL MINES (Continued)

Name of Mine	Situation	Year	Tons	Profit	Dividends	Reserve Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
le Royale	U. S	1913	314,679	232,302	150,000				2 17
anhoe	Aus	1913	239,314			991,417	3,728		
imbo Gold	Rhod	'12-'13	37,180	—£17,350					
algurli	Aus	'12-'13	128,415	£101,961	£96,000	250,000	3,759	9 69	5 81
err Lake	Ont	'12-'13	18,792	837,315	600,000		4,984	61 92	18 39
nights Deep	Tran	'12-'13	1,009,730	£172,401	£144,793	2,777,000			
yshtim Corp	Sib	1913	351,043	£311,578	£314,058	356,000			
ake Copper..	U. S	'12-'13	83,109	52,441	None			2 64	3 27
e Roi No. 2...	B. C	'12-'13	35,555		43,740		4,633	7 33	7 12
ena Goldfields	Sib	'12-'13	820,189						
ucky Tiger	Mex	1913			450,662		2,585		4 38
ain Reef West	Tran	'12-'13	232,058	£38,144	£24,559	591,830		7 31	6 51
cKinley-Darragh-Savage	Ont	1913		771,487	1,023,937				
exican....	U. S	1913	15,973						10 40
exico Mines of El Oro	Mex	'12-'13		£191,886	£162,000				
iami	U. S	1913	1,058,754	1,534,685	1,491,979	20,300,000	37,697	4.77	3.39
inerals Separation	Aus	1913		£5,090					
octezuma..	Mex	1913	603,654	2,402,447	1,950,000		22,710		
ohawk	U. S	1913	366,458		500,000				
lontana-Tonopah	U. S	'12-'13	52,402		100,000	32,000	6,773	11 58	
lt Bischoff	Tas	½-1913	116,063	163,000	173,000			3 23	1 18
lt Elliott	Aus	'12-'13	41,633	£141,811	£202,837	430,000		48 46	
lt Lyell	Tas	½-1913	84,833	134,000		3,373,616	1,214		
lt. Morgan	Aus	'12-'13	322,098	£331,708	£200,000	3,347,000		17 20	12 20
lysore	India	1913	302,662	2,352,000	1,824,000	1,377,102	27,331		
evada Con	U. S	1913	3,169,108	2,345,564	3,998,914	39,108,590		3 22	2 95
evada Hills	U. S	1913	41,919	176,966	None		6,243	12 18	7 95
evada Wonder	U. S	'12-'13	39,118		281,399		6,832	13 70	12 80
ew Idria	U. S	1913	76,993	65,013	40,000			4 71	3 87
ew York & Honduras Rosario	Hond.	1913	91,606	575,343	220,000	355,396	15,689	15.06	9 81
ew Modderfontein	Tran	'12-'13	565,400	£483,926	£420,000	4,547,000		9 62	5 46
ew Rietfontein	Tran	1913	185,830	£14,225	£15,252	57,737		5 20	4.84
ipissing	Ont	1913	77,240	1,824,365	1,800,000	216,644	13,614		14 81
orth Butte	U. S	1913	462,799		820,000		19,499	11 20	
orth Star	U. S	1913	106,090		300,051		3,158	11 32	5 20
ourse	Tran	'12-'13	577,200	£254,731		1,795,600	27,805	7 33	5 18
undydroog	India	1913	90,650		475,200			17.64	7 28
ld Dominion	U. S	1913	169,961	481,445	690,000				
oregum	India	1913	153,536	£174,832	£129,251	189,947	14,813		5 41
riental Con	Chosen	'12-'13	313,701	571,384	429,390	805,900	33,248	5 60	3 47
roya-Black Range	Aus	'12-'13	59,680					8.73	6 46
roya Links	Aus	1913	139,130	£15,899		146,775	5,960	5.38	3 86
sceola	U. S	1913	735,044	381,967	721,125			2.39	1 75
tavi	W. A	'12-'13	54,100						
uro Preto	Brazil	1913	66,139	—£3,503		114,528		6.56	6 59
ahang Con	Malay	'12-'13	127,543	£49,796	£36,874			7.53	5 55
ortland	U. S	1913	127,054 dump 53,245 o.e.		300,000		12,433		
rester Block A	W. A	1913	229,990	£38,340		691,670	5,660	6 16	7 37
rincess Estate	Tran	1913	257,476	£4,505		614,000		7 39	6 05
rogress	N. Z	1913	34,996	£2,131				7 40	7 71
ay Con	U. S	1913	2,366,007	2,398,466	1,631,504	78,380,966		3 34	2 38
o Tinto	Spain	1913	1,859,571	£1,673,372	£1,487,500				
obinson	Tran	1913	668,900	3,500,000	2,010,000	10,073,000		8 58	3 83
obinson Deep	Tran	'12-'13	623,800	£269,579	£275,000	1,538,000		7 15	5 00
osaberg Minerals	Tran	'12-'13	14,175 dump 21,742 ore		£65,000				
ound Mountain	U. S	'12-'13	57,360	29,150		[illegible]	4,716	4 92	[illegible]
nta Gertrudis	Mex	'12-'13	263,625		1,093,500			11 70	
Fox	Mex	1913	7,056		115,000		1,002		
[illegible]	Rhod	'12-'13	37,263	£14,662					
[illegible] Mining	Chosen	1913	71,535		500,000	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Copper	U. S	1913	364,584	176,440	150,000		13,600		
[illegible]	[illegible]	[illegible]	68,920	£42,281	£47,204	110,000		11 31	[illegible]
[illegible]	U. S	[illegible]	100,225		500,000			[illegible]	[illegible]
[illegible]	[illegible]	'12-'13	912,200	£128,765	£450,000	[illegible]		[illegible]	[illegible]
[illegible]	U. S	1913	105,674	137,455	112,463				
[illegible]	Aus	1913	162,101	[illegible]	66,300	[illegible]			
[illegible]	[illegible]	1913	[illegible]	[illegible]	[illegible]		4,588	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	112,262	[illegible]	£15,000	174,097	1,211	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	U. S	1913	[illegible]		[illegible]				
[illegible]	[illegible]	[illegible]	172,208	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		
[illegible]	[illegible]	12-'13	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	U. S	[illegible]	[illegible]		[illegible]			[illegible]	
[illegible]	N. Z	[illegible]	42,980		[illegible]			[illegible]	
[illegible]	U. S	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	W. A	[illegible]	[illegible]	[illegible]		[illegible]			
[illegible]	[illegible]		[illegible]	[illegible]				8 17	[illegible]
[illegible]	[illegible]	[illegible]	470,135		[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	129,618	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			22 30	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]				
[illegible]	U. S	[illegible]	[illegible]	[illegible]	300,000				
[illegible]	[illegible]	[illegible]				[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]				
[illegible]	[illegible]			[illegible]					
[illegible]	[illegible]	1913					[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,747,710	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	B. C	[illegible]		[illegible]				[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		
[illegible]	[illegible]				180,000		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			
[illegible]	N. Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	N. Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8 78	
[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	10,171	[illegible]	
[illegible]	U. S		[illegible]	[illegible]	[illegible]				
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]	U. S	[illegible]	[illegible]		[illegible]				[illegible]
[illegible]	Aus	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			

[illegible]

Chronology of Mining for 1914

JANUARY

Jan. 1.—Arizona Copper Co.'s old smelting plant, at Clifton, Ariz., permanently closed.

Jan. 4—Tacoma smelting plant closed on account of strike

Jan. 5—Buckhorn Mining Co.'s 400-ton mill, at Buckhorn, Nev., put in commission.

Jan. 7—Work resumed at Tacoma smelting works.

Jan. 8—Strike of South African state railways' employees.

Jan. 10—Twelve men killed in colliery explosion at Rock Castle, Ala.

Jan. 12—Operations begun in 600-ton testing mill of Inspiration Consolidated Copper Co., Miami, Ariz.—Fire in Negaunee mine, at Negaunee, Mich.; two men killed.

Jan. 15—Miners' union officials in Lake Superior copper country indicted by Houghton County grand jury.

Jan. 16—Strike at Rio Tinto.

Jan. 20—Three men killed at hoist at Coggins mine, Eldorado, N. C.

Jan. 21—Fire in Boston mine of Utah Copper Co., at Bingham, Utah; five deaths, three rescuers losing their lives in attempt to find two miners who were caught in workings.

Jan. 22—Balaklala sampling mill destroyed by fire.

Jan. 24—U. S. Senate passed Alaska railway bill, directing the President to purchase or construct 1000 miles of railroad in Alaska, at a cost not to exceed $40,000,000.

Jan. 27—Leaders in South African railway strike deported, it having been found that they planned starting a revolution.—Cave-in at Capote mine of Cananea Consolidated Copper Co., at Cananea, Sonora; four killed.

Jan. 29—Strike of miners at Coniagas mine, Cobalt, Ontario.

FEBRUARY

Feb. 1—Chino Copper Co. discharged all minors in its employ.

Feb. 2—Three miners killed in cave-in at North Uno mine of Oliver Iron Mining Co., near Hibbing, Minn.

Feb. 9—Congressional investigation of strike in Lake Superior copper country begun.

Feb. 10—Congressional investigation of Colorado coal-fields strike begun.

Feb. 12—Chinese government granted important oil concession to Standard Oil Co.

Feb. 15—Three mine guards and a deputy sheriff found guilty of manslaughter for killing a man at the height of the Lake Superior copper strike.

MARCH

Mar. 8—Congressional committee investigating Colorado coal-mine strike completed taking of testimony at Denver.

Mar. 9—Congressional committee, investigating copper-country strike, completed taking of testimony in Michigan.

Mar. 13—Archie L. Wisner and John J. Meyers sentenced to six years each and Meyers in addition fined $10,000 for fraudulent mine promotion.

Mar. 13—Anaconda Copper Mining Co.'s 20-deck round-table plant at Washoe works at Anaconda, put in full operation.

Mar. 16—Tsunmidato copper mine, in Japan, reported to have caved in; 300 men said to have been in the mine at that time.—Hidden Creek smelting works of the Granby Consolidated company, at Anyox, B. C., blown in.

Mar. 18—Alaska railway bill signed by President Wilson.

Mar. 20—Colorado Fuel & Iron Co. brought suit for $1,000,000 damages against United Mine Workers of America and various officials of the organization.

Mar 21—First party of oil-well drillers left San Francisco for the fields in China, recently acquired by the Standard Oil Company.

Mar. 27—Anaconda Copper Mining Co. commenced construction of 2000-ton leaching plant at Washoe works at Anaconda, Mont.

Mar. 28—Reported that liquidation of silver stocks of the failed India Specie Bank had been completed.

Mar. 31—General closing down of coal mines in Ohio because of failure of operators to come to agreement with miners in regard to wage scale.—Erection of steel work begun by American Bridge Co. on main concentrator building of the Inspiration Consolidated Copper Co., at Miami, Arizona.

APRIL

Apr. 1—Underground mining abandoned at Utah Coppe Co.'s property, at Bingham Cañon, Utah.

Apr. 2—Sheep Creek tunnel, of Alaska-Gastineau Minin Co., near Juneau, Alaska, holed through.

Apr. 3—Strike at Dean mine, of Hudson Iron Ore Co near Highland Falls, N. Y.

Apr. 8—Last spike driven on Grank Trunk Pacific Ry 1½ miles east of Nechacco River Crossing, B. C.

Apr. 12—Michigan copper miners vote to end strike begu July 23, 1912.

Apr. 14 —Strike at Cananea, Mexico.

Apr. 19—U. S. forces land at Vera Cruz.

Apr. 20—Anaconda Copper Mining Co. proposes taking ove International Smelting & Refining Co.

Apr. 20-21—Pitched battle between Colorado coal miner and state militia, in coal fields of southern Colorado.

Apr. 24—American Smelting & Refining Co. ordered a American employees out of Mexico.

Apr. 28—President Wilson ordered regular troops to th strike zone in Colorado.—Explosion in collieries of New Rive Collieries Co., a Guggenheim corporation, at Eccles, W. Va 180 lives lost.

MAY

May 1—First shipment of copper from Hidden Cree smelting works, of Granby Consolidated company.—International Zinc Convention begins curtailment of production rate of about 18 per cent.

May 2—All ore docks in Lake Superior iron country ope

May 4—U. S. Circuit Court of Appeals in San Francisc rendered decision holding Minerals Separation Co.'s frotl flotation patent invalid.

May 14—Oil struck at Calgary, Alta.

May 21—Court of mediation in Mexican political situatio convened at Niagara Falls, Canada.

May 23—Fire in Pocahontas mine, Joplin, Mo.

May 26—Stockholders of Anaconda Copper Mining Co. having voted on May 20 to purchase and take over the International Smelting & Refining Co., certificate of surrender charter of International company was filed in New Jerse

May 28-31—Celebration of the 50th anniversary of th founding of the School of Mines of Columbia University.

JUNE

June 1—Timber Butte mill, at Butte, Mont., began regula operations treating Elm Orlu ore.

June 10—East Tennessee mine surface plant of Ducktow Sulphur, Copper & Iron Co., at Isabella, Tenn., destroyed fire.

June 12—Butte miners started rioting in protest again unions levying assessments to support strikers in other districts, charging union officials with irregularity in disposin of union funds.

June 17—Two mills of Witherbee-Sherman & Co., at Mineville, N. Y., destroyed by fire.—Workmen at the Abangare mine in Costa Rica seized and operated mine and mills whe company attempted to shut them down pending introductio of a system for preventing theft of gold.

June 19—Fire in the Vieille Marihaye colliery, near Liég Belgium, resulted in entombing 200 coal miners.—An explosion in the Hillcrest colliery, Hillcrest, Alta., resulted i the death of 199 miners.

June 21—New union formed by Butte miners to be know as Butte Mine Workers' Union.

June 22—The Supreme Court decided the Intermountai rate case in favor of the Interstate Commerce Commissio and against the railroads.—Supreme Court handed down dec sion in favor of Southern Pacific R.R. in its California o lands case.

June 23—Butte miners dynamited old Western Federatio Hall.

June 29—Kennedy Extension vs. Argonaut case decided favor of defendant.

June 30—Mexican Mining Co. settled suits and decided t rejoin Comstock Pumping Association.—Pulverized-coal firin of reverberatories started at Anaconda.

JULY

July 1—Anaconda Copper Mining Co. closed down the concentrator at Great Falls, Mont.

July 2—Cananea striking miners returned to work.

July 3—Suit brought against the American Smelting & Refining Co. by Sidney Norman and others, representing minority stockholders of the Federal Mining & Smelting Co., was dismissed by Justice Philbin.—Railroad strike in the Cripple Creek district, Colorado.

July 6—Circuit Court of Appeals at San Francisco re-ffirmed its decision in case of Minerals Separation, Ltd., vs. ames M. Hyde.

July 15—Seven miners were killed by a rush of sand into raise at the Vulcan mine at Alpha, Mich.

July 18—Announcement made that Phelps, Dodge & Co. ad taken over the Tombstone Consolidated mines in Arizona.

July 29—Twelve miners were killed by an explosion of ynamite in sinking a shaft in the Krajaii potash mine, near assel, Germany.

July 31—Anaconda Copper Mining Co. closed down the reat Falls smelting plant and also seven mines in the Butte istrict, because of impending war in Europe.—Closing of ew York and Boston Stock Exchanges.

AUGUST

Aug. 1—Decision by Interstate Commerce Commission on ailroad rate case only partly favorable to roads.—Germany eclared war on Russia, this being the beginning of the great ar.

Aug. 3—Copper Producers' Association announced suspension of monthly statistics.—Jackling, Hayden-Stone companies nnounced 50% curtailment of production. (Most of the other opper producers took similar action immediately afterward.) -"Engineering and Mining Journal" suspended quotations of opper and silver.

Aug. 4—Five men killed and four injured by premature last in steam-shovel pit of Nevada Consolidated at Ely, evada.

Aug. 7—Quotations of price of silver resumed at London.

Aug. 8—First announcements of impending closing of obalt silver mines.

Aug. 10—Beginning of A. I. M. E. meeting at Salt Lake ity.—Suit brought against Bullwhacker Copper Co. by some f company officers to recover money advanced.

Aug. 12—Three men suffocated while fighting fire at Big en mine, Kern County, Calif.

Aug. 14—Jacob Langeloth, chairman of board of directors f American Metal Co., died.—Operations suspended in Czar nd Holbrook shafts of Copper Queen; 400 men dismissed.

Aug. 15—Constitutionalists entered City of Mexico.—Can-nea closed down.

Aug. 20—Open quotations of prices for sheet zinc with-rawn by the manufacturers.

Aug. 22—Smoot bill for silver purchase passed Senate.—uotations of price of silver resumed at New York.

Aug. 26—Beginning of high-handed regulation of Butte abor by Butte Mine Workers' Union.

Aug. 30—Alleged rebel miners dynamited Anaconda com-any's employment office at Parrot mine.

SEPTEMBER

Sept. 1—Calumet & Hecla passed quarterly dividend. Mine roduction curtailed and wages and salaries cut.—Resignation f Messrs. Kinzie, Kennedy and Lass from Treadwell group.—artial law declared in Butte.

Sept. 7—Announcement of President Wilson's terms of ettlement offered Colorado coal miners and operators.

Sept. 8—All but one (Davis-Daly) of Butte mining com-anies joined in declaration against closed shop.—Nevada onsolidated and Ray passed dividends; Chino cut.

Sept. 9—Muckie McDonald arrested in Butte.

Sept. 12—James B. Haggin died.—Announcement of gold strike north of Tonopah.—Explosion at Ralph's coal mine, Huntly, N. Z., resulted in loss of 13 miners.

Sept. 16—Petition in bankruptcy filed in New York against hio Copper Co.

Sept. 17—Eleven men caught and killed by cave-in at entennial-Eureka mine, Eureka, Utah.—Volcanic eruption at White Island, Bay of Plenty, N. Z., resulted in serious loss f life, the sulphur property of the New Zealand Sulphur Co. eing buried.

Sept. 18—Three men killed by fall of ground in bottom f prospect shaft at Maiden Rock, near Butte.

Sept. 19—Interstate Commerce Commission reopened railroad-rate case.

Sept. 22—Anaconda cut dividend.—Job office of Tonopah Bonanza blown up.

Sept. 23—Villa broke with Carranza.—New Texas School of Mines at El Paso opened.

Sept. 26—Committee of Safety of the City of Butte organized with between 300 and 400 members.

Sept. 30—Announcement of first shipment to Canada by gold pool.

OCTOBER

Oct. 1—Phelps-Dodge introduced company-store profit-sharing plan for employees.—El Oro company resumed operations on small scale after five months' shutdown.—Cave-in at American Davey mine, in Joplin district.

Oct. 2—First withdrawal of militia from Butte.

Oct. 6—Duncan deposed as mayor of Butte.

Oct. 8—Pittsburgh meeting of A. I. M. E.—Montana supreme court rendered decision to effect that military courts in Butte were illegal.

Oct. 12—Boer commando mutinied in South Africa.

Oct. 14—Dunbar blast furnace of American Manganese Manufacturing Co. blown in, using Cuyuna iron-manganese ores.

Oct. 16—Additional withdrawal of militia from Butte.—Cloudburst in southeastern Missouri did great damage to railroads and mines.

Oct. 17—Mason Valley suspended operations.

Oct. 18—Butte & Superior closed down.

Oct. 19—Fire broke out in Mexican mine on Comstock, soon controlled.—St. Joseph Lead Co. announced curtailment of 25% in output of lead.—News of curtailment by Cœur d'Alene mines.

Oct. 20—Alaska coal-land leasing bill signed by President.

Oct. 21—Settlement of Silver King Coalition-Silver King Consolidated suit by compromise, each company getting certain claims.

Oct. 22—First active buying of copper since July.

Oct. 23—War-tax bill signed by President.

Oct. 26—Bullwhacker stockholders accept reorganization plans.

Oct. 27—Generals De Wet and Beyers revolted in South Africa.

Oct. 28—Completion of permanent organization of California Metal Producers' Association.—British detain three ships carrying copper to Italy, and two going to Scandinavia.—Italy reported to have put embargo on copper export to Germany.

Oct. 30—Colonel Maritz, rebel leader in Cape Province, beaten and driven out of colony.

Oct. 31—Copper at 20c. per lb. in Germany.

NOVEMBER

Nov. 1.—"Engineering and Mining Journal" resumed quotation of copper market.

Nov. 3—Election Day—Arizona accepts prohibition and 80%-native-labor laws.—Montana defeats workmen's compensation measure.—Socialist defeat in Butte.—England holds copper shipped to Italy on American vessels.

Nov. 5—First trial run of Jones furnace at Marquette.

Nov. 7—Beginning of sanitary survey of Joplin district by U. S. Public Health Service and U. S. Bureau of Mines, with object of combating miners' phthisis.—Missabe docks at Duluth close.

Nov. 9—New York Metal Exchange reopens.—London Metal Exchange reopens.—Caving shaft at Sibley mine of Oliver Iron Mining Co. on Vermilion range, Minn., catches six men, of whom only one is later taken out alive.

Nov. 10—British ambassador at Washington reports that Italy prohibits export of copper, but does not prevent transit to neutral countries over Italian territory.

Nov. 11—Curb market resumes open and unrestricted trading with permission to publish prices.

Nov. 12—Demand sterling at 4.86¾, lowest since April.—Final withdrawal of troops from Butte.

Nov. 16—Federal Reserve banking system inaugurated.—Conviction of Boris Thomasen, member of I. W. W., for arson, following confession of having helped to set recent fires in Tonopah and Goldfield.—Gary steel mills increase operations.

Nov. 18—First distillation furnace fired at Langeloth, Penn.

Nov. 22—Muckie McDonald and Joe Bradley convicted of kidnapping.

Nov. 28—New York Stock Exchange opens for bond trading at minimum prices.—Formation of Safety and Sanitary League in Joplin, Mo.

Dec. 1—Announcement that M. A. Hanna & Co. will sell Great Northern iron ore.—Final war-tax measures effective.

Dec. 5—New York Stock Exchange permits stock trading with minimum prices.

Dec. 7—Seventeenth annual meeting of the American Mining Congress in Phœnix, Arizona.

Dec. 8—Report of Selby Smelter Commission filed with superior court of Solano County, Calif.; favorable to smelting company.

Dec. 12—International Hotel burned at Virginia City, Nevada.

Dec. 15—Case to test constitutionality of 80% law begun in Federal court at Tucson, Ariz.—Formation of Michigan Equal Tax Association at Marquette to fight tonnage-tax proposal.

Dec. 16—General increase in freight rates on lead and spelter from St. Louis to Eastern points.

Dec. 19—Butte & Superior resumed milling.

Dec. 24—Memorandum from Washington to London requesting readjustment of system of searching and detaining American shipments.—Isle Royale mill burned to ground in Michigan copper country.

Dec. 27—Death of Charles Martin Hall, inventor of process of aluminum smelting in general use.

Dec. 31—Surrender by Steel Corporation of its lease on the Hill iron-ore lands on the Mesabi range.

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Mining Stocks in 1914 in New York

The accompanying tables show the 1914 quotations on mining stocks listed in New York. The Exchange was closed from July 31 until early in December.

NEW YORK CURB TRANSACTIONS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2[illegible]	6	2[illegible]	[illegible]
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67,750.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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7,370	Mut M & Ls pf	1	2⅞	1	2[illegible]
131,670	*Nevada Hills	45	61	20	30
200	Nevada Wonder	1½	1½	1½	1½
40,450	*New Utah Bingham	40	69	36	61
16,500	New Utah..	⅛	[illegible]	[illegible]	7/16
151,962	Nipissing M. Co	7¾	8[illegible]	5[illegible]	6[illegible]
8,600	No Butte Develop	3/16	[illegible]	1/16	1/16
4,650	Ohio Copper	7/16	[illegible]	5/16	[illegible]
1,355,975	*Oro	10	21	5	13
34,700	Pacific Smelters	[illegible]	[illegible]	1/32	[illegible]
5,675	South U. M. & M.	[illegible]	5/16	¼	[illegible]
84,760	Stand Silver-L	1[illegible]	1⅞	1¼	1[illegible]
243,835	Stewart ..	1[illegible]	1 11/16	1	1 7/16
1,900	Stewart M tr ctfs	1 5/16	1 5/16	1 1/16	1 3/16
300	Tonopah-Belmont	7½	7½	7½	7½
597,940	*Tonopah Merger	52	72	26	36
106,043	Tonopah Ext...	1¾	3	1¾	2 1/16
14,728..	Ton M. of Nev.	6[illegible]	7 15/16	5¾	7¾
30,600	Tularosa	[illegible]		3/32	¼
1,300	Tri-Bullion	3/32	⅛	1/16	1/16
16,515	*Tuolumne Copper	55	87½	23	24
2,000	*Union Mines	5	6	5	6
200..	Union Copper......	⅛	⅛	⅛	⅛
1,200..	United Verde Ex...	1½	2 3/16	1½	2
467,051	.*West End Cons	1 5/16	1⅝	46	57
267,300	*West End Ext	3	5	1	3
14,900..	*Wettlaufer S. M	4	8	4	7
774	Wh Knob Cop pf	¼	1⅜	¼	1⅛
14,480..	Yukon Gold Mines	2 3/16	3⅛	1⅞	2¼
Total shares 1914					11,004,172
Total shares 1913					10,576,792

BONDS

2,500..	Braden Copper 6s.	160	160	130	130
10,000	Braden Copper 7s	167	167	160	163
2,700..	Can. Cop. deb. 6s.	80	80	55	55
90,000..	Chile Copper 7s...	112	112	107	110½
6,000	Mason Valley 6s	60	60	53	53
13,000	Va-Car Chem 6s	104¼	104¼	100⅜	101⅛
Total 1914					$124,200

*Cents per share

STOCKS ON THE NEW YORK STOCK EXCHANGE

Sales		Highest		Lowest		Closing	Net Change
429,700	Alaska Gold Mines	28¾	May 18	19½	July 30	26¼	+ 5¾
37,940	Allis-Chalmers Co	14¼	Feb 20	6	July 30	8	1
19,125.	Allis-Chalmers Co pf	49	Jan 26	32½	July 30	36	- 7
3,002,550	Amalgamated Cop	78¾	Feb 4	48¼	Dec. 24	51⅝	21⅜
351,280	Am Smelting	71⅞	Feb 4	50¼	July 30	56¼	8
29,085	Am Smelting pf	105	Jan 27	97½	Apr 25	99¼	- [illegible]
2,670	Am Smelters pf B	85	Jan 19	79¼	July 28	79¼	2¼
274,300	Anaconda	38¼	Feb 3	24¾	Dec. 23	25½	10¾
10,900	Batopilas Mining	1¾	Feb 10	[illegible]	Apr 24	[illegible]	[illegible]
265,750	Bethlehem Steel	46⅝	Dec 31	29½	Jan 2	46½	+16⅝
29,950	Bethlehem Steel pf	91½	Dec 31	68	Jan 10	91¼	+27½
466,300	Chino Con Cop	44	Feb 4	31⅞	Dec. 24	33½	6
125,200	*Comstock Tunnel	10	Feb 10	5	May 1	6	2
925	Federal Mining & Smelting	15	Jan 24	7¼	May 2	10	1
7,154	Federal Mining & Smelting pf	4[illegible]	Jan 27	28	Dec 30	28[illegible]	7
[illegible]	General Chem Co	180	Jan 23	160	Apr 27	167	13
[illegible]	General Chem Co pf	[illegible]	Jan 1	107	[illegible] 2	108	- 1
[illegible]	Great Northern Ore ctfs	[illegible]	[illegible]	22	[illegible] 30	27	7[illegible]
[illegible]	Guggenheim Exp	[illegible]	April 2	40	July 30	45	[illegible]
2,800	[illegible]	[illegible]	[illegible] 14	109	[illegible]	110	[illegible]
[illegible]	Inspiration Cop	[illegible]	[illegible]	14	[illegible]	16	1[illegible]
[illegible]	[illegible]	30	[illegible]	26	July 30	28	2
[illegible]	Miami Cop	[illegible]	[illegible] 16	16	Dec 12	17	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] 26	40	[illegible]	43½	1
[illegible]	[illegible]	[illegible]	Feb 18	10[illegible]	[illegible]	107	[illegible]
[illegible]	Nevada Con Cop	[illegible]	[illegible] 22	[illegible]	July 30	11[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Feb	82	Dec [illegible]	80	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] 28	[illegible]	[illegible] 21	[illegible]	[illegible]
4,780	[illegible]	[illegible]	[illegible]	1	June [illegible]	1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	18	Dec [illegible]	18	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible] Copper	[illegible]	[illegible]	21	[illegible]	32[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	10[illegible]	[illegible] 24	104	1
[illegible]	[illegible] pf	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 28	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Feb. 1	[illegible]	[illegible]	[illegible]	1

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Necrology

Among the [illegible] identified with the mining and metallurgical industries who died during 1914 were the following:

[illegible]	[illegible] 13	[illegible]	Nov. 4
[illegible]	[illegible]	[illegible]	May 6
[illegible]	Sept. 11	[illegible]	[illegible] 18
[illegible]	Nov. 30	Potter, William	[illegible]
[illegible]	Feb. 2[illegible]	[illegible]	July 13
[illegible]	[illegible] 1	[illegible] Joseph	Feb. 24
[illegible]	Sept. 2	[illegible]	June 21
[illegible]	[illegible]	[illegible]	Sept. [illegible]
[illegible]	[illegible]	[illegible]	May [illegible]

The Metallurgy of Lead in 1914

By H. O. Hofman*

The August meeting of the American Institute of Mining Engineers, held at Salt Lake City, Utah, formed the occasion for bringing out a large amount of information on the details of the practice of lead and of silver-lead smelting and of refining. It forms thus a landmark for lead as did the meeting of the preceding year at Butte, Mont., for copper. Innovations in all the branches of the metallurgy of lead have thus been put on permanent record.

Roasting Ore

Since the days of Plattner, it is known that in roasting PbS there are obtained PbO and $PbSO_4$; Demwolff, who studied this question (*Metall und Erz*, 1914, Vol. 11, p. 619), found that at temperatures below 450° C. there is formed mainly $PbSO_4$, and that in the presence of a catalyzing agent the whole of the PbS can be changed into $PbSO_4$. On the other hand he ascertained that the more the roasting temperature is raised above 450° C., the larger will be the percentage of PbO formed and that above 750° C. the reactions between undecomposed PbS and $PbSO_4$ as well as PbO will liberate Pb which will be oxidized to PbO.

The Hall process (Eng. and Min. Journ., 1913, Vol. 96, p. 35; *Min and Sci. Press*, 1914, Vol. 109, p. 518; *Bull.* 76, M. and M. Soc. of Am., Sept. 30, 1914), which aims to roast sulphide material in such a way as to oxidize the metal without oxidizing the sulphur which is to be expelled as vapor and collected as flour, has not so far been tried with lead sulphide. The early laboratory work on pyritic ore and the results of later large-scale trials at the Balaklala works, Coram, Calif., are very promising. As far as the reactions taking place are understood, there appears to be no reason why lead-bearing sulphide should not be amenable to the process as are iron and copper sulphides.

Blast-roasting of lead-bearing mixtures has increased to such an extent that it has made almost obsolete the older modes of oxidation. With this growth of the process different apparatus have been used; the two great rivals are the Huntington-Heberlein pot and the Dwight-Lloyd straight-line machine. The results of W. W. Norton (*Bull. of A. I. M. E.*, August, 1914, p. 1993) at the Murray smeltery near Salt Lake City, Utah, and G. C. Riddell (*op. cit.*, November, 1914, p. 2744) at East Helena, Mont., obtained with both devices in two important works of a single company are therefore of greatest interest. Without going into details they may be summarized by the following statement:

Item	Advantage Lies — At Murray with	At East Helena with
Cost of installation	D. & L.	D. & L
Cost of roasting	H. & H	Even
Adaptability to charge	D & L.	D & L
Metal loss	Even	Even
Physical condition of product	H & H	D & L

The data of G. C. Riddell and a discussion by A. S. Dwight (*op. cit.*, November, 1914, p. 2741) bring out the fact, also experienced at Herculaneum, Mo., that blast furnaces running with D. & L. material require less coke than when they carry the product of the H. & H. pot.

Smelting and Converting

The furnaces of the different smelteries of the country resemble one another much in their general aspect; there are, however, considerable differences as regards details of construction and of manner of operating. J. A. Palmer (*Bull. of A. I. M. E.*, July, 1914, p. 1447) brings out some of the leading features. The cross-section at the tuyere-level is 42-46 by 130-160 in. Steel water jackets are replacing those of cast iron; the flare of jackets and of shaft-walls above is much smaller since the charges are made up largely of blast-roasted material. The use of this material has not only greatly increased the smelting power of a furnace, but has done away with the dirt troubles experienced with charges made up of coarse and fine ores, especially when of different chemical composition as is usually the case. The chemical composition of the slag to be made, which used to be the main consideration, has been supplemented by other points of view, such as formation temperature, fluidity and cost. Formerly low lead-contents of slag and matte produced were the leading guides for good work; since the introduction of the baghouse which recovers dust and fume from the gases passing off at the throat, it has been found that the over-reduction furnishing slag and matte carrying little lead created considerable loss at the throat; at present both sources of loss receive the attention that is due them; daily assays of fluedust in addition to those of slag and matte give indications of the degree of reduction taking place in the furnace.

The lead-content of a blast-furnace charge is usually about 15%. The silver-lead furnaces of East Helena, Mont., and the lead furnaces of Herculaneum, Mo., carry as much as 40 Pb on the charge; such a lead content demands special attention of the furnaceman if he is to succeed in recovering values to a satisfactory degree.

The East Helena works (R. L. Newhouse, *Bull. of A. I. M. E.*, August, 1914, p. 1801) treats galena concentrates from Idaho with siliceous silver-gold ores and produces, with three furnaces in operation, 6000 tons of lead bullion per month. The sulphide ore is blast roasted in Huntington-Heberlein pots and Dwight-Lloyd sintering machines. The Huntington-Heberlein division has four Godfrey rough-roasters and 12 pots of 12 tons capacity, and treats 300 tons charge per day; the Dwight-Lloyd division has six machines with pallets 42x264 in., each machine with a capacity of from 90 to 120 tons charge per day. The three blast furnaces in operation are 48x136 in. at tuyeres and 18 ft. high, a fourth is held as reserve. A furnace treats per day 220 tons charge with from 30 to 40% lead with 33 oz. blast pressure. A typical charge consists of Huntington-Heberlein product 36.5 and Dwight-Lloyd 52.6%, carrying 12.92% coke (or 10.1% fixed carbon); it contains Pb, 31.9, and S, 3.8%. There are 15.4 parts of foul slag resmelted. The slag made shows: SiO_2, 33.2; FeO, 31.9; MnO, 2.6; CaO, 18.4; MgO, 2.1; Zn, 5.0; Pb, 0.90%; Ag, 0.30 oz. per ton. The matte, of which 11.1% is formed, contains: Pb 13.4; Cu 9.7%; and Ag 18.7 oz. per ton. Gases from the blast roasting and smelting divisions are passed through baghouses.

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The works of Herculaneum, Mo. (Eng. and Min. Journ., 1914, Vol. 98, p. 900), treat Missouri galena. The concentrate with Pb 64 to 75% is blast roasted in eight Dwight-Lloyd machines with pallets 42x264 in. to a sinter with Pb, 45 to 50; SiO_2, 12 to 15, FeO, 17 to 21; S, 4 to 5; Ca(Mg)O, 4 to 5%, smelted in four blast furnaces, 42x192 in. at tuyeres and 17 ft. high, at the rate of 225 tons charge per furnace per day, with 12.5% coke and 30 oz. blast producing 90 tons of pig lead. The slag aimed at contains: SiO_2, 33; FeO, 36; CaO, 14.5; MgO, 4; Al_2O_3, 3%; in addition there are present S, 2; Zn, 4; and Pb, 1.2%. The first matte produced containing 3% Cu is rough-roasted in an oil-fired Holthoff furnace, 36 ft. in diameter, at the rate of 40 tons in 24 hr., and in a seven-hearth Wedge furnace at the rate of 60 tons, with a sulphur reduction of from 24 to 12%; it is worked into the sinter charges and smelted until its copper-content has reached 7%, when it is treated alone. The lead is run from the well of the blast furnace through a swinging trough into molds held in a casting wheel; the rough bars are liquated in four reverberatory furnaces, the lead is collected in two 30-ton kettles, poled, and siphoned into molds held in two casting wheels. The gases from the blast furnaces and the refinery pass through a baghouse.

Treatment of Matte

The two processes of concentrating-smelting and converting have undergone some changes. In the first, the usual method of comminution by crushing is being replaced by granulating. This has been the practice at El Paso (Eng. and Min. Journ., 1914, Vol. 98, p. 465) for a number of years; it is being introduced at Herculaneum where the matte from the forehearth will be tapped into a ladle, transferred by an electric crane to a barrel-shaped tilting storage-furnace, as is converter copper in some copper smelteries, and granulated.

The success attained at the Midvale works near Salt Lake City, Utah, with the seven-hearth Wedge furnace in roasting matte without the use of carbonaceous fuel (L. D. Anderson, Eng. and Min. Journ., 1914, Vol. 98, p. 51) has been the incentive for other plants to do the same. The success is due to the innovation of providing the upper four roasting hearths with multiple-outlet dampers through which the hot gas from each hearth can be made to pass directly into the flue instead of forcing it to travel upward in the usual way. In this manner a complete control of temperature has been made possible. In running the furnace it has been found necessary to have as little draft as is possible; thus the water-depression in the main flue is 0.1 in., on the first and second hearths it is 0.035 in., on the third 0.010, and on the fourth and fifth hearths even less; the two lower hearths are open and serve as coolers. The furnace treats 75 to 80 tons of matte in 24 hours.

In converting, the silica-lined vessel of Omaha has had to yield to the basic converter, and with this vessel the feeding of siliceous ore to slag the iron has been given up at the Tooele works of the International Smelting Co. (Kuchs, *Bull. of A. I. M. E.*, July, 1914, p. 1752). Here there are in operation five basic barrel converters with shells 96x150 in., three for lead matte and two for copper matte; the gases from lead converters go through a baghouse, those from the copper converter through a flue to a chimney. Ten tons of lead matte are poured into a converter and blown in two hours; lead and zinc are oxidized and pass off with the fumes. Most of the iron and some of the copper are oxidized and transferred to a copper-matte converter, where the iron is scorified by additions of siliceous ore, and the oxidized copper sulphurized; the copper charge is then finished in the usual way. The advantage of this mode of treatment is that the lead blast furnace is not forced to treat the large amounts of iron-lead slags formed in the ordinary practice, and has to work up only the fume collected in the bags.

Bag Filtration

Bag filtration of gases from furnaces treating lead-bearing materials has become almost universal practice. Gases from blast roasting and converting contain enough metal to pay for recovery by filtration, those from blast furnaces with charges containing little lead may or may not make the operation profitable. The baghouse, however, serves as a safety apparatus and has therefore been installed at most large plants in spite of the large cost of installation and of operating.

H. H. Alexander (*Bull. of A. I. M. E.*, August, 1914, p. 2001), in a paper on the subject, shows how the formation of SO_3 in converting can be reduced to a harmless percentage if the gases are diluted by air and cooled to a temperature that is too low for the formation of the corroding SO_3. Nevertheless most plants use the more expensive woolen bags, as their greater resistance to heat and sulphurous gases renders them cheaper. L. D. Anderson (*Bull. of A. I. M. E.*, July, 1914, p. 1689) records experiences of the Midvale works. Here the SO_3 in the gases is neutralized by additions of calcium and zinc oxides; stress is laid in having the gas pressure in a bag low, that is 1 to 2 in. water; the bags are freed from dust by replacing the pressure with a vacuum and repeating this change two or three times every eight hours. The blast-furnace dust, carrying As 35 to 45%, is collected in hoppers, transferred by screw-conveyors to cars and treated in an arsenic-plant; the dust from the blast-roasters, As, 9 to 16%, is briquetted and added to the blast-furnace charges. If dust contains over 45% As, there is danger of self-ignition.

The Cottrell electric precipitation is in successful operation at the Garfield smeltery (Howard, *Bull. of A. I. M. E.*, August, 1914, p. 2029) collecting the lead fumes from the copper matte converters. At Anaconda (E. M. Dunn, *Bull. of A. I. M. E.*, November, 1914, p. 2738) it has been found that fractional precipitation of vapors is feasible by regulation of temperature and speed of gases. Schiffner (*Metall und Erz*) has succeeded in collecting antimonious oxides by electric condensation.

Desilverizing

The most notable event is the starting of the lead refinery of the International Smelting & Refining Co., at East Chicago, Ind. (H. P. Hulst, *Bull. of A. I. M. E.*, August, 1914, p. 1865, November, p. 2749.) Here the lead bullion from Tooele, Utah, is desilverized by the Parkes process, and part of the refined lead freed sufficiently from bismuth by the Pattinson process to make it available as corroding lead. The plant, which treats 200 tons of lead bullion per day, is modern in its equipment for handling materials. Lead which is not to be sampled is conveyed from the cars mechanically into two softening furnaces which have a capacity of 300 tons, that which is to be sampled is melted in two kettles of 45 tons capacity. There are two 100-ton desilverizing kettles, one 300-ton refining furnace, and one 200-ton reverberatory molding furnace. Besides there are two 30-ton residue reverberatories for drosses and skimmings; two water-jacket blast furnaces, 42 in. in diameter and 14 ft. high, for treating antimony- and silver-bearing intermediary products; eight retort-furnaces with 1300-lb. retorts; and two Rhodes cupeling furnaces with tests of 5 tons capacity. The Pattinson division contains two 60-ton crystallizing and four 20-ton heating kettles, and one Hulst press. The mode of operating the Parkes plant is the usual one; by Pattinsonizing the bismuth content of the refined lead 0.08 to 0.12% is reduced by a single crystallization and the assistance of the Hulst press to 0.08 to 0.05 per cent.

An innovation in the treatment of the refining skimming, obtained in freeing from zinc lead desilverized in the Parkes process, has been devised by R. D. Divine (*Bull. of A. I. M. E.*, August, 1914, p. 1877) and put into operation at the lead refinery of South Chicago. The process consists in crushing the skimming to ½ in., mixing with finely pulverized oil-coke and soda ash, and smelting in an oil-fired reverberatory furnace at 1000° C. on a bath of lead. From 80 to 85% of the zinc is burned off and collected in a baghouse; the lead and antimony go into the metal bath; the baghouse fume is electrolyzed at Omaha furnishing a high-grade spelter; and the soda slag is smelted in the blast furnace treating antimony skimming.

The Metallurgy of Copper in 1914

By Lawrence Addicks*

The condition of the copper market, none too good during the first half of 1914 and simply chaotic during the second, forced such a curtailment in production upon the industry that metallurgical progress had not the steady onward sweep characteristic of recent years, advances having been confined to more or less restricted fields. The war situation has caused every plant to run under abnormal conditions and some, notably the great smeltery at Great Falls which has contributed so much to the metallurgy of copper, have shut down completely. The result is that progress has in most departments to be stated in general terms rather than by pointing out specific achievements.

New construction has been similarly affected and while no plants under actual construction have been abandoned, work is proceeding at a much slower rate and contemplated extensions to existing plants, such as that to the Great Falls electrolytic refinery, have been laid over to await better times. One notable contribution to smelter construction work has been made by the publication[1] in the most systematic detail of the construction costs of the large new plant of the Arizona Copper Co. The transactions of the American Institute of Mining Engineers continue to be rich in the records of copper practice and easily the most comprehensive book yet published on modern copper metallurgy[2] has been issued by Professor Hofman during the year.

Ore Dressing

A growing tendency toward simplification of concentrator flow sheets is evident and it is safe to say that the concentrator of the future will be more compact. This simplification is being brought about, first, by the use of a less elaborate system of classification, resulting in the elimination of some of the screens and jigs, and second, by the realization that a gravity concentrator is but a relatively inefficient mechanism at best and that higher recoveries can better be obtained by following the concentrator proper with some other process such as flotation or leaching rather than by increasing the internal complexity of the old-style mill.

The court decision[3] whereby certain of the patents controlled by the Minerals Separation Co. were not held to bar the public use of the general flotation principle, resulted in a greatly increased interest in the possibilities of this process for retreatment of concentrator tailings, and experiments are under way wherever the values now lost lie chiefly, if not entirely in sulphide minerals. As yet there seems to be no simple set of ordinary chemicals to be counted on for effective work, a great range of more or less expensive organic compounds entering into most experiments. It is this cost of chemicals, given a suitable mineral, which will probably determine the ultimate scope of flotation.

Leaching attacks the problem from a very different point of view. Oxidized minerals are readily attacked and in most cases a direct recovery of electrolytic copper is contemplated. It is in the handling of the precious metals that leaching is handicapped, but these are often present in tailings in but negligible amounts.

In a general way, therefore, flotation and leaching are in competition for the handling of concentrator tailings and it is quite possible that ultimately the field will be divided between them; the net result being a greater total recovery and a simplified preliminary concentration. This is of especial interest in the case of some of the so called porphyry operations where success has been obtained in low-grade ores by using very cheap mining methods and handling enormous tonnages rather than through high recoveries. It is quite possible to consider overall recoveries from a low-grade ore of over 90% with a concentration-leaching combination.

Leaching

Leaching is now having a thorough trial in Montana, Arizona, Michigan and Chile on problems differing widely in their nature. Only one of these trials, namely that at Anaconda, involves the recovery of silver; here salt is added to the leach liquor and the products go to an ore reverberatory. In the other cases the direct recovery of cathode copper is contemplated. In all but one case, that of the Calumet & Hecla, sulphuric acid is the active leaching agent. The native Lake copper is to be dissolved by an ammonia process. At Anaconda and Douglas, roasted sulphides are handled; at Butte, silicate; at Ajo, Arizona, carbonates and oxide; at Lake Linden, Michigan, native copper; and at Chuquicamata, Chile, oxy-sulphate. At Anaconda concentrator sand tailings are to be treated; at Douglas, sands, slimes and part of the concentrates; at Lake Linden stamp tailings; and at Ajo, Butte and Chuquicamata, ore. Such a varied set of conditions calls for an equally varied application of leaching processes and no one plan will fit all cases. It is probable, however, that this work will so develop the general methods of handling individual parts of the problem that a much wider field, involving complex ores, may be intelligently attacked.

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[1] "Bull. of A. I. M. E.," July, 1914, p. 1497.

[2] "Metallurgy of Copper," McGraw-Hill Book Co.

[3] "Eng. and Min. Journ.," Vol. 97, p. 1067.

Regarding some of these experiments not much has yet been made public. Concerning the Anaconda[4] and Chuquicamata[5] processes ample data are available. The whole problem is believed to be of so much importance that a brief recapitulation of the various plans is given below.

At Anaconda the concentrator sands carry about 12 lb. of copper and 0.55 oz. of silver to the ton. An 80-ton test plant gave such satisfactory results that a 2000-ton-a-day unit is under construction. The sands are roasted in an externally fired MacDougall, giving about 930° F. with 2½% of coal. The hot calcines are cooled in a rotary water-cooled drum and delivered to percolation tanks where they are leached with byproduct sulphuric acid and salt. The copper is eventually to be precipitated upon sponge iron to be made from a concentrator product. It will be noted that this operation is very similar in its result to flotation, the final product being practically a concentrate minus its sulphur.

At Butte the Butte Duluth Mining Co.[6] is surface mining a low-grade (perhaps 2½% copper) ore, the mineral being chrysocolla with some carbonates and the gangue chiefly silica. The ore is crushed to about 10 mesh and leached with sulphuric acid in modified Dorr classifiers. The slimes are taken to a Dorr thickener followed by a Kelly filter-press. The sands are carried to successive classifiers used as washing machines. The stronger solutions are electrolyzed with lead anodes and the weaker precipitated upon scrap iron. It will be seen that this is a direct application of cyanide machinery to copper-leaching work.

At Douglas, Phelps Dodge & Co. has installed a 75-ton test plant after conducting considerable research work, designed primarily to try out leaching on the ores of the Burro Mountain Copper Co.[7] at Tyrone, N. M., which is one of its subsidiary companies. The mineral is chiefly a finely disseminated chalcocite in a highly siliceous gangue carrying 10 to 15% alumina. The plan of operation is to give a preliminary concentration, roasting concentrates and tailings separately, leaching both products, sending the leached concentrates calcines with about half the copper extracted to the smeltery at Douglas. The tailings are roasted with fuel oil at about 950° F. in a MacDougall and fed hot through an "hour-glass" to a sluice carrying the leaching liquor and delivering into the first of a series of seven Dorr thickeners. This is an application of the trough lixiviation used years ago in the hyposulphite leaching of silver. Continuous countercurrent washing is employed by means of the thickeners and a part of the wash water is diverted to a cementation plant. The liquor from the first thickener is sent through a "neutralizer" where cement copper from the previous operation reduces any ferric sulphate and is then pumped to the electrolytic cells. Carbon anodes are used and ferrous sulphate employed as a depolarizer. The rate of circulation and composition of electrolyte are adjusted to yield an 80% current efficiency and about 2.5 lb. cathode copper per kw.-hr. are counted upon. The bulk of the ferric sulphate formed in the cells is reduced in an outside tower with sulphur-dioxide gas from roasting the concentrates, yielding sufficient sulphuric acid to balance out the process. In this case it will be noted that cyclical operations have been abandoned, the process being continuous throughout, and that the smelting plant is being utilized to work up the tailings from one operation, the bulk of the copper, however, being recovered as cathodes. These ores carry but negligible quantities of silver and gold, but any present in the concentrates will go to the smelter with these tailings.

At Ajo[8] the Calumet & Arizona Mining Co. controls the New Cornelia mine where there is an immense capping of oxidized ore. Here the relative scarcity of water has some bearing upon the leaching problem and upward percolation is being tried instead of using cyanide machinery. A 35-ton test plant has been erected. In general, a counter-current series of leaches is contemplated with the idea of applying a neutral solution at first, using the oxidized ore to precipitate part of the iron and alumina in the foul solutions. These precipitates appear to be more or less insoluble in the succeeding acid washes. It is planned to electrolyze the solutions and two methods are being tried to handle the impurities—one to oxidize them with roasted concentrates or similar material, somewhat along the lines of the old Hofman process, and the other to ignore them, using sulphur dioxide in the cell as a depolarizer.

At Clifton, Ariz., the Shannon Copper Co. is working on the possibility of sulphatizing lime by mixing oxide and sulphide ores, so as to make possible the sulphuric acid leaching of ores high in calcium carbonate.

At Lake Linden, Mich.,[9] the Calumet & Hecla Mining Co. is installing a mammoth dredge to reclaim the tailings from the lake bed. These sands are to be reground and concentrated. The tailings from this concentration will carry about six pounds of native copper to the ton and are to be leached. On account of a high-lime content making acid treatment costly, a process based on the reaction between copper oxide and ammonia is to be employed. The details of the process have not been made public, but a solution of ammonium carbonate in ammonia water is presumably to be used for the oxygen carrying liquor, successive films of oxide being formed on the particles of native copper and dissolved. The proof of the process will be in whether the regeneration of relatively expensive reagents will be sufficiently perfect when treating such very low-grade material. A 2000-ton plant has been in course of erection.

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[4] "Bull of A I M E," August, 1914, p 2165

[5] "Trans Am Electrochem. Soc," Vol 25, p 193

[6] "Bull I. M M," May 21, 1914.

[7] "Eng and Min Journ," Vol 98, p 288

[8] "Bull of A. I M E," August, 1914, p. 2011.

[9] "Min and Sci Press," Vol. 109, p 361.

The largest leaching plant under course of construction is that being built by the Chile Exploration Co., at Chuquicamata, where a 10,000-ton-a-day plant is well on toward completion.

Here there is an enormous surface deposit of brochantite contaminated with salt, which is to be leached with dilute sulphuric acid, the copper being precipitated electrolytically. Owing to the high solubility of the mineral content, a 90% extraction on a 2% ore is made when crushing to 1/4 in. Six leaching vats made of reinforced concrete lined with mastic asphalt, 110 ft. wide, 160 ft. long and 16 ft. deep, are placed end to end and the ore from the crushing plant delivered by a traveling bridge. Downward percolation with piston washes is to be used, a leaching cycle taking six days. The tailings are to be removed by grab buckets. The liquor is to be freed from chlorides before electrolyzing by precipitation as cuprous chloride by treatment with shot copper in revolving drums. Magnetite anodes without depolarization are employed in the electrolysis. The cuprous chloride is smelted with lime and carbon to copper and a calcium-chloride slag.

It will be seen from the foregoing that we have upward and downward percolation as well as cyanide machinery at work. The Chuquicamata deposit is unique, however, and for most work fine crushing is likely to be essential to efficient extraction, so that the Dorr thickeners and similar apparatus are likely to see a considerable adaptation and development. The Arizona Copper Co. has a Dorr thickener successfully at work in a tank 130 ft. in diameter which has handled over 1000 tons of solids in 24 hours. In electrolytic work, anodes of lead, carbon and magnetite, with and without depolarizers, are being employed and it seems clear that old-time difficulties with insoluble anodes have been overcome.

Roasting

The use of concrete hearths[10] in furnaces of the MacDougall type is extending. After some experiments they have been employed in the new battery of seven 18-ft. furnaces at the Copper Queen plant. They reduce the masonry repairs and facilitate the removal of incrustations. It is most desirable to minimize the repairs required on account of the serious loss of capacity owing to the time required for cooling down and heating up.

This type of multiple-deck furnace has long been used in this country for the production of sulphur-dioxide gas from pyrites at acid plants and of calcines from sulphide ores at smelting plants. It seems likely that it will hold its own in the third field of producing soluble sulphates and oxides in leaching work. Muffle furnaces for this work have not found as much favor as was at first expected, chiefly on account of high fuel consumption. Attention to delicate temperature control of the charge in the ordinary furnace is now being given by the three makers of the type. It is quite unusual for a single metallurgical apparatus to cover successfully such a varied field of operations.

Where a chloridizing roast is employed, there is a considerable volatilization loss from any open type of furnace and in this connection mention should be made of a shaft roaster, the result of work by Messrs. Holt, Dern and Christensen[11], at Park City, Utah. The present furnace consists of a sheet-iron box or shaft with a cross-section of about 4x4 ft., although larger units are contemplated. At the bottom is a row of oscillating grates and the top is covered by a hinged lid, there being a side outlet to the flue. The charge is perhaps 4 ft. deep and consists of a mixture of ore, coal dust, salt and water, with the possible addition of sulphides, depending upon the character of the ore. About 3% coal is the maximum required. As soon as any glow is perceived on top of the charge, a green charge is added and the oscillating grates continuously deliver ground fritted material at the bottom. The blast traveling upward meets first the hot sinter and is preheated; it then enters the roasting zone; and finally it encounters the moist cool charge on top, where it is cooled and any volatile compounds condensed. It is claimed that the volatilization and dust losses are small and that a product ideal for percolation is made. The furnace is at present running on silver dumps but can be also utilized for copper work, where the recovery of silver values has to be considered.

The rotary kiln at Chrome, N. J.,[12] continues in operation and greater fuel economies are being obtained by means of heavier feeds. Recent campaigns show a ton of flue dust nodulized with eight gallons of fuel oil. Some excellent work has also been done on flotation concentrates, satisfactory nodules being made with six gallons of oil per ton. It seems quite possible to conserve sufficient sulphur to make pyritic smelting in a blast furnace possible and this is of great importance where fuel is so expensive that the cost of reverberatory smelting is excessive. It is understood that the Braden Copper Co. is installing three kilns in Chile for work of this class.

Reverberatory Smelting

Coal-dust firing, which was revived at Copper Cliff with very satisfactory results, has been followed up at Garfield and Anaconda[13] with similar success. At both plants it is to be installed throughout and at Garfield it will replace fuel oil. Apparently the early difficulties from coal ash falling on the charge have been entirely overcome; in fact, the reason for the great improvement over early attempts doubtless lies in the thorough drying and grinding given the coal.

At Anaconda a furnace was especially built for the trial, thereby permitting a revision in the method of charging similar to that practiced at Copper Cliff. The charge is piled high along the sides, obviating the necessity of fettling, and but a very small bath of molten matte is carried. In this way a large smelting area is exposed to the heat, which accounts for the high smelting rate obtained and brings up again the question of the economy of longer furnaces. The trial furnace had a hearth of 21x124 ft. and smelted as high as 550 tons a day, 475 tons being a month's average, with a coal consumption of about 7:1, thereby fully confirming the results obtained at Copper Cliff. It is now proposed to build a furnace 25x144 ft., in which it is hoped to smelt 800 tons a day with a coal ratio of 8:1.

This advance in practice will have a bearing on the relative economy of blast and reverberatory furnaces.

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[10] "Trans. of A. I. M. E.," Vol. 46, p. 383.

[11] "Bull. of A. I. M. E.," July, 1914, p. 1699.

[12] "Bull. of A. I. M. E.," July, 1914, p. 1671.

[13] "Eng. and Min. Journ.," Vol. 98, p. 725.

Fuel cost has always been the main item in the operation of a reverberatory plant. In the old days when the ratio was three or four to one, a reverberatory was often out of the question as against a blast furnace running on a coke ratio of 10:1 and advances toward pyritic smelting increased this handicap. Then waste-heat boilers redeemed 25% of the heat value in the coal; and now the coal consumption has been cut in two as against a few years ago. A reverberatory still requires a uniform preheated charge with adjusted sulphur contents, but permits much greater latitude than a blast furnace in the type of slag produced, and it would seem that it will eventually entirely displace the blast furnace in large plants operating chiefly on concentrator products, while the blast furnace, preceded by some type of sintering when necessary, will control the field of smaller plants with variable ore supply or where a more or less oxidized charge has to be smelted.

Blast-Furnace Smelting

No special development in blast-furnace practice has been reported during the year. The closing down of the Great Falls plant cut off any further research on the effect of furnace lines upon the speed of smelting.

Some interesting experiments are being carried out at the Copper Queen plant at Douglas on the possibilities of the McKee boiler for generating low-pressure steam from the waste heat of blast-furnace slag. The stream of slag is granulated and carried into the boiler at the same time by a stream of water acting somewhat as an injector and overcoming the slight pressure of steam in the large drum which constitutes the boiler proper. The granulated slag is continuously removed by bucket conveyor trapped by a water seal. The chief loss of heat is in the hot water entrained with the outgoing slag. The plan is to use the steam generated in low-pressure turbines for the development of electric power. The trials to date indicate the device to be practical as a steam generator, the only difficulty being that some pulverized slag comes over with the steam and this would cut the turbine blades. Experiments are in progress on the possibilities of mechanical separation of these solid particles. One way of escape would be to generate the steam in a separate vessel inclosed in the main boiler. This could also operate turbines running with an inlet pressure slightly below atmospheric and therefore do away with the necessity of trapping the primary boiler openings. A similar conclusion has been arrived at in English experiments on iron slags[14]. There is no reason why a similar scheme could not be applied to reverberatory slag.

The Detroit Copper Mining Co. has erected a 44x396-in. blast furnace at Morenci[15] for the treatment under low blast of a charge consisting chiefly of concentrates, which would generally be considered a reverberatory proposition.

Converting

Practice in basic converting is now standardized and since it has become generally understood that the durability of a basic lining depends upon maintenance of a protective coating of magnetite, practically unlimited tonnages are obtained from a single lining. The vertical shells continue to be used in new installations in preference to the horizontal type.

Fume Condensation

A great deal of work is being done in the field of abating the smelter-fume nuisance, perhaps the greatest progress being along the line of electrostatic precipitation. Practically all new flue installations are being equipped with suspended wires to collect the bulk of the solids. The bag house can be relied on to collect practically the whole of the remaining solids, but the high installation cost, coupled with that of neutralizing agents to protect the bags, have militated against its use where widely varying acidity is to be dealt with, as in the use of copper-converter gases. At Garfield[16] a series of exhaustive experiments with the Cottrell system has been carried out and a plant to treat all the converter smoke has been made part of the new flue extension. A new type of pipe electrode was developed and over 95% average clearance of gases proved practicable. Also promising results on fractional precipitation of different impurities were experimentally obtained by using treaters in series, with appropriate temperature drops. At Anaconda[17] experiments are in progress to develop a cheaper type of Cottrell installation, using larger pipes for the electrodes.

The experiments being carried out at Coram, Calif., on the Hall[18] process of roasting sulphides with producer gas or fuel oil, with the consequent recovery of elemental sulphur and corresponding elimination of sulphur dioxide from the fumes, have been very interesting. Unfortunately the breaking out of the war put a stop to the experiments just when very promising results were being obtained.

Indirectly, leaching concentrator tailings and utilizing the sulphur dioxide from roasting the concentrates in the subsequent electrolysis may be considered as a contribution toward fume condensation.

Refining

Considerable attention is being paid at the present time to improvement in refining-furnace design. For smelting very foul material with the production of high-grade anodes the basic furnaces at Chrome seem to have fully justified their higher first cost. The demands made upon basic brick are resulting in improvement in their quality. It is understood that at least one of the large manufacturers is installing machinery for molding magnesite shapes under heavy pressure in accordance with foreign practice. It is also to be hoped that suitable domestic sources of magnesite will be developed so as to lower the still relatively high cost of such brick.

Narrower and longer furnaces for melting cathodes are being built. The Baltimore refinery has a furnace 14 ft. 6 in. by 48 ft. and the Chrome plant has just finished one 13 ft. 11 in. by 40 ft. The narrower furnace makes it easier to control the roof repairs, which are always higher than in reverberatory smelting, owing to the cyclical instead of continuous operation, with consequent temperature changes. Longer furnaces were tried by the Michigan Smelting Co. a number of years ago, but as these were shortened after a trial, development in this direction was given a check. It appears that troubles from other sources were unjustly blamed on the length of the furnace. The new Chrome furnace has a sand bottom, chrome-brick side walls and a silica-brick roof. The indicated coal consumption appears to be about 10%.

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[14] "Eng. and Min. Journ.," Vol. 98, p. 290.

[15] "Eng. and Min. Journ.," Vol. 98, p. 201.

[16] "Bull. of A. I. M. E.," August, 1914, p. 2029.

[17] "Bull. of A. I. M. E.," November, 1914, p. 2738.

[18] "Bull. M. and M. Soc. of Am.," Vol. 7, No. 9.

Some excellent results have been obtained from recent waste-heat boiler installations at the Chrome refinery. B. & W. type boilers, followed by economizers, have given equivalent evaporations ranging from six to seven pounds, and it is believed that with some changes a clean boiler will give eight pounds. Cold water is fed to the economizer and part of the feed leaving the economizer is returned to the entering side by means of a small centrifugal booster. This prevents sweating and corrosion.

The problem is more difficult than in smelting practice, as there is a great range of capacity to take care of, again due to the cyclical operation of the furnace, although modern methods of recharging are steadily minimizing the difference. There is an additional handicap in that while a high-grade bituminous coal is burned at the refining furnace, a much cheaper steam size of anthracite is burned under the boilers at the Atlantic seaboard refineries and this lowers the cost of the steam with which the waste-heat steam must compete, and hence the value of the waste-heat steam.

* *

Metallurgy of Zinc in 1914

By W. R. Ingalls

The art of zinc smelting is one involving a multiplicity of details, careful attention to which is necessary in order to secure good metallurgical results. Progress in this branch of metallurgy therefore rarely occurs through the introduction of any radical innovation, but rather through improvements in minor details.

Thus American smelters have been devoting a good deal of time and expense to the manufacture of a retort of more tensile strength and more durability than has heretofore been made in this country. As a rule, the "hard driving," i.e., distillation at very high temperature, as practiced in Germany and Belgium, is unknown in America. Distillation under that condition means higher extraction of zinc, other things remaining equal, one of the things that must remain equal being satisfactory retort life. Certain American smelters have been directing their attention to making retorts conforming essentially to those used in Germany. They have been handicapped somewhat by the American clays, which do not conform to the European, but the difference has been rectified artificially. The retorts made in this way by one important smelter show a much longer life, the retorts lasting until the shell, in numerous cases, is not over 3/8 in. thick.

Considerable attention is also being given to the analysis of the reduction fuel, and the relation of the elements of its ash ingredients to the same elements in the ore, having in view a better blending of ore and reduction material. This, of course, is excellent sense.

It is attention to just such details as the above that makes or breaks the zinc smelter. At Hillsboro, where such thought and care have been exhibited, the extraction of zinc averaged about 2% higher in 1914 than in 1913.

Furnace Firing

Experimental novelties in the firing of both roasting furnaces and distillation furnaces are the use of crude petroleum and coal dust. Crude-petroleum firing has indeed ceased to be a novelty. Coal-dust firing was tried at Collinsville, Ill., in connection with the roasting furnaces (Brown horseshoe) and the distillation furnaces, but the experiments were not developed to a conclusion. Nor were they at Cherryvale, Kan., where one of the distillation furnaces was fitted up for this purpose. The indications were regarded favorably at Cherryvale, the ability to produce the requisite temperature and the cheapness of this method of firing being regarded as settled, but the mechanical details remain to be worked out satisfactorily.

At Cherryvale several of the furnaces are regularly operated with oil-firing and with oil- and natural-gas firing combined. The oil burners take low-pressure air, low-pressure oil and high-pressure steam. These burners, five in number, are introduced from the cellar into the rear of the combustion chamber.

In connection with the roasting furnaces the oil burners are also successful. They are introduced through the roof arch, being placed like the five of a pack of playing cards. The first two, set abreast, are each about 2 ft. from the side wall of the furnace. The next burner is 9 ft. back of the line of the first two. The two remaining burners are 9 ft. back of the middle one.

It is found at Cherryvale that in roasting about 125 gal. of oil per ton of crude ore is required, and in distillation about 250 gal. per ton of roasted ore. With oil costing 50c. per bbl., the use corresponding to those figures is reckoned as being equivalent to the use of gas at about 6c. per 1000 cu.ft.

Treatment of Residuum

The method in use at Cherryvale, which has been mentioned in previous reviews, continues to give satisfactory results. All of the residuum is sifted over a screen with 5/8-in. apertures and over a 20-mesh screen. The oversize from the 5/8-in. screen goes back to the distillation furnaces, being high in zinc. The material between 5/8-in. size and 20-mesh goes to the steam boilers, where it is burned on perforated grates, undergrate blast being supplied by Connersville blowers. Some zinc oxide is recovered from the rear of the combustion chamber and is saved.

At the Bartlesville works of the Bartlesville Zinc Co., Archibald Jones is clinkering the residuum by burning it in heaps, the prime purpose being to put it in good condition for the lead smelter, but incidentally some of the zinc is reduced, volatilized and collected as oxide in the outer part of the heap. Such portions are saved separately for reworking for zinc. The amount gained in that way is perhaps not yet very large, but Mr. Jones has by no means given up hopes of increasing it.

Charging and Discharging Machines

The use of the Saeger charging machine is now a matter of regular practice at the works of the National Zinc

Co., at Bartlesville, Okla. It is found that the quality of the work done by this machine is better than it is possible to do by hand, i.e., the retort is much more satisfactorily charged. The operation of hand charging requires three hours. The machine does it in one hour and enables 2000 lb. more of ore to be put in the furnace. In other words, the retorts are charged more densely.

It is found that the excessively fine flotation concentrates now coming to the zinc smelters are producing two difficulties in machine charging. One of these is the sticking of the very fine ore to the augers, necessitating frequent cleaning of them during the charging operation. The other is the tendency of the retorts to blow out with considerable force, sometimes only 20 minutes after they are charged, thereby burning the men putting up the condensers. This, of course, is due to the difficulty of the gas to find egress through the minute interstices of this excessively fine charge; and increasing the density of the charge naturally increases this difficulty. Gas is developed in the charge, and, being unable to issue freely, acquires an increasing pressure from the heating until the pressure becomes sufficient to blow out more or less of the charge. Even before the days of the charging machine and the fine flotation concentrates, cases have been known of a retort actually exploding when it had been charged very densely and had not been spiessed sufficiently often.

J. J. Simmonds, of Iola, Kan., patented a retort-discharging machine. This consists substantially of a truck carrying a series of bars, or plungers, with sprockets at each end of the bar over which travels an endless chain of scrapers. The machine is run up facing a tier of retorts, into which the scrapers are introduced and set in motion, the mechanical arrangement being very ingenious. After one tier of retorts has been cleaned, the scrapers are withdrawn, the machine is moved ahead, and another tier is treated in the same way, the discharging of the retorts being thus done tier by tier. This apparatus was developed at the works of the Laharpe Smelting Co. After that plant became idle the machine was put in operation at the No. 3 plant of the Prime Western Spelter Co., at Iola, and was operated there for three months for demonstrating purposes. Mr. Simmonds, the inventor, has informed me that the average time required to discharge a tier, or vertical row of retorts, is about 45 sec., when the machine is once in position at the furnace and in motion, divided as follows: 5 sec. to move the scrapers to the mouth of the retort, 25 sec. to discharge the retort, 10 sec. to withdraw the scrapers, and 5 sec. to move the machine forward to the next position, i.e., to attack the next tier of retorts. The scraper chains are sprayed with water, which keeps them cool. The apparatus is not only speedy, but also is reported to do good work and to be capable of handling a residue that is considerably fused. In the opinion of some distinguished zinc metallurgists this machine has solved the problem of mechanically discharging retort-residues. Arrangements are now being made to install the machine at three works.

Roasting Furnaces

The new Sand Springs plant in Oklahoma was equipped with Cappeau furnaces, but most of the new zinc smelteries of the United States are built in the Eastern coal fields, are designed to make sulphuric acid and their builders stick to the mammoth Hegeler furnace, a construction capable of roasting about 50 tons of ore per day and costing about $75,000. The improvements in this furnace, since its introduction about 30 years ago, have been only in structural features and mechanical details.

The Spirlet, one of the popular new European furnaces, was introduced in the United States in 1914 by the Grasselli Chemical Co. This is a multiple-hearth turret-furnace, whereof the hearths themselves are revolved, projecting teeth from the bottom of one hearth rabbling the ore on the next hearth below. The furnace is ingeniously designed so that it may quickly be dismantled for repairs and it desulphurizes blende with very low fuel consumption, 10% or less.

Hydrometallurgical Process

At any given time during the last 20 years it has been safe to assume that experiments with hydrometallurgical processes of zinc extraction are going on at three or four places, and 1914 was no exception. The work at Bully Hill, Calif., was checked, but only temporarily, the metallurgists of that company apparently thinking well of the results so far. Some plans regarded as promising are also being carried out by the Consolidated Mining & Smelting Co. at Trail, B. C. Both at Bully Hill and at Trail the idea is to sulphatize the zinc and electrolyze the solution. The Bunker Hill & Sullivan took over the Malm process, has tested it in a 50-ton plant at Kellogg, Idaho, and Mr. Bradley has pronounced it a success. In this process the zinc and lead of the ore are chlorinated, giving a chloride solution from which metallic lead is precipitated by means of metallic zinc. The zinc-chloride solution is then boiled down and molten zinc chloride is electrolyzed, giving chlorine and zinc, which go back to the process, except that the surplus zinc is ready for market as spelter. Some details of the process remain to be worked out, among others the handling of the chlorine gas, which always has been a troublesome feature in the processes of this class. In California some experimental work was done with the Reed process, making electrolytic zinc out of the bag-house fume from the Mammoth Copper Co.

Electric Smelting

No additional news of technical nature has come from Trollhattan and Sarpsborg. A lawsuit over patents between the Trollhattan and the Ilen companies was decided in Norway in favor of the latter. Thierry is reported to be smelting in the Pyrenees zinc residues from the indigo-dyeing industry and to be making a commercial success of it. Krefting did experimental work in Norway, Cote & Pierron at Ugine, in Savoy, and Queneau in Belgium. The experimental work at Nelson, B. C., was discontinued, it being regarded as conclusively settled that an electric zinc-smelting furnace so small as one ton of daily capacity is a commercial impossibility, while the satisfactory development of a larger furnace was regarded as too doubtful to be undertaken at Nelson. Johnson did a lot of interesting work at Hartford, Conn., and organized a company that is going to build a commercial plant at Keokuk, Iowa, his plans including a furnace larger than anybody else has yet built and operated.

Stamp Milling in 1914

By Herbert A. Megraw

Stamp milling during the year has followed closely the practice of the past few years, and there have been no new developments of especial interest. Possibly the most interesting installation completed during the year has been that of the Aurora Consolidated, at Aurora, Nev., where forty 1600-lb. stamps were installed. The Aurora people believed these to be the heaviest stamps operating in the United States, but this is not true, since the Iola Mining Co., at Candor, N. C., installed 1700-lb. stamps and has been running them for some time. Incidentally it may be mentioned that the Iola company has worked out its deposits and sold its mill, which it is believed will now be run on a mixture of ores from the surrounding district.

The stamps at the Aurora mill crush through 1/4-in. screen, and the product is tube-milled. Each battery of five stamps is driven by an individual back-geared motor powerful enough to lift the stamps into action from whatever position they may be, so that it is not essential that they be hung up before starting. The tube mills at the Aurora are 6 ft. in diameter by 16 ft. long, and are in closed circuit with Dorr classifiers, the latter being said to be the largest so far constructed. The tubes are arranged in units of two, each pair being driven by a 150-hp. motor equipped with outboard bearings and Morse silent-chain drive. The Aurora mill treats the ore as a total slime.

Another new mill erected during the year is that of the Plymouth Consolidated Gold Mines, Ltd., Amador County, Calif., which was started on the first of August It is equipped with 30 stamps of 1250 lb. each, running at 104 drops of [illegible] in. Their capacity when crushing through 4-mesh screens, varies from 11 to 14 tons per stamp, according to the character of the ore. Each stamp requires 2.34 hp., including the transmission and motor losses.

The mortars are anchored to the foundation by cross-bolts. Amalgamation at the Plymouth mill was attempted at first only on plates outside the mortars, but it was found that [illegible] of the coarse gold would not amalgamate on [illegible] plates [illegible] in contact with [illegible] silver [illegible] amalgamation. The difficulty was [illegible] by feeding quicksilver into the Hardinge mill [illegible] the [illegible]. The [illegible] through 60-mesh. [illegible] Hardinge [illegible] amalgamation [illegible] in the [illegible]. The [illegible] amalgamation was [illegible]. [illegible] that the [illegible].

The [illegible] mill at Candor, N. C., [illegible] stamps. The ore is first [illegible] crusher and then [illegible] Allis-Chalmers [illegible] mill. The [illegible] tube mill. The plant is operated as a total-slime mill, the slime being cyanided. The [illegible] mill was built without stamps and has been [illegible] successfully is an important step toward the elimination of stamps as primary crushing machines. Upon ores of a character suitable to such work it is cheaper, both in installation and operation, to use rolls rather than stamps.

The most extensive plant planned and about completed during 1914 is that of the Alaska Gastineau at Juneau, Alaska. This is a 6000-ton unit, which will be duplicated when the mines are in position to furnish the requisite quantity of ore. Milling practice will follow rather closely that adopted by the large porphyry coppers. Jaw and gyratory crushers will do the preliminary breaking of the ore, which will then be handled by rolls in series, being classified between each, and finally to tube mills. All the ore will be concentrated, but no information has been made public as to whether the tailings will be rich enough to receive further treatment or whether the concentrates will be shipped or treated on the ground. Conditions in general point to their being shipped to smelters.

The Commonwealth mill at Pearce, Ariz., has been operating most of the year. This plant, as was noted last year, was built with 1500-lb. stamps and the open type of mortar, similar to that in use at Cinco Minas

On the Rand there has been very little new work in progress. The weight of stamps seems to have reached a maximum beyond which nobody has cared to progress. There seems to be some little tendency to retire somewhat from the high point of over 2000 lb. per stamp which was advocated some time ago. The war has put a stop to all new work in the South African country, and operators consider themselves lucky to be able to keep going.

The Buckhorn mill at Buckhorn, Nev., has been operating successfully during the year. This mill was installed without any stamps, and uses crushers, rolls, Hardinge mill, Akins classifiers, and two tube mills for regrinding. A total slime product is made, agitated in Dorr agitators, and washed by continuous counter-current decantation in Dorr thickeners. The success of this mill, running without stamps, parallels that of the Uwarra, already mentioned, in North Carolina.

The Dome mill at Porcupine, Ont., has doubled its stamp installation, installing stamps of the same weight as those originally used. The [illegible] not [illegible] [illegible]. The [illegible] the [illegible] sands. The sand [illegible] the [illegible] treatment.

A [illegible] mill [illegible] plant [illegible] was [illegible] stamp mill [illegible] been broken [illegible].

The [illegible] Consolidated [illegible] solution through 16-mesh screens. The [illegible] tube mill, the [illegible]. A total slime is [illegible] mill in closed circuit. The [illegible] at Porcupine, Ont., [illegible] twenty 1050-lb. stamps, making a total of slimes through regrinding in tube mills. Amalgamation before cyanide treatment is practiced also, but in cyanide solution. The new Vipond mill, which has just completed a cyanide-treatment annex, treats the ore in crushers, rolls and Hardinge mills. The whole pulp, now made into a total slime, is treated by cyanide. There is no amalgamation of any sort here. The Cornucopia mill, in Oregon, has twenty 950-lb. stamps, and treats 100 tons per day, cyaniding a total slime.

Analysis of Cyanide Practice

By Herbert A. Megraw

The year has brought forth the usual quota of development in cyaniding and some unexpected modifications. In general, progress has been along the lines of gradual development and not in strides of sensational interest.

The Condition in Mexico

One is compelled to regret, both from a technical and from a business standpoint, the continuance of difficulties in Mexico which have made it almost impossible in many cases, and quite so in many others, to operate mills with any degree of success. Naturally, the construction of new plants has been reduced to a minimum. Technical changes have been almost nil, and those plants which have been able to continue operations have done so with an apprehensive eye upon political conditions, investing no unnecessary money and devoting little thought to technical progression. They have been more interested in producing what precious metal they could and getting it out of the country without having it fall into the hands of political bands who might annex it to further their cause.

The large mills in Mexico have continued to run; those at El Oro, Pachuca, Guanajuato, and other important camps have been operating most of the time, with perhaps one or two periods of idleness about the time of the American occupation of Vera Cruz. Practically all of them have started up again recently, and there is every reason to believe that it will not be long before serious work will be undertaken in all parts of the Republic. Political tranquillity is not to be realized yet, but the trend of events is expected to be in that direction.

The Nipissing Process

The metallurgists of the Nipissing Mining Co., of Cobalt, Ontario, gave publicity to their new process of desulphurizing the rebellious silver minerals which they are treating in their low-grade mill. This is the only item of startling interest in the cyanide mills during the year. The successful attempt to treat high-grade rebellious silver minerals directly by cyanide, without concentration, amalgamation, roasting or any other auxiliary process, has given a distinct fillip to operators who have been accustomed to regard this sort of material as hopeless for cyanide plants and causes them to look about and wonder what mineral will be the next to come under the influence of cyanidation.

Changes in the Porcupine District

In the Porcupine district the feature of greatest interest has been the change in the flow sheet of the Dome mill. The original system of making a total-slime product and treating it by agitation has been supplanted by a separate-treatment process, both sands and slimes being treated each in a special installation. The sands are leached in a new addition to the plant which contains a series of large steel tanks, while the natural slimes produced are treated in the original slimes-treatment apparatus. The mill capacity has been considerably increased, but no additional regrinding mills have been put in, the result being that the amount of natural slimes produced just about equals the total of slimes produced in the original mill. Crushing is still performed in water and amalgamation is practiced as formerly.

Two new mills are working in the Porcupine district—the Porcupine Crown and the Vipond. The latter was formerly operated as a crushing and amalgamating mill, but has recently acquired a cyanide plant which treats the tailings from the mill. The important feature of both these plants is that they have been designed to make use of the continuous counter-current decantation process. The process is carried out in about the same way at the two mills, and since the system at the Porcupine Crown has been adequately described in the Journal, no good purpose would be served by repeating it here.

The development of counter-current decantation has been one of the most interesting features brought forth during the year. The system seems to have been remarkably successful wherever tried, and some mills already built with extensive filters have found it advisable to set aside these installations and make use of the counter-current decantation principle. This has been done at the Tom Reed mine, at Oatman, Ariz., and also at the Gold Road mill, at Kingman, Ariz. Many other mills have made use of the system partly or wholly, and among these may be mentioned the Vulture, at Wickenburg, Ariz., the New Reliance and the Mogul, in the Black Hills of South Dakota; the Nevada Hills, at Fairview, Nev.; the Argo, in Colorado; the Hollinger, in the Porcupine district; the McIntyre, in the same district, and a good many others. The principle is being seriously considered in connection with the hydrometallurgy of copper slimes.

Filter Processes Now Limited

The process of filtering slimes has been changed radically from its original application. It was designed at first to be the sole factor in the recovery of solution and dissolved metal in slimes tailings, but at the present time hardly any filter plant is used for that purpose. Most slimes are being washed, sometimes thoroughly and sometimes only partially, before delivery to the filter, and the latter is expected only to reduce the moisture content. This change is largely due to the continuous-decantation systems which have proved so successful.

Development of Tube Milling

The development of tube milling is a continuation of the tendency noticed during the past two years leading toward shorter tubes of larger diameter. The basic reason for the tendency toward this practice is that it is considered more advisable to grind in short steps, classifying between each, so that no machine will be clogged up with finer material than it is capable of handling efficiently. It is generally believed that power is saved by this procedure and that a more satisfactory product is obtained.

Classifiers are usually placed directly alongside the tube mills which they serve, the latter being fitted with scoop feeders of large diameter so that the classifier oversize may fall directly into them, while the classifier receives the outflow of the tube mill directly without elevating. According to this system no elevating machinery is necessary, the classifier serving to raise the oversize, which must be ground, to a level sufficiently high so that it can be taken care of by the scoop feeder on the tube mill.

One of the latest installations of the short, large-diameter mills is found in the plant of the Aurora Consolidated Mines Co., at Aurora, Nev., where six mills 6 ft. in diameter by 16 ft. long are performing the regrinding work. The mill is designed to treat 500 tons daily.

A Late Theory of Tube-Mill Grinding

It is worthy of notice that there are some operators who are now advocating a theory at variance with that accepted a few years ago to account for the grinding action in tube mills. It has heretofore been believed that the tubes require such a speed that the pebbles may be elevated so as to fall free through space upon the charge and pebbles beneath them. It is now being said that the grinding accomplished by tube milling is almost entirely by attrition and that a cascading action, the pebbles falling through space, not only does not produce greatest efficiency, but actually detracts from the amount of work done. The question is by no means settled yet, and a good deal of discussion may be expected upon the subject.

The question of tube-mill linings has received no extended discussion recently. Operators have apparently convinced themselves of the advantages of some particular type for their own use, and are sticking to it without further comment. There should be a superlative type, however, and it is likely that further discussion and experiment will discover it.

Agitation Methods and Devices

Agitation methods have followed previous practice, and perhaps there have been some minor betterments of existing machines, but nothing new has been offered. A good many Dorr agitators have been installed in new plants, and a few of the Pachuca type have been built, but not many. One plant, the Uwarra, in North Carolina, installed Hendryx agitators, depending upon violent action to secure prompt extraction results in spite of the higher costs in power for operating. The new Aurora mill uses Dorr agitators, together with Trent replacing machines for changing solutions. It does not include counter-current decantation.

Some mills have been depending upon passage through counter-current decanting machines to secure agitation, but this has been principally limited to gold mills where little agitation is required. The Hollinger has heretofore depended upon that system, but has about come to the conclusion that some additional agitation will be beneficial.

At the Porcupine Crown, two Dorr agitation tanks are used between the primary thickening tanks and the counter-current decantation series. The theoretical use of the continuous counter-current decantation process is not to secure extraction or to displace agitation tanks, but to serve as a washing and replacing plant for cleaning the slimes already treated and making them ready for discharge, free from cyanide solution and dissolved value. When a counter-current system is used, however, it is almost invariably found that some additional dissolution of precious metal takes place and this is usually recovered.

Same Precipitation Methods in Use

Precipitation methods have changed very little from the common use of the past few years. The Merrill zinc-dust process is regarded as the best and most economical in use, and is continuing to enter practically all of the new mills. Its many advantages make it impossible to disregard the process when an installation is considered. The Merrill process has been installed at the new Aurora mill in Nevada. Zinc shavings are being used in many of the plants in which they were originally installed and in a few of the small, temporary plants which are being erected at the present time, but in hardly any of the large modern installations. There is no denying the fact that zinc shavings will precipitate about as well as zinc dust, but are more expensive of zinc and labor, and involve a handling of loose precipitate without any safety factor, which is satisfactorily avoided by the use of the Merrill processes, including the locked filter press.

Leaching Sands

The change of the Dome mill from a total-slime plant to a separate-treatment plant opens up again the question of all-slime vs. separate-treatment processes. The truth of the question, of course, lies in the comparative cost of regrinding to make a total slime, and sand treatment, while considering the additional metal left in tailings as part of the cost. If the amount of metal recovered from the sands by leaching allows sufficient profit over its cost more than to counterbalance the higher saving attained in the all-slime process, less its undeniably higher cost, then the sand treatment is better. The question must undoubtedly be worked out for every ore considered. An additional question appears in selecting the proper mesh, or fineness of grinding to which the sand must be reduced for leaching treatment. It has been often pointed out that sands, whatever their fineness, may be leached, so that the fineness required in any particular ore must be worked out with reference to the cost of grinding to that point. We may expect to see other plants turn toward sands leaching if the Dome experiment is successful.

The Flotation Process

In view of the rapidly expanding interest in the flotation process, we endeavored to obtain some data showing the present magnitude of its development in America. That such development has already become large is exhibited by a list of 31 mining companies that are now using it in one form or another.

The responses to our inquiries which were quite harmless, were noteworthy in their exhibition of the bane which the protracted patent litigation has spread over this important subject. We inquired respecting the name of the flotation process employed, the number of flotation units, their aggregate monthly capacity, the tonnage of material treated in 1914, and the tonnage of concentrates produced, the quantity of oil used and the kind of ore treated.

Several mining companies excused themselves from answering "by advice of counsel." Certain companies that are operating without license said plainly that they preferred not to communicate any data. Butte & Superior, the largest user, was frank and full. So were, in general, the companies which replied that they are using the Minerals Separation Co.'s process but one of these replied that under the term of its license it could not furnish information respecting the quantity of oil used.

Eight companies, including all but one of the large producers, reported that they had treated about 700,000 tons of material in 1914, producing about 120,000 tons of concentrates. Six of these companies, which treated about 520,000 tons of material, used about 1,560,000 lb. of oil, or an average of about 3 lb. of oil per 2000 lb. of ore. The largest part of the concentrates produced was blende, going to the zinc smelters, but there was a substantial production of copper-sulphide mineral, going to the copper smelters, and of galena concentrate produced by the mills in southeastern Missouri.

With regard to the process used, the mining companies operating under Minerals Separation licenses generally said they were employing the "Minerals Separation" process. Certain of them specified the modification, e.g., the "Minerals Separation, cold non-acid." Others are using the Callow, Towne and other processes. Others report generically that they are using the "froth-flotation" process.

A good many of the mining companies on the list of 31 report that their work so far has been merely experimental. Most of these companies express themselves hopefully respecting the expected outcome, but one which has tried several types of flotation apparatus reports that results have varied between mediocre and poor, this being in the case of a certain copper ore which, apparently, is not well adapted to flotation

In general, however, the data communicated to us indicates a wide range of ores that are capable of treatment by the flotation process. We think that it is reasonably safe to say that nearly 1,000,000 tons of ore were treated in North America in 1914 by the flotation process, and the production of concentrates was, without any doubt, upward of 150,000 tons. These figures are impressive, but they are below those of Australia where the flotation process received its initial commercial development and from where an immense tonnage of floated blende concentrate has been derived annually in recent times. Without any doubt there is going to be a far larger use of the process in America in the near future; and we feel safe in prophesying that its use for the treatment of low-grade copper ores will greatly exceed its use for zinc ores, and within a very short time will amount to millions of tons annually.

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Gold Dredging in 1914

By Robert E. Cranston*

During 1914 the progress of the gold-dredging industry was nearly at a standstill. Few new dredges were built, although several of those that had worked out their ground, or become obsolete, were dismantled and rebuilt, or taken to other fields and there rebuilt. Doubtless owing largely to the fact that there was so little new construction, few marked improvements were made in machinery or methods. Although we hear of so little actual new building going on, still there are many reports out that different properties are about to be equipped, or dredging [illegible] and it is possible that in 1915 we may see some revival of this form of mining. The depressed financial conditions caused by the European war may have had quite a little to do with the lack of progress, but the main reason, I believe, is that there is little [illegible] suitable for dredging. There were [illegible] dredging successfully [illegible]. [illegible] there is no better business [illegible] than gold mining, and gold dredging [illegible] results and regular profits.

Several [illegible] in Alaska and the Yukon [illegible] the activity [illegible] Seward [illegible] disappointment [illegible]. The [illegible] that [illegible]. The results of Seward [illegible]

[illegible]

able and considering the large amount of money that has been expended there for investigation work the results are most discouraging. I have seen several favorable reports from properties in the Philippine Islands, but we must await more matured data before any reliable opinion can be given as to the future of dredging in that country.

California

During the early part of 1914 the Northern California Mining Co. applied for the privilege of operating a gold dredge within the town of Oroville. For this privilege it was willing to reclaim a certain amount of land and make it into a park for the town, but, owing to objections by the citizens, this plan was abandoned. The State Anti-Débris Association brought suit against the Pennsylvania Dredging Co. for dumping tailings in the Feather River and there were several other like suits brought in different parts of the state. Where actual damage was done the companies were usually forced to discontinue the work resulting in the damage, but where no damage could be shown decisions were rendered in favor of the companies. This is as it should be. During October the Indiana Gold Dredging Co. installed a reconstructed dredge near Chico, on Butte Creek; this dredge was rebuilt from their old No. 3, which was originally at Oroville and went into commission in April, 1904. During the year the tailings dump of the old Cherokee mine near Oroville was prospected and it is claimed that the results warrant the installation of a dredge to handle this material. The Bear River was again prospected. The people doing this work are said to be Nevada capitalists. This area has been gone over many times and the actual dredging results there have not been satisfactory, so I have not much hope that the results of this new prospecting will open up any great quantity of land suitable for dredging in this district. The Gardella Dredging Co. completed a 5-cu.ft. bucket dredge for the Gold Hill mining district in Auburn Ravine; the machinery for this dredge is from a dismantled boat at Oroville. On the American River the El Dorado & Placer Counties Gold Mining & Power Co. built a gold dredge at Butcher Ranch. It expects to work a number of bars along the river above the holdings of the Pacific Gold Dredging Co., which company is operating successfully at Mammoth Bar and nearby portions of the American River. Successful dredging operations were reported by the Alta Bert Co., near Trinity Center on the Trinity River, and there was considerable prospecting going on at other points along this river. The El Oro company moved the machinery of its old No. 1 dredge from Oroville to Greenhorn Creek near Yreka, Siskiyou County, there installed it on a new hull and put in a revolving instead of a shaking screen. This dredge, now known as El Oro No. 3, started digging Aug. 20. In the Igo district above Redding a systematic investigation was carried on during the summer, but the results were not made public. In the Folsom district the only matter of interest which I note is that the Union Dredging Co. got into financial trouble, and its 9-ft. Bucyrus dredge was sold by order of the court at public auction. In Merced County the Yosemite Mining & Dredging Co. is having one of its old dredges rebuilt by the Yuba Construction Co.[1] Considerable prospecting is reported outside of the proved area on the Yuba River. I believe there is a fair chance here of finding additional ground which will pay to dredge. The Yuba Consolidated Gold Fields had two of its old dredges (Nos. 3 and 4) rebuilt by the Yuba Construction Co. These dredges have steel hulls and are operating on the Yuba Consolidated Co.'s property at Hammonton.[2] One of the old Indiana company's boats was rebuilt and moved to Michigan bar on the Cosumnes River. This dredge went into commission about Apr. 1.

OTHER STATES

There was considerable interest manifested in several districts in Montana. Perhaps Madison County received the most attention, and the country north of Virginia City was investigated by several of the larger California operators. Apparently, these investigations were not satisfactory, since they were discontinued and I can learn of no purchases having been made. The Big Creek placers near Libby, Lincoln County, Mont., were prospected by drilling during the summer and it was expected that all necessary machinery would be placed on the ground and operations started before the end of the year, but the latest advices I have indicate that there will be no work done until next season. In Deer Lodge County, the Butte-Georgetown Gold Mining Co. has tested placer ground near Georgetown.

The dredge at Empire, Ormsby County, Nev., was reported completed, but I have seen no notice that it has yet started operations. This dredge is to be used on tailings from the old Virginia City mills. The Federal Mines Co.'s dredge at Unionville, Humboldt County, is reported as digging 1500 yd. per day. The dredge has $5\frac{1}{2}$-cu.ft. buckets and gasoline is used for fuel.

During the year all three dredges of the Tonopah Mining Co.'s property at Breckenridge, Colo., were put in shape and are now operating. These dredges are said to be doing well. The Bed Rock Gold Dredging Co. is reported as having under construction a dredge for the Hahn's Peak district, in Routt County, Colo. The property is known as the Hornet placers and is in Way's Gulch. The Tin Cup Dredging Co. replaced its old gold-saving tables with a special patent riffle known as the Richards pulsator riffle, made by the Denver Engineering Co. Accurate records are being kept of the results of this work, but they are not available at this time. If this riffle proves a success it may have a considerable bearing on the future equipment of gold dredges, particularly where fine gold and much black sand is encountered.

Early in the year it was reported that two dredges were to be built in Oregon, one near Gold Hill, Jackson County, and the other in Bear Creek. I have had no information as to whether these dredges were built or not. The Santa Fé Dredging Co. of Golden, Bernadillo County, N. M., built a large steam-driven dredge which is expected to handle 6000 yd. of material per day.

ALASKA, THE YUKON, AND SOUTH AMERICA

The Houston Dredging Co. purchased a new dredge and hydraulic plant for its property at Mile 26. The American Dredging Co. proposes to operate a combination of tin and gold dredge on the Anacopick River. The Arctic company is planning to install a large dredge on Sunset Creek, in the Port Clarence district, and the Circle City Mining & Dredging Co. recently purchased the Klondike Mining Co.'s dredge No. 2, which sank in October, but this dredge is not likely to be in commission again before next season.[3]

In Colombia, the Pato dredge at Zaragosa continued its checkered career. During January and February high values were encountered but in March the dredge got into a clay bank and lost the pond water, and owing to low water in the river was not able to start operations again until April. The dredge then operated successfully until the middle of September when it turned over and sank. It was floated a week or so later and it was estimated at that time that repairs would be completed in about a month. W. H. Prichard reported that further drilling added another hundred acres to the proven area of the Pato territory and bids were submitted for the construction of a new dredge on its San Francisco property.

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[1] This is a $3\frac{3}{4}$-cu.ft. bucket electrically operated dredge, having a capacity of 2700 cu.yd. per 24 hr.—EDITOR.

[2] These are electrically operated, 7-cu.ft. bucket dredges handling 4000 cu.yd. per day.—EDITOR.

[3] The Straub Manufacturing Co. built two dredges in 1914. One was for the Flume Dredge Co., operating on Crooked Creek, and one for P. Servatius, operating on Arctic Creek, Alaska. These boats are 28x60 ft. and require 24 in. of water for flotation. They have a 37-ft. ladder with $2\frac{1}{2}$-cu.ft. buckets made of $\frac{1}{2}$-in. pressed steel fitted with manganese-steel lips. These two boats ran for the full season, 120 days, and averaged 1000 yd. per day, digging from 4 to 14 ft. deep to bed rock, which is limestone and very hard. These boats are of the flume type and carry a flume 74 ft. long fitted with railroad iron riffles, with an undercurrent riffle which sends the fine concentrates and gold back to a special constructed table which saves the very fine gold. These boats are fitted with a Krogh 12-in. centrifugal pump which supplies the flume with water. They are also fitted with a 3-in. cleanup pump connected with a 4-hp. engine. The boat is fitted with a 4-hp. Cushman engine connected with a 3-kw. 110-volt generator for lighting purposes. The main power consists of a 60-hp. Western gas engine. All driving mechanism is driven by friction and operated from the pilot house. This boat requires three men on each shift, which is 12 hr.—EDITOR.

[4] Lobnitz & Co., Ltd., constructed a dredge for the Cie Française du Mataroni, French Guiana, South America, with a bucket capacity of $3\frac{1}{2}$ cu.ft., steam-driven. The same works also built a dredge for the Cie des Mines de la Faleme, Senegambia, 7-cu.ft. buckets, steam-driven, and also two 15-cu.ft. bucket dredges for tin mining in Siam.—EDITOR.

Economic Geology

By Adolph Knopf[*]

The subject of most general interest during the year was the origin of the garnet zones and associated ore deposits that occur at the contact of limestone and intrusive granitic rocks. Lindgren[1] gives an admirably lucid summary of the present status of knowledge concerning the contact-metamorphic ore deposits, as viewed by those upholding the doctrine that the deposits represent almost wholly an accession of material brought by magmatic emanations. This hypothesis may be characterized, to use a chemical term, as the "fixation" hypothesis. Leith[2] presents the opposing view that the garnet and other silicates associated with the ore minerals are dominantly derived from the recrystallization of substances originally present in the limestone. Most interesting is his contention that this hypothesis, as contrasted with the fixation hypothesis, represents merely a difference of emphasis—surely a recession from the stand taken several years ago—but it is clear that the opponents of the recrystallization hypothesis will hardly accede to this view.

In the forefront of recent papers on contact-metamorphic deposits is that by J. B. Umpleby[3] on the genesis of the Mackay copper deposits, Idaho. These deposits were believed by Kemp to be a unique type consisting of arborescent, pipelike masses of garnetiferous ore inclosed in granite porphyry, which had been formed while the environing porphyry was still viscous. It is shown, however, that the loci of garnetization and ore deposition were determined by blocks of limestone that had become engulfed in the porphyry at the time of intrusion, and that the mineralization ensued after the porphyry had become solid. Kemp's conclusions concerning the prevalence of the lime-iron garnet, andradite, and the high theoretical importance of this fact are amply confirmed. The geologic conditions at Mackay are peculiarly favorable for a study of the moot question of the function of magmatic or meteoric waters in the genesis of ore deposits; after a careful weighing of both sides of the problem the conclusion is reached that the evidence is wholly in favor of the agency of magmatic emanations.

The problem of the contact-metamorphic deposits and the agency of magmatic waters was attacked from a different angle in two stimulating papers by A. C. Lawson. In the earlier paper[4] he challenges the current interpretation that the great granite intrusion in southwestern Montana, known as the Boulder batholith, is a batholith, and argues that it is in reality an irregular, transgressive accolith resting upon a synclinal basement. The surrounding bedded rocks thus dip in under the igneous mass. Under this supposition conditions during the cooling of the laccolith would, therefore, have been ideal for the establishment of a circulation of meteoric waters. It is from solutions of this kind, rather than magmatic waters, that the ore deposits of the Butte and Helena mining regions originated. Regarded from another aspect, this paper illustrates forcibly how often the practical problems of mining geology are closely tied to the apparently abstract problems of petrology. In the second paper[5] Lawson, replying to his critics, attempts to show, with considerable success, that much of the argument in favor of magmatic waters applies equally well to the hypothesis of meteoric waters and that the problems of the origin of contact-metamorphic deposits is still an open question. Continuing, he points out that at Bingham, Ely, Bisbee, Clifton-Morenci, and probably at Cananea, the ores are genetically associated with an intrusive mass which in every case invaded a syncline. The structural conditions at these mining districts, therefore, favored the establishment of an energetic circulation of waters of surface derivation; and until this possibility is disproved, the doctrine of magmatic waters cannot be held to be a scientifically established theory.

Gold Deposits

The genesis of the Rand deposits, which now supply 38% of the world's annual output of gold, was discussed at length by C. B. Horwood,[6] who is an ardent advocate of the infiltration theory. These articles contain much material of value, but the treatment is diffuse and unsystematic. The mineralization is regarded as genetically affiliated with the intrusion of the diabase dikes associated with the reefs, but the evidence adduced, as may be said of earlier similar attempts, can hardly be deemed conclusive. In a brief discussion E. T. Mellor[7] announces that his detailed mapping of the Witwatersrand is approaching completion and that he has found much evidence in support of the placer theory, in addition to that already brought forward by the advocates of that view. It is obvious, therefore, that the origin of the Rand gold deposits is not yet a closed question. Of interest in this connection is the fact that in two recent reports[8] buried auriferous placer deposits are carefully described; and the description of these undoubted "fossil" placers demonstrates that some of the arguments that are advanced for and against the placer origin of the Rand gold are without serious merit.

Malcolm Maclaren has contributed a paper on "The Persistence of Ore in Depth,"[9] but despite the comprehensiveness of the title, the discussion is restricted to gold deposits. His main thesis is that geologic structure, by which is meant the chemical and physical character of the wall rocks inclosing gold deposits, is the vital factor in determining the persistence of ore in depth; "depth" exerts only an indirect control, inasmuch as the greater the depth, the greater is the likelihood of change of geologic structure. An interesting application of this principle is to the Mother Lode of California. According to Maclaren the carbon of the Mariposa slates was the factor that determined the precipitation of the gold in the veins of the Mother Lode system; hence those veins that are inclosed in the black slates will hold their gold tenor down to the lower limit of practicable mining, whereas the veins inclosed in amphibolite schist, as at Angels Camp, will fail in depth. This hypothesis is of great economic importance, if it can be substantiated. So long ago as 1896 Lindgren had shown the inapplicability of this explanation to the veins of the Grass Valley district, and in his recent work on mineral deposits, he emphasizes his earlier conclusion that the influence of carbon as a precipitant of gold from hypogene vein-forming solutions has been much overrated.

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[*] U. S. Geological Survey, Washington, D. C.

[1] "Econ. Geol.," Vol. 9, p. 283.

[2] Idem., p. 293.

[3] Idem., pp. 307-358.

[4] "Is the Boulder Batholith a Laccolith" A Problem in Ore Genesis," "Univ. Cal. Bull. Dept. Geol.," Vol. 8, No. 1

[5] Idem., Vol. 8, p. 219.

[6] "Min. and Sci. Press," Vol. 107, p. 563 et seq.

[7] "Min. and Sci. Press," Vol. 108, p. 781.

[8] Diller, J. S., "Mineral Resources of Southwestern Oregon," "U. S. Geol. Surv. Bull. 546;" Moffit, F. H., "Geology of the Nome and Grand Central Quadrangles, Alaska," "U. S. Geol. Surv. Bull. 533."

[9] "Min. and Sci. Press," Vol. 108, p. 566.

T. A. Rickard[10] dissents from Maclaren's hypothesis, and, fortified by the solid facts of experience, shows that all ore deposits, in spite of downward continuity of favorable structure, tend to impoverish in depth. The treatment of the subject is essentially empirical, but W. H. Emmons,[11] singling out one factor that influences the persistence of ore in depth, shows that the mineral composition of primary ore is likely to govern the range of metals and sulphides deposited during secondary enrichment, the downward extent of enrichment can, therefore, be prognosticated with some degree of probability.

Silver-Lead Deposits

The origin of the silver-lead-zinc deposits of the Broken Hill region is the principal subject of a recent memoir.[12] The Broken Hill lode, which is one of the world's greatest argentiferous lead-zinc deposits, has heretofore been but inadequately described and accordingly this contribution to its genesis is to be welcomed, although it falls far short of the detailed completeness commensurate with the economic importance and the geologic interest of the deposit. The country rocks in the vicinity of the lode consist of schists and gneisses, which are shown to be of pre-Cambrian age. These have been cut by large intrusions of granite, following which came innumerable pegmatite dikes, all of pre-Cambrian age. The ore is composed of argentiferous sphalerite and galena with a little pyrrhotite; the gangue materials are chiefly rhodonite and manganiferous garnet, with minor quantities of quartz and fluorspar and sporadic apatite and tourmaline. Toward the extremities of the lode the gangue becomes dominantly composed of calcite. The gangue minerals indicate that the deposit originated at a relatively high temperature; the quartz when tested optically according to the methods advocated by F. E. Wright showed that this temperature, however, did not exceed 575° C. This agrees with all experience so far gathered; no quartz occurring in an ore deposit has yet been found that was formed at a temperature higher than the 575° inversion point. The pegmatites, many of which are metalliferous, are thought to be of unusual interest as illustrative of their rôle as ore bringers. Following upon the intrusion of these pegmatites, and as a later phase of magmatic solidification, solutions were given off from which the constituents of the orebodies were deposited. The Broken Hill lode is, therefore, like its inclosing rocks, of pre-Cambrian age.

Lindgren and Whitehead[13] have described a remarkable deposit of jamesonite ($2\ PbS.\ Sb_2S_3$) at Zimapan, Mexico. Its unusual mineral association—garnet, danburite (calcium borosilicate), amphibole, and others indicate, like that at Broken Hill, that a relatively high temperature prevailed at the time it was formed; to determine this temperature more closely a careful study of a sodium-chloride cube occurring in a liquid inclusion in quartz was made, from which it is concluded that the probable temperature was 525° C. This result, however, was obtained by extrapolating the solubility curve of sodium chloride nearly twice its known length, so that some doubt attaches to this determination; such are the difficulties that beset present attempts at geologic thermometry.

Coal and Iron

"The Origin of Coal,"[14] by David White and Reinhardt Thiessen, is a comprehensive report on the genesis of this mineral fuel. The report falls into two portions. In the first half White considers the geologic features of the occurrence and origin of coal. He discusses the physiographic conditions that prevailed during the deposition of the coal-forming substances, the climatic conditions and the rate of deposition. After a brief consideration of the 10 theories that have been advanced to account for the devolatilization of coal, the hypothesis is maintained that the transformation of peat or lignite to coal of higher rank is effected by regional thrust-pressure, essentially horizontal in direction, acting on and transmitted through the buried coal-bearing strata. In the second half the results of an elaborate microscopic study of coals by Thiessen are presented, from which the conclusion is drawn that "coal is chiefly composed of residue, consisting of the most resistant components of plants, of which resins, resin waxes, waxes, or the derivatives of the compounds composing these, are the most important." A notable feature of the report is the large number of photographic illustrations of microscopic sections of coals, resulting from the devisal of a new technique. This publication, without question, contains the best treatment of the origin of coal that has yet appeared under one cover and is not burdened with too extended an array of details or citation of authorities.

A treatise of more general scope is that by O. Stutzer, entitled "Kohle (Allgemeine Kohlen Geologie)." This forms the second volume of "Die Wichtigsten Lagerstätten der Nicht-Erze" by the same author. It is an attractive volume, and parts of it will prove of interest even to those not specialists in coal.

A valuable work on the iron ores has lately appeared from the pen of E. C. Eckel.[15] This volume furnishes in succinct form a conspectus of the world's iron-ore deposits, as viewed in their geologic and economic relations. The outstanding feature of the geologic portion of the volume is the emphasis laid on the predominant importance of the ores of direct sedimentary deposition. The sedimentary ores are estimated by Eckel to comprise so large a proportion as 63.1% of the known iron-ore reserves of the world. There seems to be no question in the author's mind that all of the bedded, or to use a safer term, stratiform deposits included in the above summation, have been conclusively demonstrated to be of direct sedimentary origin. Concerning the igneous ores, however, he is more cautious, believing that these "may or may not really exist." Possibly a clue to the cause of this skepticism may be found in the author's own statement on p. 62 that "it is perhaps a natural tendency of human nature to assume that the only possible mode of origin is that which the author happens to have studied." If the tonnage of all ores that are due to igneous processes —magnetic segregation and contact metamorphism—are added up, including in this summation all that by any probability might be considered due to igneous processes, they are found to contribute but 10.7% of the known reserves. Clearly, then, magmatic waters seem not to have played in the genesis of the iron ores the important part assigned to them in the genesis of the other heavy metals.

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[10] "Persistence of Ore in Depth," "Bull. I. M. M. 122."

[11] "Compte Rendu, 12th Internatl. Geol. Congress," 1914.

[12] Mawson, Douglas, "Geological Investigations in the Broken Hill Area," "Memoir Royal Soc. South Australia," Vol. 2, Pt. 4, p. 211, 1912. Although this publication bears the date 1912 upon its title page, it appears to have reached this country only this year.

[13] "Econ. Geol.," Vol. 9, p. 435.

[14] "U. S. Bureau of Mines Bull. 38."

[15] "Iron Ores—Their Occurrence, Valuation and Control."

In recent years the concepts of colloid-chemistry have been applied to the problems of ore genesis, principally to the mineral transformations in the zone of oxidation, where such compounds as opal, chrysocolla, limonite, and the like are common. Few investigators have applied them to the problems of ore deposition from ascending thermal solutions. In this connection Lindgren, following an earlier suggestion by Becker, appears to have been the pioneer, having in 1896 discussed the possibility of the agency of colloids in the formation of the Grass Valley gold veins. Again, Lindgren and Ransome, in order to account for certain features of the Cripple Creek ores, advanced the hypothesis that some of the constituents of the vein-forming solutions had been present in the colloid condition. But these attempts were mainly of a tentative nature, and their validity is in fact denied by Krusch. In a recent paper Tolman and Clark[16] urge a radical extension of these ideas. They find that carbon dioxide and hydrogen sulphide, constituents that are common in hypogene vein-forming solutions, are strong dispersive agents for the copper sulphides, and suggest that the distribution of ores within the veins may be related to the escape of these agents. They believe that the experimental determination of the relative dispersion of the different sulphides at a series of temperatures and pressures will lead to a new advance in our knowledge of the science of ore deposits.

R. C. Wells[17] presents the results of a laboratory study of the electrochemical features of the metallic sulphides common in ore deposits. This work is based largely on the principle that the potential of a mineral functioning as an electrode depends on the concentration of the metallic ion in contact with it; the results obtained supplement in an important way, therefore, the earlier work of Buehler and Gottschalk, who measured the difference of potential between the different metallic sulphides.

Allen, Crenshaw and Merwin[18] have reinvestigated their former results on the genesis of wurtzite (the hexagonal zinc sulphide) and marcasite (the orthorhombic iron disulphide). It has been demonstrated that, under the conditions of experimentation, the unstable forms are obtained only from acid solutions; that is, marcasite, wurtzite and metacinnabar—the dimorphs of the commoner minerals pyrite, the blende, and cinnabar crystallize from acid solutions only. These three minerals are, therefore, of peculiar genetic significance, and investigators will be stimulated to a sharper lookout for their occurrence in ore deposits. In illustration of this a recent paper by Ransome[19] may be briefly referred to. The Goldfield ores were ascribed by Ransome to deposition in an acid environment, and reëxamination of certain of the ore from that district showed that part of the zinc sulphide present has crystallized as wurtzite: a result in harmony with the experimental deductions and with the explanation originally offered for the deposition of the ores.

State Geological and Mining Officials

The following lists of the directors of state geological surveys and of the chiefs of state mine-inspection bureaus, constitute a convenient reference:

STATE MINE INSPECTORS, COMMISSIONERS, ETC.

State	Name and Address
Alabama	C. H. Nesbit, Chief Mine Inspector, Birmingham.
Alaska	Sumner S. Smith, Mine Inspector, Juneau
Arizona	G. H. Bolin, State Mine Inspector, Phoenix
Arkansas	John H. Page, Commissioner, Bureau of Mines, Manufacturers and Agriculture, Little Rock; John T. Fuller, State Mineralogist, Tom Shaw, State Mine Inspector, Midland.
California	F. McN. Hamilton, State Mineralogist, San Francisco
Colorado	T. R. Henahen, Commissioner, Denver
	James Dalrymple, State Inspector of Coal Mines, Denver
Idaho	R. N. Bell, State Mine Inspector, Boise
Indiana	Edgar A. Perkins, Chief Mine Inspector, Indianapolis
Iowa.	E. M. Gray, Pres., State Mining Board, Des Moines
Kansas	Francis Keegan, State Mine Inspector, Pittsburg
Kentucky	C. J. Norwood, Chief Inspector of Mines, Lexington
Maryland	Wm. Walters, State Mine Inspector, Midland
Minnesota	F. A. Wildes, State Mine Inspector, Hibbing
Missouri	George Bartholomaeus, Secy., Bureau of Mines and Mines Inspection, Jefferson City.
	George Hill, Chief Mine Inspector, Bevier
Montana	W. B. Orem, State Mine Inspector
	John Sanderson, State Coal Mine Inspector, Red Lodge.
Nevada	Ed. Ryan, Carson City
New Mexico	Rees H. Beddow, State Mine Inspector, Gallup
New York	W. W. Jones, State Mine Inspector, Albany.
North Dakota	Jas. W. Bliss, State Engineer, Bismarck
Ohio	J. C. Davies, Chief Inspector of Mines, Columbus
Oklahoma	Ed. Boyle, Chief Inspector, McAlester
Oregon	H. M. Parks, Director, Bureau of Mines, Corvallis
Pennsylvania	James Roderick, Chief, Department of Mines, Harrisburg.
South Dakota	Otto E. Ellerman, State Mine Inspector, Lead
Tennessee.....	Geo. E. Sylvester, Chief Mine Inspector, Rockwood.
Texas	J. J. Broman, State Mine Inspector, Round Rock
Utah	J. E. Pettit, State Mine Inspector, Salt Lake City
Virginia	Capt. Richard B. Roanoe, Mine Inspector, Richmond.
Washington	Jas. Bagley, State Inspector of Coal Mines, Seattle
West Virginia.	Earl Henry, Chief, Department of Mines, Charleston.

STATE GEOLOGISTS

State	Name and Address
Alabama	Eugene A. Smith, University
Arkansas	N. F. Drake, Fayetteville
Connecticut	Wm. N. Rice, Hartford
Colorado	R. D. George, Director, Boulder
Florida	E. H. Sellards, Tallahassee
Georgia	S. W. McCallie, Atlanta
Illinois	F. W. DeWolf, Director, Urbana
Indiana	Edward Barrett, Indianapolis
Iowa..........	Geo. F. Kay, Des Moines.
Kansas	Erasmus Haworth, Lawrence
Kentucky	J. B. Hoeing, Frankfort
Maryland	William Bullock Clark, Baltimore.
Michigan	R. C. Allen, Lansing
Minnesota	W. H. Emmons, Minneapolis
Mississippi	E. N. Lowe, Jackson
Missouri......	H. A. Buehler, Rolla.
Nebraska	E. H. Barbour, Lincoln.
New Jersey	H. B. Kummel, Trenton.
New York	John M. Clarke, Albany
N. Carolina	Joseph Hyde Pratt, Chapel Hill
N. Dakota	Herbert A. Hard, Fargo
Ohio..........	J. A. Bownocker, Columbus.
Oklahoma.....	C. W. Shannon, Norman.
Pennsylvania..	R. R. Hice, Beaver.
Rhode Island	Chas. W. Brown, Providence
S. Dakota.....	E. C. Perisho, Vermillion
Tennessee	A. H. Purdue, Nashville
Texas	W. B. Phillips, Director Bureau of Economic Geology, Austin
Vermont	G. H. Perkins, Burlington
Virginia	Thos. L. Watson, Charlottesville
Washington	Henry Landes, Seattle
West Virginia	I. C. White, Morgantown
Wisconsin	W. O. Hotchkiss, Madison
Wyoming.....	L. W. Trumbull, Cheyenne.

The above lists were compiled in December, 1914, from the latest information available at that time.

From the above it will be seen that of the 48 states of the Union, 34 have organized geological surveys.

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[16] "The oxidation, solution and precipitation of copper in electrolytic solutions and the dispersion and precipitation of copper sulphides from colloidal suspensions, with a geological discussion. "Econ. Geol.," Vol. [illegible], p. [illegible]

[17] "Electric Activity in Ore Deposits," "U. S. Geol. Surv. Bull. 548."

[18] "Effect of Temperature and Acidity in the Formation of Marcasite (FeS_2) and Wurtzite (ZnS). A Contribution to the Genesis of Unstable Forms," "Am. Journ. Sci.," Vol. 38, p. 393.

[19] Ransome, F. L., "Wurtzite at Goldfield, Nev., "Journ. Wash. Acad. Sci.," Vol. 4, p. 482.

Arizona in 1914

Some important legislation affecting the mines was voted in 1914, among which was the law requiring that 80% of the employees be citizens; this law will doubtless be the subject of an appeal to the courts. The vote in favor of prohibition met the approval of most mine operators.

In the vicinity of Kingman in Mohave County, the Tom Reed mine at Oatman and the Gold Road mine at Goldroad, produced about as usual. The Frisco mine was inactive most of the year, but an important development in the district was at the Arabian mine, about 12 miles from Kingman, where the Mines Co. of America carried on work during the year with favorable results, 15 men being employed. The shaft is down about 200 ft. In the Chloride district, the Tennessee and Golconda mines shipped to Needles and Bartlesville, respectively, but the rest of the district was comparatively inactive.

At Hackberry, the Copper Giant mine was taken over by Sen. W. A. Clark, but was shut down on Oct. 6. At the Walkover mine, a small force was kept at work; the ore developed carried an ounce or more of gold, and the copper content was increasing with depth. The Hackberry mine, a large silver producer in years past, was optioned to Qualey Bros., of New York, and a vertical shaft sunk to strike the vein below the old workings. At Music Mountain, the Nevada-Arizona Mining Co. proceeded with the development of its gold property, the enlarging of its mill and the installation of a seven-mile pipe line. At Crown King in Yavapai County, the Nelson reported finding a body of good milling ore and there were favorable developments in the Montezuma. The encountering of ore by the United Verde Extension company in its property east of the United Verde was the event of the year in the Jerome district and bids fair to lift Jerome out of the list of one-mine camps.

The Vulture Mines Co., about 20 miles southwest of Wickenburg, operated steadily throughout 1914, employing 200 men. The company milled approximately 35,000 tons yielding about $16, representing a recovery of from 88 to 90%, an increase over the extraction of 1913. The Nicol shaft was sunk east of the old workings to the 135-ft. level to supply an air connection and to explore some old ground, and incidentally disclosed some good ore. The mercury and tungsten deposits in Maricopa County attracted attention in 1914 and several companies were formed to exploit them.

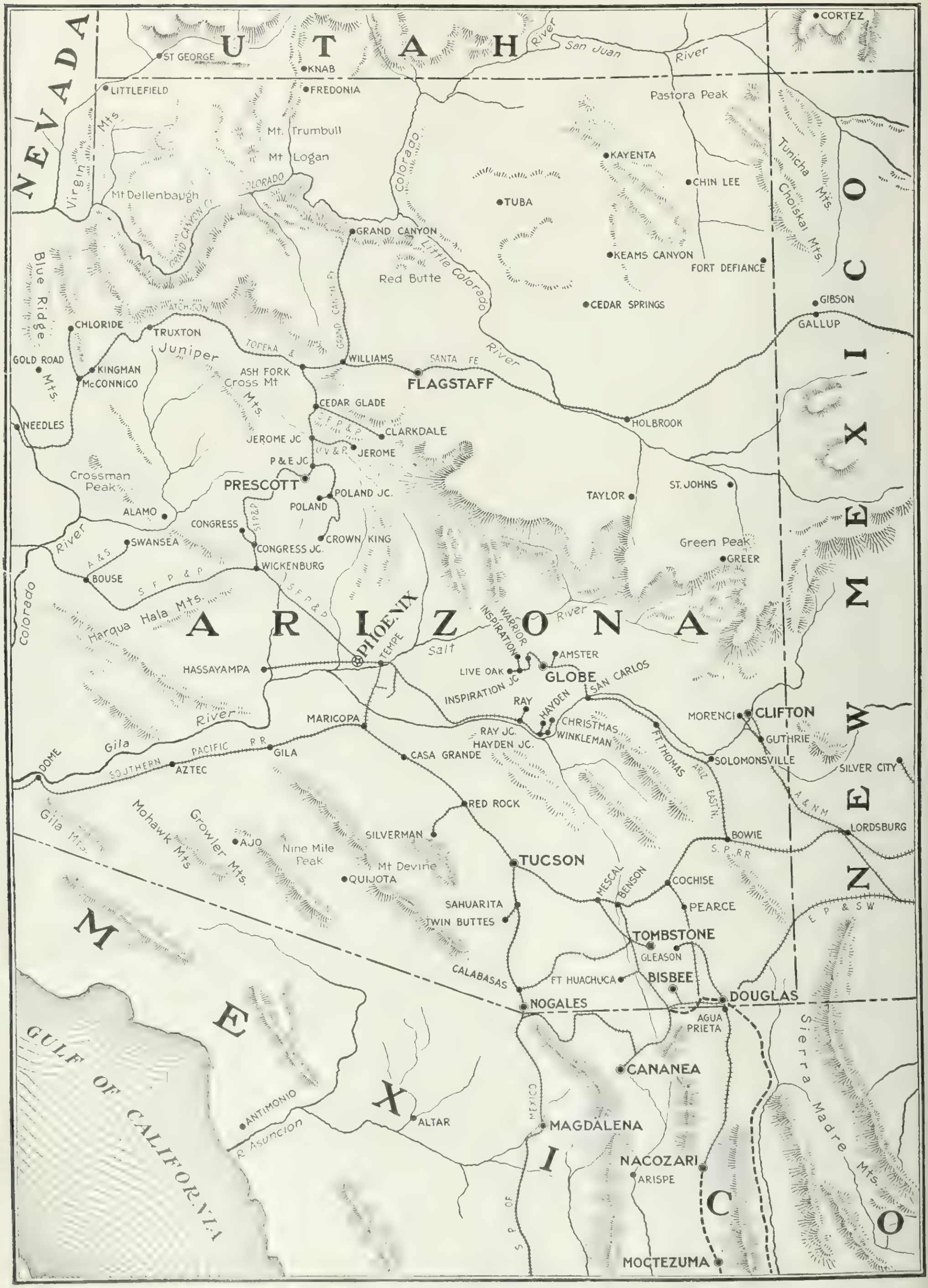
In the Casa Grande district the copper properties did but little, although the Vekol mine shipped a few cars as did also the Lake Shore, which was sold to San Diego men. The Silver Leaf was sold to Mississippi men; the Isabella deepened its shaft and the Reward mine made a few shipments. The O. M. C. Milling Co., a recently organized company, put down a shaft and made preparations to install reduction works to treat the free-milling gold ore on its property 25 miles south of Casa Grande.

The Empire Zinc Co. continued to develop its San Xavier mine in the Twin Buttes district, about 20 miles south of Tucson. The Bush-Baxter mine was started last May from a 10-ft. assessment hole, and at the end of 1914 was producing 500 tons per month from development work by one shift. The ore is purchased by the American Smelting & Refining Co. and up to Dec. 1 over 1800 tons were shipped that averaged approximately 7% copper, 2 oz. silver, 33% iron, 3% lime, 25% silica, and 15% sulphur. Further equipment will be installed. Under the direction of Edmund E. Walter, the old Paymaster mine opened new orebodies; other operators were McGill & White, the Blanche-Rose Mining Co., and H. Whitcomb opened the old property of the Tucson Mines Co. for Chicago men. The Saginaw copper property, owned by Albert Steinfeld, about 12 miles southwest of Tucson, was drilled by the E. J. Longyear Co. for the Calumet & Arizona Mining Co., but without satisfactory results. The Snyder mine in the Sierrita district, southwest of Twin Buttes, under option several years ago to the Calumet & Arizona Mining Co. with the expectation of developing a disseminated copper-sulphide orebody, was recently leased to the company and 1500 tons of siliceous copper ores shipped to the company's smelting works at Douglas for converter flux. In the Courtland-Gleeson district all company operations were suspended, but leasers worked on the high-grade ore in the mines of the Great Western Copper and the Calumet & Arizona mining companies. The suspension of the Shannon Copper Co.'s operations at Gleeson was due to the decline in the price of copper and will probably be resumed, but the other properties are practically exhausted. The Mascot Copper Co. continued its development at Dos Cabezas.

At Pearce, the Commonwealth Mining & Milling Co. operated steadily with the exception of a short shut-down in August when for two weeks the company was unable to market its bullion; the monthly production amounted to about 60,000 oz., obtained from 9000 to 9500 tons of ore. About 170 men were employed. In the Johnson district, northwest of Cochise, several properties including the Republic copper mine were in operation until the outbreak of the European war.

In Santa Cruz County, the R.R.R. mine, operated by N. L. Amster under lease from R. R. Richardson, was closed down owing to a lawsuit involving the original ownership of the mine. The World's Fair mine was optioned to a syndicate composed of Messrs. Smith, Pearce and others of the Commonwealth mine; development work was started in March and continued throughout 1914, a considerable amount of lead-silver ore having been shipped. The flux mine, near Patagonia, was bonded to a San Diego man and a mill is to be erected as soon as the treatment method can be determined. The Royal Blue, the Bland, and Empress of India mines shipped ore during the early part of 1914, but were closed in August. The ending of the uncertainty regarding the old Baca land grant of 100,000 acres is expected to result in renewed activity eventually. Among developing properties in this county were the O. K., Chief, Connecticut, Buffalo, Three Stars, Red Fox, Joplin, Pittsburgh, Trench, American Boy, Blue Lead, Progressive, Harrison, Old Glory, Warsaw, Havaline, Four Metals and Santo Niño. The Elephant's Head, Duquesne and two properties worked by McIntyre & King near the international boundary, shipped regularly until the war started. The Sheey and the Silver Cañon, worked under lease by the Copper Queen and Thomas Pulliam, respectively, were returned to the owners.

At Castle Dome, the Big Eye Mining Co. ran its 2-



ARIZONA, SHOWING THE CHIEF MINING CAMPS

stamp mill which is being enlarged to five stamps. R. D. Delugge did development work under lease on the King of Arizona mine and expects to install a five-stamp mill. The Castle Dome Gold, Silver and Lead Mining Co. installed a Stebbins dry concentrator, and Phœnix men leased the north end of the Castle Dome Mining and Milling Co. property, C. Platt being in charge. Near Oro Blanco, the Switzerland group of mines was under development and about the end of the year, an important gold vein was cut. W. J. Partridge made several shipments from the Idaho mine. The Austerlitz was idle on account of litigation.

Mining in California in 1914

By Lewis H. Eddy*

There was increase or normal production of metals and minerals in 1914 in California, with the exception of copper and quicksilver.

The North Star, Champion, Empire, Brunswick, Golden Center, Tightner and other deep mines in Nevada and Sierra counties added largely to development and the installation of new modern machinery. In the Mother Lode region development and production were forwarded at practically all the big mines. Installations included a new modern mill at the Plymouth Consolidated, stamps and Hardinge mills combined; and a stamp mill at the Keystone; cyanide plant at the Melones, and electric tram cars at the Eagle Shawmut.

In Shasta County the new electric hoist at the Gladstone mine was completed and set in operation. A cyanide plant was installed at the Midas mine; fire destroyed timbering in the lower levels. The mine was sold to the Victor Gold Mining Co. and reopened.

The apex suit of the Kennedy Extension Gold Mining Co. against the Argonaut Mining Co., which was tried in the latter half of 1913, was decided in favor of the Argonaut in June, 1914. The Argonaut immediately began the removal of the stamp mill and contemplated additional stamps. All the several mines along the Mother Lode, in Amador County, installed satisfactory systems for disposing of the tailings of the stamp mills, chiefly by the adoption of the flume method. A notable deviation from this method and the most important installation for the purpose in the Mother Lode region, or in the state, were the tailing wheels and impounding dam put in operation by the Kennedy Mining & Milling Co. The Zeila mine, at Jackson, Amador County, went out of the producing class practically with the close of 1913. The milling plant and all the surface improvements were removed and the mine permanently closed after an unsuccessful effort to sell the property.

In the first half of 1914 there was an encouraging outlook toward the disposing of mining property to large operators. Some of the important old mines which had been reopened and were in course of development were under consideration by large operators and there is little doubt that important deals would have been made had not the European war tightened the money market. This interruption of mine sales was especially notable in the Forbestown district, where the sale of the Gold Bank-Golden Queen would otherwise most likely have been consummated. This property and the New Burlington were under consideration at the close of the year. An important deal was consummated at the end of the year in Tuolumne County, when the Dutch and Sweeney mines were sold to New York men acting in the company name of Dutch-Sweeney Mining Co., with W. G. Devereaux, manager of the Melones mine, as president.

Electrification of mining plants in Randsburg district marked an advancement particularly notable for the reason that the district is isolated, situated on the northern edge of the Mojave desert. The Skidoo mines and the Cerro Gordo mines advanced in development and production. New development was also undertaken at the Mojave Consolidated, the Tropico on the Mojave desert and at the American Girl and Tumco mines, near Yuma.

The American Trona Co. installed an initial plant at Trona for treatment of the Searles Lake deposit for the recovery of potash, and built a new railroad from Searles to Trona, a distance of 31 miles.

Hydraulic miners adopted improved methods of handling heavy gravel and stacking the tailings away from the streams, demonstrating the economy and practicability of elevating gravel with giants. Improved dam construction has been adopted and in the latter part of the year progress was being made in the construction of a dam provided for impounding of tailings from a large area of hydraulic mines in Sierra and Plumas counties.

The mining and smelting of copper were seriously interrupted the first half of August as a result of the European war. The Mountain Copper Co. discontinued both mining and smelting and suspended work on the construction of a concentration plant, which was to have been completed and in operation before the end of the year. The Balaklala smeltery was not in operation during the year, but the extraction and shipping of ore were in progress until interrupted by the war trouble. The Mammoth Copper Co. reduced its production by closing down one of the three furnaces in operation. Efforts on behalf of the farmers of Shasta County to renew the fight against the Mammoth were undertaken in the latter half of 1914, and a suit was filed in the U. S. District Court in November, the result of which had not been reached at the end of the year. The Selby Commission concluded its investigation and filed a report with the Superior Court of Solano County in favor of the Selby Smelting & Lead Co., finding that the company was not violating the injunction against the court decree after the installation of the baghouse, which was done at the request of the commission.

During the year inspection of mines was in progress by the State Industrial Accident Commission in coöperation with the U. S. Bureau of Mines. This initial work will form a basis upon which may be constructed an adequate mine-inspection law. Organization of the California Metal Producers' Association was completed, and the association has taken up the question of mine insurance, and will also take a hand in future legislation affecting the mining industry.

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Metal Mining in Colorado in 1914

By George E. Collins*

The year 1914 was another comparatively uneventful one throughout this state, no new district having been discovered, and no new mine of exceptional importance. Taking the state as a whole, a large output was made, on a small and insufficient profit margin. Higher metal prices, or metallurgical methods which will permit of the extraction of more valuable aggregate marketable products from complex ores, are urgently needed. To the latter the relatively small extent of most of the orebodies is the most serious obstacle.

As for many years past, Cripple Creek and Leadville continued the most productive districts. In the former the richness with increasing depth of many of the most important mines has been well maintained: this applying especially to the Golden Cycle, Vindicator and Cresson. A bonanza of exceedingly high-grade ore was discovered on the 12th level of the last-mentioned mine in December. Work at the El Paso has been somewhat set back by the burning of the shafthouse in October. The Portland, although not so rich as in its early years, is still an important and profitable mine. Metallurgical methods in this district have finally settled down to a combination of concentration and cyaniding for the lower-grade ores; the higher grades being treated as heretofore by roasting and chlorination. The most important new mill was that erected at the Vindicator mine for the treatment of its low-grade ores by washing and sorting.

At Leadville the output has been well maintained, the drop in metal prices having had a less serious effect than might have been supposed, owing, probably, to the stimulation of leasing activity. It is understood that the principal zinc producers have contracts based on a minimum price for spelter, so that they have been able to maintain production, notwithstanding the low market for zinc. Considerable damage was done by fire to the roasting plant at the Arkansas Valley smelter during October. The principal producers were again the Iron Silver, Wolftone and Yak Tunnel. Arrangements for reworking the down-town properties, to be drained through a central shaft, are being perfected, and it is hoped that work will be commenced early in the coming year.

In the San Juan conditions are still rather dull. At Telluride the Tomboy remains highly productive and profitable, largely through its purchase of the Montana claims. A cyanide plant, designed to treat the tailing from this property, is being hurried to completion. The Liberty Bell continues to be a large factor in the prosperity of the district: but the Smuggler-Union has to face a continually lower grade of ore, and its prospects are not bright. The Black Bear is being reopened and an aërial tramway being built to Pandora, where the ores will be treated by contract in the Smuggler mill. At Silverton the Silver Lake and the Gold King, both worked by tributers, have made a fairly good production; and the Sunnyside, where reconstruction after the fire was completed early in the year, has continued its long career of active output. At Ouray the Camp Bird made a highly satisfactory profit, and the last annual report stated that there was still a year's work assured. The Atlas, where the flotation process is in use, and the Wanakah, which exploits a series of replacement deposits in quartzite, the ore being smelted locally and matte shipped to Omaha for refining, have also produced steadily.

In Gilpin County mining was inactive. In Clear Creek County the output has been greater than for several years, especially in the Argo and Central tunnels. Through the former the Gunnell (a Gilpin County mine) has produced a heavy tonnage of good ore. Some rich ore was found by drifting on the Golden Age, a continuation of the Sun and Moon vein. In the Central tunnel an important and profitable orebody is being opened up in the Lake vein.

In Boulder County the principal new development was in the old Caribou district, where an interesting attempt is being made to treat by cyanidation the low-grade silver ores remaining in the veins and on the dumps. There is little activity in the Creede and Aspen districts, both of which are hard hit by the low prices of lead and silver.

The Colorado mines which have been most unfavorably affected by the war are those treating complex ores, and also those producing ores of the rarer metals, such as tungsten and vanadium. Of the former the most important are the Wellington at Breckenridge; the Iron Mask at Red Cliff; the Mary Murphy at Romley; and the Sunnyside at Silverton. None of these can be making any adequate profit at present prices, and the two last mentioned are largely dependent on their gold values.

None of the smaller districts has been very active. The hopes based on the new silver district at Eagle have not been borne out so far by results, and the same may be said of the newly revived Summitville district. The Rawley at Bonanza is still idle: and the lead mines at Italian Mountain, in Gunnison County, which last winter were producing heavily, are again less active.

The gold dredges at Breckenridge are understood to have had a prosperous season, which has been prolonged until the time at which this article is written, thanks to a mild and late fall. The dredge at Tin Cup has not yielded the results hoped for by its promoters.

Tungsten mining in Boulder County is dull, because of the small demand for tungsten for steel alloys, due to the war. The price ruling ($5.85 per unit for 60% grade) is lower than has prevailed during recent years, and is apparently too low to stimulate activity.

The carnotite industry in southwest Colorado has also been completely disorganized as a result of the war, and shipments have temporarily been almost suspended. Two mills for the dressing of low-grade carnotite ore were nearly completed. In the Daily district above Empire in Clear Creek County, some molybdenite deposits, believed to be of importance, are being actively developed by the Primos Chemical Company.

The strike in the coal districts, where disorder and violence were encouraged by the weakness of the state government, continued throughout the year, and culminated in a sanguinary riot at Ludlow; the conduct of the state militia at which has been the theme of much unjust and ill-informed comment throughout the country. Finally, on the invitation of the governor, Federal troops were brought in, and the result was the immediate subsidence of disorder.

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NOTE—What was apparently an important event in Colorado in 1914 took place just after Mr. Collins' article was forwarded. At a depth of 1269 ft. in the Cresson mine was found a vug or cavity in a watercourse, a common occurrence in this district, but instead of being lined with the usual quartz crystals, this was filled with calaverite. One assay reported to us was 11.341 oz. of gold per ton. The country rock in the neighborhood of the vug will ship $150 per ton.—EDITOR.

The State Supreme Court reversed a former ruling which seemed to imply that the "gross value" of ore, which the revenue law passed last year used as the principal element in the valuation of mines for taxation, meant the gross assay contents, and defined it to mean the gross sum actually received for the ore at the mine. Another question as to the constitutionality of the law in using both gross and net value as the basis for assessment, is still *sub judice.* It is of no use to increase taxation beyond the point where it fails to produce revenue, and it is quite clear that mines in Colorado, with the exception of the few very profitable ones, are unable to bear further burdens of any kind.

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Idaho Mining Industry in 1914

By Robert N. Bell*

In Bonner County, up near the British line, the Idaho-Continental mine completed a concentrating mill of 200 tons daily capacity with a hydro-electric power plant during the summer, but beyond turning it over no production was made. This enterprise has developed 100,000 tons of high-grade lead-sulphide ore, carrying excellent values in silver. In the same county, milling equipment of 50 tons daily capacity was completed on the Lawrence mine, at Clarks Fork, and the Idaho-Montana Amalgamated mine near Bonners Ferry.

In Custer County the Red Bird Mining & Smelting Co. operated its small smeltery for about a month and produced 2700 bars of bullion containing about 80 oz. of silver per ton. The Red Bird mine has been further developed during the year and now shows a supply of relatively high-grade lead-silver ore aggregating about 100,000 tons, with an average value of about 20 oz. silver and 20% lead.

In the same region there are a number of promising lead-silver and siliceous ore deposits that will doubtless be heard from when better transportation facilities are afforded. In the same county, at Mackay, the Empire Copper Co. made its normal production until the war intervened. The usual strong force of lessors has been maintained. A lower tunnel, to be 4000 ft. long, is being pushed, which will undercut its present workings 1000 ft. deeper, and this should reach the ore within a few months. The company is contemplating the erection of a Christensen process mill to handle its extensive reserves of low-grade ore.

The Wilbert mine and mill, in Fremont County, were operated during part of the year and made a production of over 3,000,000 lb. of lead, but was forced to suspend milling by reason of the low prices and the fact that while the resources are relatively high in lead, they have always been low in silver.

In the principal lead-silver mines of the Gilmore district of Lemhi County, the year's shipments of mineral are considerably lower than those of 1913. A good output was made from the Latest Out mine, under the management of the principal owner, Ralph Nichols, and the property is looking its best at the bottom, a depth of 600 ft. A small development force was carried on the adjoining Pittsburgh-Idaho mine.

The adjoining Allie and Gilmore companies have developed several parallel lead-silver veins through a 3000-ft. working tunnel during the year, and are meeting with encouraging results. One of these veins, parallel to the lead deposits, carries a long shoot of earthy-brown iron ore, containing average values of $15 per ton in gold, with only traces of lead and silver, and considerable of it was shipped during the year. A short slab of rich visible-gold ore was found in the vein at the 400-ft. level, from which two small carloads were shipped, containing gold that netted the company about $300 per ton. The two dredging enterprises of this county at Kirtley Creek and Bohanan Creek were successfully operated, and at Idaho City, in Boise County, the dredge of the Boston & Idaho company maintained continuous operation.

The total output of gold from Idaho will be smaller by reason of the almost total suspension of milling operations in the Delamar lode mine, in Owyhee County, which has for years been a large producer.

New interest is being manifested in the placer resources of Idaho at several points, notably in the Boise Basin, where extensive dredging areas still remain; discoveries of dredging ground have been made at the head of the South Fork of the Payette River, in the Warrens, and in the resort district, and it is likely that additional hydraulic and dredging enterprises will be operated and undertaken during the coming year. The Warrens deposit carries a uniform proportion of fairly clean monazite sand in about the same proportion as the black magnetic-iron sand usually occurring in ordinary placer-gold deposits.

In Bonner County, on Boulder Creek, the Idaho Gold & Radium Co.'s property has been under process of development for the past three years. This enterprise is based on an old river-channel deposit of placer gravel more than 100 ft. deep and of extensive area that has been well tested and is said to contain an average value of 50c. per cu.yd. in coarse placer gold. Another deposit of a similar nature and yardage value is being equipped on the Moyea River in the same county.

Some extensive investigation was carried on among the low-grade lode deposits of the Big Creek district in Idaho County, but a wide divergency of opinion as to terms continues to block progress in this interesting region.

An estimate of the gross metal contents of all mineral shipped from Idaho during 1914 is given herewith. The marked increase in zinc output is largely credited to the Con. Interstate-Callahan mine, near Wallace. Its splendid development and production of high-grade crude ore and concentrates during the past year make this property one of the large zinc producers of the world.

The production is: Gold, 63,795 oz.; silver, 13,566,000 oz.; lead, 343,461,000 lb.; copper, 4,402,000 lb.; zinc, 49,207,000 pounds.

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*State mine inspector, Boise, Idaho.

Mining in Montana in 1914

By Theodore Simons*

As in past years, Butte, in 1914, furnished the bulk of Montana's copper, amounting to about 200,000,000 lb., the Anaconda and North Butte being the chief producers. During the latter half of the year the decline in the copper demand, due to the war in Europe, made a curtailment of production imperative. The Anaconda's smelting plant, at Great Falls, and a number of its Butte mines, were forced to shut down. Anaconda and North Butte are at present working their largest mines five days a week, with an output of 50% of normal. Butte-Duluth operated all the year, producing 1,515,000 lb. of copper. The East Butte, Alex Scott, Ballaklava, Bullwhacker, Tuolumne are closed down entirely; other properties are confining their activities to development and repair work.

The Conrey Placer Mining Co., operating four dredges in the Alder Gulch district, Madison County, which handled 6,300,000 cu.yd. of gravel, furnished the bulk of the placer gold in Montana. Silver Bow County followed next, the gold coming chiefly from the copper ores of Butte. Prominent among mines, producing gold from dry or siliceous ores, was the North Moccasin of the Barnes-King Development Co., at Kendall, Fergus County, whose output averaged $40,000 a month. Other more or less steady producers were the Keating Gold Mining Co., of Radersburg, Broadwater County, shipping 50 tons of $20 ore per day; the Southern Cross, Deer Lodge County, treating 500 tons a day of $8 ore by cyaniding, and a number of smaller properties in Madison, Blaine, Cascade, Granite, Fergus, Beaverhead, Lewis and Clark counties.

The bulk of Montana's silver came from the Butte copper and zinc mines.

From 313,874 tons of ore mined and milled, the Butte & Superior Co. produced 98,200 tons of zinc concentrates, assaying 53.27% zinc and 25.5 oz. silver per ton; and 4000 tons of lead-zinc concentrates, assaying 45.64% lead, 13.72% zinc and 42.8 oz. silver.

Senator Clark's Elm-Orlu mine and Timber Butte concentrator started operation in July. The mill, of a capacity of 500 tons per day, uses table concentration, followed by oil flotation. Since starting operations, it has produced about 20,000,000 lb. of zinc and 350,000 oz. of silver.

The Havre Natural Gas Co. sank three wells near Havre, Hill County, which assure sufficient gas flow to supply the city with light and power. In Musselshell County, near Ryegate, a Butte company is drilling for oil and gas in a district known as the most promising in Montana. In the Sweet Grass hills, California interests are drilling for oil under the direction of Ira Segur. Similar operations are carried on in the Big Muddy district in Sheep Creek Basin, 17 miles west of Dillon, Beaverhead County.

One of the richest sapphire-bearing districts in the world, situated in Fergus County, 27 miles southeast of Neihart, was profitably exploited by the "New Mine Sapphire Syndicate" of London, England. The gems are in great demand on account of their singular beauty.

The new slimes plant at the Washoe works of the Anaconda Copper Mining Co. at Anaconda was started in March. Its capacity is 26,000,000 gal. of slime pulp per day. The plant consists essentially of 160 Dorr thickeners and twenty 20-deck round tables with a concentrating area of 108,000 sq.ft. The concentrates upon being condensed in five thickeners, pass through Oliver filters which make dry cakes ready for the smelter. In the same month, construction of the 2000-ton leaching plant to treat the concentrator tailings was begun. Plant will be ready for operation early this year. Roasting in McDougal furnaces followed by leaching and copper precipitation on iron is the process adopted.

The first coal-dust fired reverberatory at this plant was started in September. During that month it smelted 475 tons daily with a coal consumption of 13.8% against 260 tons and 24.1% coal consumption in the natural-draft coal-fired furnaces. The company is now fitting all reverberatories for coal-dust firing and will erect a furnace 144x25 ft., inside measurement, that will smelt 800 tons daily with a fuel consumption of 13.33% or better. The company's 100-ton sulphuric-acid manufacturing plant will be completed early this spring and will furnish acid for the leaching plant and for the local market.

The Butte-Duluth Co.'s leaching plant at Butte was entirely remodeled during the year and now has a capacity of 1000 tons per day. From the new rock house the ore goes to large Dorr classifiers, used for leaching, which deliver the tailings by a belt conveyor to the dump, while the copper-bearing solutions go to 64 electrolytic cells which extract the bulk of the copper. The last wash water passes to an iron precipitating plant, making cement copper.

The East Helena plant of the American Smelting & Refining Co. ran throughout the year at normal capacity of 15,000 tons per month, 10,000 tons of which was lead ore from the Cœur d' Alene district. Two additional Dwight-Lloyd sintering machines installed during the year increased the roasting capacity by 250 tons per day.

No strikes affecting production were reported from any mines in the state. Butte, however, furnished considerable excitement during the latter half of the year resulting from a growing dissatisfaction in the ranks of the miners with the mismanagement of the local union and the Western Federation. Early in June this culminated in street riots, followed by the dynamiting of the Miners' Union Hall, the formation of an independent union, the deportation of miners, and a number of other lawless acts. The fact that the local authorities were unwilling or unable to suppress these disturbances brought a horde of irresponsible agitators to Butte, who day after day incited their hearers to violence, looting and defiance of the law. To prevent a consummation of these threats, citizens of Butte and Silver Bow County appealed to the governor for protection, who on Sept. 1, declared the county under martial law which prevailed until Nov. 1. During that time the state militia, consisting of 700 men and officers, managed the affairs of the city and county. Saloons were closed, street speaking forbidden, the ringleaders of the riots were arrested, and order was restored throughout the city and county. The chief offenders are now serving time in the penitentiary. Unionism among Butte miners virtually ceased to exist and at present the men are working under practically open-shop regime to the great satisfaction of everyone.

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Mining in Nevada in 1914

The mining industry in Nevada progressed appreciably during 1914, and there were many developments, some discovery and some rather important plant construction.

Goldfield Consolidated continued working along the same lines as in 1913, and under the management of Albert Burch its operations have prospered.

The Atlanta property, at Goldfield, is working through the shaft of the Merger Mines Co. Among the companies which are carrying on developments in the Goldfield district, are the Goldfield Oro, Booth, Sandstorm, Kendall Con, Silver Pick, Great Bend, Blue Bull, New Jersey, Kewanas, Yellow Tiger, and the Diamondville Black Butte. Some of these are also shipping small quantities of ore. During the year the Great Bend, Daisy, Vernal, Spearhead, Combination Fraction, and C.O.D. have been operated by lessees. It has been announced that the Milltown, Commonwealth, and Lone Star properties will be operated during 1915.

The Jumbo Extension operated throughout 1914 without interruption. The year's production amounted to about $25,000 tons. The Florence Goldfield Mining Co. operated during the year, making a total profit of about $85,000.

The property of the Aurora Consolidated Mines Co., Mineral County, belonging to the Goldfield Consolidated interests, completed the new stamp mill at Aurora, which is now operating to capacity, about 500 tons per month.

Operations on the Comstock during 1914 were not so prosperous as could be desired. The principal event was the initiation of pumping operations in the Gold Hill mine by the Sturges interests, which control the Yellow Jacket, Crown Point and Belcher mines. A promising body of ore was opened up on the 1500 and 1600 level in the Belcher mine. This is the first time since 1886 that any work has been done below the 1400-ft. level.

During the first half of the year little work was done owing to the differences in regard to the management of the pumping associations. In July these differences were compromised, but the war stopped all development. Most of the mines depend upon assessments for their running expenses and the closing of the stock exchange made it impossible to collect them.

In October, Mexican was beginning to explore at the 2650-ft. level, when a fire in the old stopes caused a loss of access to that level. The fire has since been extinguished and Mexican has recently found good indications at the 2300 level. C. F. Duval, lessee of the Chollar and Potosi and of the Butters mill, has been operating steadily on low-grade ore in the outcrop and upper levels of these mines.

The chief gold-producing camp of the Rochester district is at Seven Troughs, 30 miles west of Lovelock. The Seven Troughs Coalition is equipped with a 10-stamp amalgamation and concentration mill. The production from this mine in 1914 was over $250,000, but only $30,000 of this was produced prior to June. In the Rochester camp, production by leasers at the Rochester Mines Co. up to the end of November was about $610,000 from 25,950 tons of ore. Most of this came from the south 600 ft. of the Crown Point claim, covered by the Big Four and Codd leases, and above the 100-ft. level in the west vein.

Building of the 100-ton mill for the Rochester Mines Co. was nearly completed. A 2700-ft. pipe line was laid for supplying the mill with water.

The Rochester Weaver Mining Co. produced about $25,000 through the work of leasers. The Nevada Packard company produced $73,000, and is now negotiating for a 20-stamp mill. A two-stamp mill is crushing high-grade ore from gold veins on Lincoln Hill.

The Star Peak mine, about 10 miles from Rochester, was developed with satisfactory results. At Jessup, 30 miles southwest of Lovelock, the Mercer group of claims has been developing. A two-compartment shaft is going down 150 ft. to intersect the two known veins. Ore is high-grade gold-silver quartz formation. A recent carload shipped from surface work gave returns of about $57 per ton.

At Manhattan, the War Eagle mill operated steadily during the year. The Associated mill was overhauled and placed in commission after an expenditure of about $8000. The Manhattan Milling & Ore Co. ran its mill continuously on ores from the Big Pine claim, and averaged close to 100 tons per day. During the last month the White Caps company operated the cyanide portion of its mill and the stamps for one shift each day. The Rogers amalgamating mill has been operating intermittently, but made some output. The installation of a new 200-ton mill on the Big Pine claim will add greatly to the production of the district.

The White Caps property developed about $300,000 worth of ore, at the rate of about $17 per ton. It is refractory and will need an installation of a preliminary process and special means of cyaniding, or handling in some other way.

The chief company in the Round Mountain district is the Round Mountain Mining Co., which operated continuously. The litigation between the Round Mountain Co. and the Round Mountain Sphinx Mining Co. was compromised in August, 1913, former absorbing the Sphinx. Lessees have contributed to some extent to the production of the district. The Buell & Patteson lease on the Mariposa claim of the Round Mountain Mining Co. produced approximately $30,000 from a vein averaging 2 in. in width.

The Mason Valley Mines Co. operated the Thompson smeltery and Mason Valley mine steadily until Oct. 17, when the smelting plant was blown out. The smelting plant treated practically all the ores produced in the district, and considerable from Goldfield, Rochester, Luning, and other Nevada camps, and a large tonnage from California properties. Nevada-Douglas Copper Co., of Ludwig, operated the mines until the blowing out of the Thompson smeltery. Work on the leaching plant has been continued, and good progress made in construction and installation. If this plant is a success, large tonnages of low-grade oxidized ore will be made available.

In the fall of 1913 Miami Copper Co. took an option on the Empire-Nevada property, and prospected by churn drilling. Work was stopped in May, 1914, and apparently no deal was made.

There were no particularly important developments at Nevada Consolidated, but some churn drilling for new ore was carried on at the property and also at Giroux during the year. Flotation experiments are still being carried on at the concentrators, and at the smeltery there are no changes of importance, other than somewhat reduced operating costs in different departments. A strong effort is being made to hold copper costs, running at half tonnage, at the same point they were before the reduction. Secondary-enrichment engineers who have been sent to the various districts by the producing companies, are now in Ely district making field examinations. Their conclusions should be of great value to the mining fraternity.

The Wonder Mining Co. operated mine and mill continuously through the year. About 50,000 tons of ore were milled, at an average cost of $2.74 per ton, recovery averaging 93.2%. The Atlas Wonder Mining Co. operated for the first half of the year.

The Nevada Hills, at Fairview, continued operations throughout the year, as did also the Buckhorn, both properties controlled by the Goldfield Consolidated interests.

The Cortez Mining and Reduction Co., Eureka County, started milling at 1500 to 1800 tons monthly capacity in December, 1913, and continued during the year. The mill was shut down in August and will probably not resume until spring.

The National district continues to be a one-mine camp. Leasing work was done on nearly all the groups of claims directly bordering on the National Mines Co.'s ground, but no ore was discovered. The National mine found milling-grade ore, and is expected to have a longer life. Five stamps have been added to the five already installed. The Buckskin National property, three miles from Nashville, has been a center of activity, and produced some ore from leases.

The most important development in the Yellow Pine district was the discovery of platinum and allied metals in the western portion of the district. The original discovery was made at the property of the Boss Gold Mining Co., about 10 miles west of Goodsprings, platinum being associated with gold and copper in a quartzose gangue. The Yellow Pine Mining Co. operated its plant at about two-thirds capacity throughout the year, producing 2200 tons of lead concentrates, 11,000 tons of zinc concentrates, and 1000 tons of crude zinc ores. The Potosi mine was sold to the Empire Zinc Co. The Frederickson property was sold to O'Kelly and Munzberg, who developed considerable mixed carbonate ore and will erect a mill in the near future Other properties which shipped zinc-carbonate ores are the Mountain Top, Mobile, Anchor, Monte Cristo, Bullion, and Bill Nye. The St. Anthony Mining Co. made 10 shipments of copper ore.

In the Jarbidge district, the Elko Mining Co. operated continuously, employing about 30 men. Considerable development work was done on the property of the Success Mining Co., to a depth of 427 ft. The Bluster people are putting up a duplicate of the Alpha mill of the Elko Mining Co. Only amalgamation will be attempted, tailings being stored for future possible cyanidation.

The Consolidated Nevada-Utah is operating at a profit for the first time. Having installed suitable equipment it has dewatered its No. 1 shaft to the 1100-ft. level, and zinc ore is now being stoped from the three lower levels. While all of the ore is not of shipping grade, the milling ore is being placed in box-cars conveniently located, and a mill will be erected as soon as the proper method of treatment can be ascertained.

The Prince Consolidated is averaging very close to 10,000 tons of ore monthly for the year, at a reported profit of 50c. per ton. It acquired the Virginia-Louise property, adjoining on the south, and work has been commenced on a new vertical shaft. The Day-Bristol property, after having been in the hands of a receiver for a year, will be sold at auction on Jan. 14, 1915.

New Mexico in 1914

The greatest metal production in this state was as usual from the Chino Copper Co. in the Santa Rita district. This company was producing at the end of the second quarter at the rate of 6,000,000 lb. per month from 6460 tons of ore per day. The copper production in September, however, was reduced to about one-half the normal output.

The next most important copper operation is that of the Burro Mountain Copper Co. at Leopold. Here development was in progress during the year, and flotation experiments were carried out at the experimental mill at Tyrone, with which the mine is connected by a standard-gage road and transportation tunnel. Construction of the central power plant, and mine development continued throughout 1914. Near Lordsburg, the 85 Mining Co. and the Bonnie shipped and some oxidized copper ore was sent to El Paso from the Apache district near Hachita.

In the Mogollon district, more ore was mined in 1914 than in any previous year; about 120,000 tons were treated by the three mills, the Socorro, Ernestine and Deadwood; a few minor shipments of high-grade ore were made direct to smelters from the Pacific and Eberle mines. The Socorro Mining & Milling Co. was especially active in the development of new properties, having purchased 20 of the Johnson claims from the Oaks company and optioned the Pacific and the Deep Down groups. The Ernestine company operated about as usual and completed an elaborate geological survey. The Alberta Development Co. and the Precious Metals Exploration Co. became producers, and the Oaks company added another mine, the Eberle, to the list. The Lincoln and the Mogollon Gold & Copper Co. were active part of the year.

Pinos Altos experienced an active year in 1914, owing to the opening of a pocket of rich gold ore early in the year on the Savanna Copper Co.'s Pacific No. 2 claim, by the lessees, Bell & Wright. This find led to a renewal of interest in the Pinos Altos district, and later the C. & O. Mining & Milling Co. found similar ore in its adjoining claim. On Apr. 1 the entire holdings of the Savanna Copper Co. in the district were leased to I. J. Stauber and Ira L. Wright, who found high-grade ore 60 ft. lower than the Bell & Wright workings. Among the development operations, most of which shipped high-grade ore in 1914, were the B. V. N. Mining Co., the Silver Cell, J. T. Janes leasing on the Hard Scrabble, and George Brown leasing on the Manhattan claim. On the west side of the camp the Cleveland mine was purchased by the Empire Zinc Co.

At Fierro, the Colorado Fuel & Iron Co. reduced normal production to about 600 tons per day of iron ore soon after the Colorado coal-mine strike started, and on Nov. 30 discontinued shipments from the camp entirely.

In the latter part of 1914 the Organ camp became the scene of active prospecting operations. The Memphis Leasing Co. in September started sinking a shaft on the

Memphis mine, and almost immediately found a good body of copper ore. Six cars were shipped, ranging from 10 to 15% in copper and carrying some gold and silver. The Excelsior mine also opened some high-grade copper ore.

The American Meerschaum & Pipe Corporation and the American Turquoise Co. both went into the hands of receivers in 1914. Considerable prospecting for oil and gas was done, but with little result. The Lucky Bill at Bayard was operated and at Steeple Rock, the old Carlisle group was taken under development by George H Utter.

In the Magdalena district, on account of the decline in the price of zinc and lead, there was but one company in continuous operation; this was the Ozark Smelting & Mining Co., operating the Graphic mine and a surface-tension flotation plant, near Magdalena. The mill treated about 40,000 tons of ore. The Empire Zinc Co., after purchasing the property of the Tri-Bullion company at Kelly, pursued development work steadily and remodeled the concentrator which will be ready early in 1915. The Juanita, leased to the MacDonald company, made a considerable output of zinc-carbonate ore.

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Mining in South Dakota in 1914

By Jesse Simmons*

The gold production of South Dakota approached $7,500,000 for 1914. Placer mining has long since ceased to be an important factor in the annual output—the state mine inspector calculates the yield during the year ended Oct. 31 at only $1800—and aside from the Homestake belt the important producing section is confined to the Bald Mountain district.

Aside from gold, the Black Hills produces gypsum, mica, minerals valuable for their lithia and phosphoric-acid content, tungsten and some copper and lead. During the year the gypsum products turned out by two mills near Rapid City had a value of $60,000. Of mica there was in excess of $6000 worth shipped, a small figure compared with years when the Westinghouse mines were operating at full capacity. Copper exploitation has been restricted since the commencement of the war. Lead is only secured in the smelting of ores mainly from Galena, Carbonate and Silver City, ores which are worked chiefly for their precious-metal content.

During the year the production of the Homestake was in excess of $6,000,000, recovered in the milling of over 1,500,000 tons. Dividends paid during the year amounted to $2,210,208, and employees shared in a bonus equal to 7% of their earnings for the year. Construction was started on a boiler plant to contain six 600-hp. boilers, steam from which will be utilized to drive a new hoisting engine at the B. & M. shaft and an electric generating plant.

In August, the U. S. Commission on Industrial Relations held a session at Lead, examined a large number of witnesses, and secured a mass of valuable testimony regarding the relations of the Homestake company to its employees. In summing up, Professor Commons, who acted as chairman of the commission, paid a high tribute to the Homestake, characterizing it as one of the most liberally managed concerns which the commission had had occasion to investigate.

On Aug. 31, the opening performance was given in the theater of Recreation Hall and Superintendent Grier made a brief address, in which he dedicated the beautiful structure to the employees of the company and residents of Lawrence County.

During the year three of the officials of the company died. They were J. B. Haggin, president; T. J. Grier, superintendent; and W. S. O'Brien, mine foreman, each of whom had occupied his respective position for many years. Their successors are E. H. Clark, Richard Blackstone and Edgar Huntley, each of whom, also, has been connected with the corporation for over a quarter of a century.

First in production of the Bald Mountain mines is the Golden Reward, which company, with nearly 3000 acres of mineral land and a 250-ton cyanide mill, at Deadwood, produced during the year approximately $370,000. Important experimentation was carried forward at the mill in an endeavor to solve the problem of commercial treatment of low-grade "blue" or unoxidized refractory siliceous ores. From exhaustive tests it appears practically certain that a preliminary roast will make a large proportion of the ores amenable to cyanidation. A tube mill was installed. Other mill installations included a Trent replacer, two agitation tanks and a Dorr classifier. The company purchased from the Homestake Mining Co. the Hidden Fortune 60-stamp mill, which was dismantled and a large part of the usable portions removed to Deadwood.

Mogul reëntered the producing class when its mill near Terry was completed early in the year. The plant embodies many strictly modern features. It is equipped with rolls, Trent Monadnock mills and a tube mill; the entire pulp is slimed and cyanided by the usual countercurrent decantation process, utilizing tanks equipped with Dorr thickeners. There are also two Dorr agitators used in the process. Pulp is discharged as tailing from the last, or fifth, thickener, where a water wash is given. At the preceding thickener tank barren solution is added and gradually worked forward. The company has granted leases on a good proportion of its mining territory; is operating the North lode on company account; has leased the Clinton mine, equipped it and granted subleases.

Important improvements were made by the Trojan company on its property at Bald Mountain, during the year just closed. Although the company has been operating for a number of years, and earning satisfactory profits, it has been expending large sums each year in betterments intended to increase efficiency in mining and milling. A sharp lookout is kept on the welfare of the men, and during the past summer work was started on the erection of a group of cottages for the married men and a commodious hotel for the bachelors. Numerous refinements were added at various points, the most noteworthy of which was the practical reconstruction of the ore railroad for half a mile, reducing the grade over which the loaded ore cars are hauled to the mill. The company operates a 250-ton cyanide mill, and also produces high-grade ores which are smelted at Denver. The production for the year was around $360,000.

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*Deadwood, S. D.

As a successful operator on low-grade ore, the Wasp No. 2 continued to merit deserved attention and earned $35,000 in dividends on the milling of rock yielding less than $1.60 per ton. During the year a new 18-ton locomotive and a number of dump cars were added to the mine equipment, and are used in removing the overburden excavated by the steam shovel. A Keystone drill was installed early in the summer and has since been kept constantly employed in prospecting.

Manager Bowman continued successfully to apply the continuous-decantation cyanidation system to the ores of the New Reliance property. This was the first adaptation of this process to Black Hills ores, and attracted much attention. Many details have been worked out in actual practice. No agitation is given, other than that secured in the stamp batteries where the ore is pulverized. The slime from the Dorr classifier is treated in four tanks equipped with Dorr thickeners; at the fourth tank barren solution is added; from this tank the pulp goes to a Portland revolving drum filter, where a water wash is given. Sand is leached in the usual manner.

Mill construction was almost completed at the Rattlesnake Jack property, near Galena. The plant will contain stamps and a Hardinge mill for crushing; Trent cyaniding machinery and Merrill zinc-dust precipitating equipment. Stockholders' differences caused a suspension of work at the Bismarck, adjoining the Wasp No. 2. Development was resumed at the Anaconda, near Roubaix, and the Hidden Treasure, on Deadwood Gulch. New mining machinery was purchased late in the year by the Echo company, and delivered at Maitland. V. R. Hodges and associates during the summer months operated the Deadwood Standard property, near Ragged Top, under lease. The Monarch property, on Two Bit Creek, continued to produce a high-grade smelting product from a small deposit. The Heidelberg yielded a quantity of $15 to $24 ore, shipped to the Golden Reward mill, at Deadwood, and announces that it is proposed to sink to quartzite. Further development of the Iron Hill property, at Carbonate, by the Titanic company, resulted in the identification of a large body of milling ore, and preparations are under way to erect a cyanide mill. J. T. Milliken secured the Oro Hondo property, adjoining the Homestake on the southeast, and sinking is in progress; the shaft, which was 1000 ft. deep, will be sunk to 2500 ft. if necessary to tap the extension of the Homestake orebodies. The Ironsides property, on Squaw Creek, produced some ore.

C. H. Kamman purchased the interests of the Pahasa Mining Co., which was the successor of the Harney Peak Tin Co. This may be considered the final chapter of history of the lattern concern, which commenced operations about 30 years ago, expended, probably injudiciously, immense sums of money and finally went into the hands of a receiver. Mr. Kamman for several years acted as agent for the receiver and later was superintendent of the Pahasa company. The Hill City M. & D. Co. purchased hoisting machinery to be installed on the 100-ft. shaft. The First National company did some development and made some mill runs on ore extracted. The Golden Summit property continued to produce high-grade ore in small quantities. The Limelight company completed its mill and operated it during the summer and fall. McNish & Mills made a test run on tin ore, with satisfactory results, and expect in early spring to commence regular operations. The Dakota Continental Copper Co. sank the shaft 37 ft., cut a station at the 825-ft. level, installed a large triplex electric-driven pump, and crosscut 240 ft., suspending work about Aug. 1.

Oregon Mining in 1914

By W. B. Hartley*

There is every indication that the production of gold, silver and lead in the state this year will greatly exceed that of any one of the preceding four years, being estimated for the 12 months ended Sept. 30 at over $1,500,000 by Director H. M. Parks of the Oregon Bureau of Mines and Geology. Labor Commissioner Hoff states that the mining industry has revived in the state and that in addition to individual owners working their placer mines there was employed during the year ending Sept. 30 a total of 578 men. These men were paid $581,650 in wages. These estimates are taken from the larger mines of the state.

A number of reports of the mining fields have been published by the Oregon Bureau of Mines and Geology during the year and several reports are now in the press pertaining to the mining districts of eastern Oregon. A work of 250 pages on the southern Oregon field by A. N. Winchell was recently published.

Eastern Oregon, as last year, produced the bulk of the gold. The Powder River gold dredge has been kept in steady operation. The Columbia, Ben Harrison, Cornucopia, Highland Rainbow and a number of other mines have been steady producers during the year.

The Old Channel mine of Jackson County has been sold to H. K. Owens, C. L. Creelman and John C. Eaton of Seattle, Wash. The new owners are making extensive improvements. The purchase price of the mine was $65,000. The Rawley copper mine on Drew Creek has also been sold to D. Van Ostrand of Milwaukee, Wis., for a consideration of $35,000.

The most recent and approved mining apparatus has been installed in the Oregon Agricultural College school of mines, at Corvallis and the attendance this fall is considered very satisfactory.

It is reported that vast beds of nitrate salts have been discovered near Vale in Malheur County, said to be 75 ft. deep and to cover six sections of land.

Abert and Summer Lakes of Lake County, whose beds are said by experts to contain millions of dollars worth of soda salts, was leased by the state land board on Dec. 16 to responsible bidders on a royalty basis.

The West Coast mines of Bohemia district of Lane County are paying and 10 stamps of the 30-stamp battery have been running most of the year. The Vesuvius mining company has been an active property and Manager Hard has kept his 10-stamp mill running all the year. Robert S. Towne, of New York, owner of the Blue Ledge mine of Jackson County, is developing the property and will build a railroad from the mine to the railroad at Jacksonville.

The gypsum mines of Baker County produced 10,920 tons of gypsum.

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*Newport, Ore.

Mining in Utah in 1914

By Edward R. Zalinski*

There was a steady output from the various camps during the first seven months, when mining operations began to be affected by the European war. Labor was plentiful, and there were no strikes or troubles of any kind.

The output of Park City was somewhat less than last year, owing to suspension of shipments by the Daly West, whose mill and hoist were destroyed by fire in 1913. Other Park City mines shipped a normal tonnage. The production of Bingham was less, but did not fall off as much as expected. The production from Tintic and Beaver counties decreased. The ore market in general was good.

PARK CITY, TINTIC, BINGHAM AND BEAVER COUNTY ORE SHIPMENTS, 1914

	Park City, Tons	Tintic, Tons	Beaver County, Tons	Bingham Shipments, Wet Tons
Jan.	5,674	30,082		767,674
Feb.	7,480	27,467		662,078
Mar.	5,590	31,861	...	857,993
Apr.	5,289	28,712	...	745,450
May	4,842	27,066	...	820,246
June	6,511	27,377	...	775,355
July	6,041	23,323	..	778,834
Aug.	4,355	19,470	...	504,892
Sept.	5,290	19,966	...	391,465
Oct.	5,379	23,603	..	396,054
Nov.	5,500 (a)	21,320 (a)		384,561 (d)
Dec.	6,000 (a)	23,500 (a)	.	400,056 (d)
Total 1914	68,951 (b)	303,747	51,550 (c)	7,484,458 (e)
Total 1913	81,822	370,240	81,641	8,326,000

(a) Shipments for November and December are estimated, but not from the average tonnage of the first ten months. They are based on the tonnage for September and October on account of metal market conditions affected by the European war. Shipments increased slightly in December.
(b) Crude ore and concentrates.
(c) Aggregate of shipments—monthly shipments not available.
(d) November and December partly estimated.
(e) Includes concentrates shipped by Utah Apex, Ohio Copper, and Bingham-New Haven.

Bingham shipments are over Denver & Rio Grande and Bingham & Garfield R.R. They also include ore shipped over the Utah Consolidated tramway, and Bingham & Garfield shipments (data furnished by courtesy of Utah Copper Co.). The shipments from Park City, Tintic, Beaver County and Bingham were obtained through courtesy of the railroads.

The production from Alta increased. The principal shippers were the South Hecla, Wasatch Mines, Michigan-Utah and Alta Consolidated. On an average, three cars of silver-lead ore a day were shipped. During the latter part of 1914 an important strike of silver-lead ore was made by the Cardiff, in Big Cottonwood, which caused considerable activity in this section. The output of American Fork was the same as last year, averaging two or three cars monthly. The Miller Hill property was the chief shipper. At Stockton, the Bullion Coalition shipped 1000 tons of lead ore a month, and there were also shipments by lessees. The Hidden Treasure, in Dry Cañon, shipped two cars of zinc ore monthly, and about twice this amount of lead. The Cliff, Ophir Hill and Lion Hill Consolidated mines, at Ophir, made shipments. In Beaver County, the principal shippers were the Moscow, Horn Silver, South Utah, Lady Bryan, and Monitor. The South Utah suspended operations. The Sheep Rock, near Beaver City, produced gold.

Smelting Operations

The United States Smelting, Refining & Mining Co., at Midvale, ran four furnaces on lead ore. The coal mines of this company maintained a steady production. The Utah Railway, a new coal road, was completed, and put in operation under the Denver & Rio Grande. The Bingham and Tintic mines of this company produced as usual. The American Smelting & Refining Co., at Murray, had four lead furnaces in operation. The main stack was remodeled to the Wislicenus ventilating type, and the height increased from 200 to 300 ft. An experimental Cottrell plant for handling fume was tried. The company maintained an experimental farm near the smeltery, where accurate data were kept on agriculture and stock conditions. The Garfield smeltery of the A. S. & R. Co. operated two blast furnaces and four reverberatories. A Cottrell system was installed for handling 125,000 cu.ft. per minute of converter fume, and operated successfully. One reverberatory was remodeled to use powdered coal as fuel. The International, at Tooele, had five lead furnaces in blast and two copper furnaces up to October; after this, one copper furnace. A Cottrell plant was installed. During August, September and October, the smelters made provisional settlements for silver and copper, but resumed full payment soon after the first of November.

The output of the Utah Copper was approximately the same as last year, or slightly greater, notwithstanding the 50% curtailment which went into effect in August. During the first quarter there was produced 32,846,155 lb. copper; 40,017,562 lb. in the second, and 28,686,672 lb. in the third, making a total of 101,550,389 lb. in the first three quarters, as compared to 119,939,809 lb. during the whole of 1913. In the last quarter the monthly production was about 6,600,000 lb., or approximately 19,800,000 lb. for the quarter, making the total gross production for the year approximately 121,350,389 lb. The total ore treated at both plants in the first three quarters was 5,434,863 tons, as compared with 7,519,392 tons during 1913. Estimating the last quarter, the total output was approximately 6,492,800 tons. The grade of the ore was 1.3411%, 1.4573% and 1.4356% copper. Experimental work in flotation was done at the Magna mill, and 28 cells were installed to treat second-class concentrates. The Ohio Copper, at Bingham, discontinued operations.

Gold, Silver and Lead

Most of the gold produced came from copper, lead and mixed ores. The output was not greatly different than last year. Little straight siliceous ore was produced by Utah mines, except to a small extent by the Sheep Rock in Beaver County, and by the Annie Laurie, at Kimberley, in Piute County. The latter property began operating under lease in September, and shipped two cars of gold ore a month. Small shipments were made by mines near Marysvale. The production of the Sheep Rock was about $3000. Several properties in Tintic, including Victoria, occasionally shipped gold ore. The Centennial-Eureka produced from siliceous gold-silver ores. Fortuna, a new gold camp near Milford, in Beaver County, attracted attention. Gold ore was received by the smelteries from outside of the state, chiefly from Nevada.

The Silver King Coalition, Daly-Judge, and Silver King Consolidated, at Park City, producing silver-lead ores, and the Utah Apex, Bingham-New Haven, United States properties, and Utah Consolidated, at Bingham, producing lead-silver ores, were the principal shippers. The Daly-West rebuilt its mill and installed a new hoist.

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*Mining engineer, Newhouse Bldg., Salt Lake City, Utah.

The Silver King Coalition built and equipped a large underground station on the Alliance tunnel level to carry on work at depth. The Daly-Judge put in an experimental Callow flotation plant in its mill to treat tailings. The Snake Creek drain and operating tunnel, which is being driven by the Daly-Judge, was advanced 3850 ft. during the year, leaving less than 4000 ft. still to be driven. On Dec. 2, the length was 10,152 ft. The Silver King Consolidated opened a large new orebody and installed machinery. The Utah Apex remodeled and enlarged its mill. The Centennial-Eureka, Chief Consolidated, Iron Blossom and Gemini, in Tintic, produced siliceous ores and lead ores.

The Mines Operating Co. produced silver by its chloridizing-leaching process from the stope fillings of the Ontario. Toward the close of the year, arrangements were made to install new roasters of the Holt-Dern type. The Park City Mills Co. remodeled the Grasselli zinc plant to treat siliceous ore from the American Flag and custom ore. The process consists of chloridizing leaching. This company operated in October, but closed down later to change its roasting equipment. The Knight Mill, at Silver City, treated low-grade Tintic ores by the Christensen leaching process. Toward the end of the year the plant was closed for changes.

ZINC

Zinc ores were mined at Tintic and Park City. The output from Tintic decreased, ore of this character being mined chiefly by lessees, who shipped 200 tons a month. The Daly-Judge was the principal producer at Park City. The tonnage of both zinc and lead ores produced by this company was the same as in 1913. The output of zinc in the form of concentrates was slightly less, but the grade was better, averaging above 40%. No zinc middlings were made. Lessees working tailings plants made occasional shipments. No zinc ores or concentrates were produced by the Daly West. The Hidden Treasure mine, near Stockton, shipped two or three cars of zinc ore monthly. The Huff electrostatic plant of the United States company treated 10 tons of zinc middlings daily from its Bingham and custom ores.

URANIUM AND VANADIUM

The production of uranium and vanadium ores up to August amounted to 550 short tons. These ores ranged from 1½ to 2½% U_3O_8, averaging 1¾%.

The production from the Paradox Valley section, in southwestern Colorado, which is in the same formation as the Utah field, was 4000 tons of ore to Sept. 1. Of this the Standard Chemical Co. treated 3500 tons, averaging about 1%. The National Radium Institute treated 200 tons, averaging 2½% U_3O_8, and 300 tons running about 2% was exported.

The principal Utah producers were the Standard Chemical Co., operating near Hanksville, in Wayne County, 110 miles south of Green River. This company shipped 50 tons, running about 2%, to its plant near Pittsburgh. The Radium Co. of America, operating on the San Rafael Reefs, 14 miles south of Green River, shipped about 50 tons to its plant near Sellersville, Penn., and sold 200 tons to the Consolidated Ores Co. These ores carried around 1½% U_3O_8. Senator T. Kearns did work on claims in San Juan County, near Monticello, 80 miles south of Thompsons; no shipments were made. The Consolidated Ores Co., of Salt Lake City, formerly David Taylor & Co., produced from claims in Emery, Grand and San Juan counties 200 tons, running 1¾% U_3O_8 and 6% V_2O_5. This company also shipped a ton of high-grade ore, carrying 17% U_3O_8, and 400 lb. running 31%. The latter is probably the highest-grade shipment of ore of this character yet made.

METAL PRODUCTION

The aggregate metal production from Utah and custom ores smelted by the United States Co., the American Smelting & Refining Co., at Murray, the Garfield smeltery of the A. S. & R. Co. and the International was:

Lead	238,610,739 lb.
Copper	145,071,710 lb.
Silver	16,018,147 oz.
Gold	207,459 oz.

The output for December is estimated. Arsenic was produced by the United States company as a byproduct. Sixteen Utah mines paid dividends totaling $6,966,118.

Alaskan Mining in 1914[*]

The year 1914 saw a number of events of great importance to Alaska, and consequently to its leading industry, mining. Among these were the passing of the railroad bill, the passing of the coal-land leasing bill, the entrance of the Granby company into the mining field, the continued tremendous activity in the Juneau district and the announcement of the existence of important low-grade prospects in the Broad Pass region.

As for production, the most accurate reports indicate a slight falling off in value for 1913, due to the decline in the price of copper. Favorable weather permitted a successful season in the interior placer fields and those of the Seward Peninsula. The lode mines in general showed a healthy activity. The value of the total mineral output of the territory is estimated at $19,218,000, compared with $19,416,000 for 1913. As heretofore, gold is the most important product, its value being $15,900,000, as against $15,626,813 for 1913. The copper production is placed at 20,850,000 lb., as against 21,659,958 lb., its value, however, showing a greater decline. The output of tin, marble, gypsum, quicksilver, coal, petroleum and silver shows a slight decrease in estimated value over that of 1913. Of the gold the placer production was $10,700,000.

SOUTHEASTERN ALASKA

Developments in the Juneau district continued at a steady rate through the year. The first of the great new properties, the Alaska-Gastineau, was about ready for initial production on a large scale at the end of December. The main features of its work for the year included the completion of the Sheep Creek tunnel, of the Salmon Creek dam, of the coarse-crushing plant, and the practical completion of the first unit of the milling plant; the reconstruction of the haulage system between the mine and the treatment plant; a large amount of development work in the orebodies; and the outlining of large new deposits reported to have increased several-fold the probable tonnage in reserve.

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[*] Taken in part from advance statement of the U. S. Geological Survey

The other definitely undertaken enterprise on the mainland, the Alaska-Juneau, continued mine development during the year along the lines previously laid down, and also did a good deal of construction work and installed machinery. The first unit of the mill, consisting of 50 stamps, was completed, and the mill should be operating to full capacity in the spring; it is expected that a capacity of not less than 20 tons per stamp will be obtained.

The U. S. Smelting, Refining & Mining Co. prosecuted its development work diligently on the Ebner group There is no information available on the results of this work, but it is reported that several hundred thousand dollars has been spent to date. The work included the completion of a crosscut tunnel to the orebody and the testing of samples in a small mill.

Across Gastineau Channel the Treadwell group continued its steady production, as heretofore. The Seven-Hundred mill was increased by 30 stamps, the 300-Stamp mill of the Treadwell was electrified, and plans were made for adding to the power plant and electrifying the 240-Stamp mill of the Treadwell. A central shaft and crushing plant started operations, handling ore from the Treadwell, the Seven-Hundred and the Mexican mines, at the rate of about 4000 tons per day. Development work underground included connection of this central shaft with lower levels of the three mines. A new incline shaft was begun for the Ready Bullion.

North of Juneau, in the Berners Bay district, operations were continued at the Kensington mine, including the completion of a 4700-ft. adit entrance; plans were also made for a mill. At the Jualin mine, under option to the Algunican Development Co., representing Belgian capital, development work was pushed for a while and some fast driving done on an adit entrance, but it was reported that a shutdown became necessary after the outbreak of the war. Latest reports indicate that the mine is to be reopened. During the year operations were started in a 10-stamp mill.

Around Ketchikan the Rush & Brown property, on Prince of Wales Island, continued work throughout the year; but the war caused a cessation of operations on practically all the other mines in the district. This is true of the Jumbo and of the Granby properties. The latter company now owns the Mamie and the Dean, and has an option on the It.

In the Porcupine district three hydraulic plants were operated. The Chichagof gold mine ran throughout the year. Some development was carried on in the Wrangell region.

Copper River Activities

A record production would have been made by the copper properties in the Copper River region, but for the break in the price of the metal. The Kennecott Mines Co. curtailed its production to such a point that at the end of the year it was not operating its concentrator, but merely shipping high-grade ore from the Bonanza and Jumbo mines, each of these working at about half capacity. The Jumbo, which began producing regularly in December, proved to be equal to the Bonanza itself, or to surpass it, both in richness and in quantity. The reduction to half capacity is in reality a reduction to about 25% of the potential production of the company.

Among the other companies, the Mother Lode continued active operation and made some valuable discoveries. The Hubbard-Elliot continued its work, and the same is true of the Alaska Consolidated, the Great Northern and the Rarus group. Hydraulicking went on in the Nizina and the Bremner districts. Nelchina has proved rather a lemon; only a little pay gravel has been found and the gold production to date is insignificant.

Along the Coast

In and around Prince William Sound two copper mines and five gold lode mines were operated. The Beatson Copper Co., on Latouche Island, about completed its new concentrator, from which production was expected to begin on Feb. 1, 1915. This mill embraces both gravity and flotation methods. New concentrate bins and docks provided with a conveyor belt for loading were erected. The mill is connected with the mine by means of a 2000-ft. tunnel, but mining is done in an opencut. About 50,000 tons were mined and shipped during the year. After February most of the production will pass through the concentrator, the capacity of which is about 700 tons.

The Ellamar during the year completed an aërial tramway connecting its shaft bins with deep-water loading facilities and having a capacity of 200 tons per hour. The discharge station is 2200 ft. out in the bay from the loading station, and the system required the erection of six towers. The year's production of the mine was about 50,000 tons, which might have been greatly increased if market conditions had justified. The Threeman Mining Co., on Landlock Bay, developed through the year, and has several hundred tons of copper ore ready for shipment. No attempts were made to take out ore except as required in development work. The property is under option to the U. S. company, which sampled it late in the summer. The Midas, now owned by the Granby company, was vigorously developed.

In the Port Wells district, the Granite mill was operated most of the year with good results. Developments here disclosed that the orebody continued in an entirely satisfactory way. The Golden Eagle installed a mill. Near Valdez a mill was constructed on the Ramsey property and another on the Big Four. The Mountain King milled a few hundred tons. The Cliff gold mine was operated during the first of the year. Gold was also produced in the Cameron & Johnson and Gold King properties. On the Kenai Peninsula, the Skeen-Lechner and Palmer Creek mills operated part of the season, and other mines were developing.

Susitna Basin

One of the most striking occurrences of the year was the announcement of the discovery of large bodies of low-grade ore, principally gold bearing, in Broad Pass, between the Susitna River drainage and the Yukon system drainage. It is uncertain as yet just what ore exists there, and what its availability may be. It is generally admitted that the deposits are low grade and their successful exploitation will depend upon the entrance of the Government railroad to or near the district. It appears, also, that the deposits carry large quantities either of antimony or of arsenic.

The Willow Creek district experienced a successful year, work being conducted on a larger scale and the output being increased over that of 1913. The Alaska Free Gold was a large producer, together with the Alaska Gold Quartz and Gold Bullion. The Gold Bullion installed a cyanide plant.

On Valdez Creek the Valdez Creek Placer Mines completed the installation of its hydraulic outfit and did a month's work before the close of the season. Considerable difficulty attended the transportation and erection of this plant, and its successful accomplishment is a notable achievement.

Fairbanks

Fairbanks had a discouraging year; there was a late start in the spring; the quartz mines were not particularly successful, and the abundance of water, while favorable in general, hindered opencut operations. The decrease in production was about $500,000 from that of 1913 and is variously estimated around $3,000,000. A notable feature of the work was the increase in the number and size of power-scraper plants, there being about 15 of these at work. This method promises to become important in the Interior, being especially applicable to shallow, low-grade ground, too limited in extent to justify a dredge. Costs run only about half as much per square foot as in drift mining.

Most of the Fairbanks production still comes from drift mines, those at Chatanika doing especially well. Jack Prest, on Upper Vault Creek, discovered some phenomenally rich pay during the winter, the streak being 60 ft. wide and averaging $6 to $8 per square foot.

The Rhoads-Hall quartz mill was the only one of 15 which ran continuously. The Willis ran intermittently on custom ore for a while and was later bought by Crites & Feldman and installed on their property, starting operations in September. This property has also installed a compressor and drills and is the second in the district to become a steady producer and give promise of long life.

Despite the encouragement given by the passage of the railroad bill, Fairbanks operations were curtailed on account of an advance of about 25% in the price of provisions following the purchase of the Northern Navigation interests by the White Pass company. Extremely dull times are looked forward to until the government railroad actually enters. Since the per capita yield of the mines during 1914 was only about $700, figuring the population at 4000, it is evident that the district is over-crowded—but in the towns, not in the mines.

Other Upper Yukon Districts

In most of the upper Yukon districts operations went on about as in the preceding year, but the Hot Springs had the best season of its history. It appears probable that the total production was nearly a million dollars. Most of this increase resulted from the extensive drilling carried on by Bock on the deep ground of lower Sullivan Creek during the last two years.

In the Circle district production was probably about $200,000; most of the work here is hydraulicking and an abundance of water was of great help. Among the principal plants operating were the Mammoth Creek, the Berry plant on Eagle Creek, and Jensen & Herrington on Lower Mastodon. The Elmer dredge on Mastodon was found unsuitable for the work and, after getting into financial difficulty, was sold. The C. J. Berry Dredging Co. acquired the properties of the Mammoth Creek Mining Co. and those of Jensen & Herrington on the lower end of Mastodon and Independence creeks; it landed a dredge at Circle during the summer and is freighting the material over to Mammoth Creek during the winter, for erection. A combination steam shovel and washing plant was installed on Independence Creek, the washing end comprising a screen, sluice tables, etc. Its success is not known.

The Koyukuk had a gain over 1913 showing a total production of about $280,000. The Chisana district appears to have established itself as a small, steady producer. Its yield is estimated at about $250,000 for 1914, coming chiefly from Bonanza Creek. During the year good prospects were found in the Healy River drainage, and late in the summer reports of discoveries at the head of the Tolovana River caused a small stampede. Definite information on the find is still lacking.

Lower Yukon Points

Ruby is considered by most well informed mining men of Alaska the coming interior placer camp. It seems probable that its 1914 production was about $1,000,000, a gain of almost 75% over 1913. Development is retarded by the lack of suitable roads, together with the high freight rate prevalent in the Yukon drainage region. Long Creek was a leading producer, together with Flint, Birch and Bear Pup. Drilling will be done on Big Creek about five miles from town during the winter. It is stated that a Union Construction dredge is to be built, having 3½-cu.ft. buckets, for operation in the district next season.

The Innoko-Iditarod region had an excellent year and yielded probably $2,200,000. There were two dredges in operation, one on Flat Creek and one on Otter Creek. That of the Yukon Gold produced $734,000.

Seward Peninsula

The Peninsula, in general, had a good year. Many of the dredges were operated at a loss, as heretofore, but the production was increased substantially over 1913, with a total somewhere between $2,700,000 and $3,000,000. Several new dredges were built, the total number of gold dredges now being 41, 11 in the Nome district, 10 in the Council, 9 in the Solomon, 5 in the Teller, 4 in the Kougarok, and 2 in the Candle and Inmachuck. Water was abundant and the hydraulic companies, as well as the small operators had a good season. Tin mining seems to be progressing. One dredge, that of the York Dredging Co., operated all the year and produced a greater tonnage than in 1913, but obtained a smaller price. Two other tin dredges operated part of the year, and a good deal of work was done on the Lost River lode tin mine. A small reduction plant run by gasoline was used here for testing, and announcement has been made of the contemplated erection of a 60-ton mill in 1915.

Other Regions

In the Kuskokwin Basin a good deal of prospecting was carried on. Copper and quicksilver showings have been found, as well as gold. Late in the year came reports of an important strike made on the Aitken & McKinnon property, on Candle Creek. The Kobuk region made a substantial production, and it is reported that increased activity may be expected here next year.

The railroad commission began work promptly after its appointment and finished a large amount of surveying before the season closed. It is understood that strong recommendations will be made for the building immediately of a railroad from a point somewhere around Seward, through Broad Pass, to the Fairbanks region.

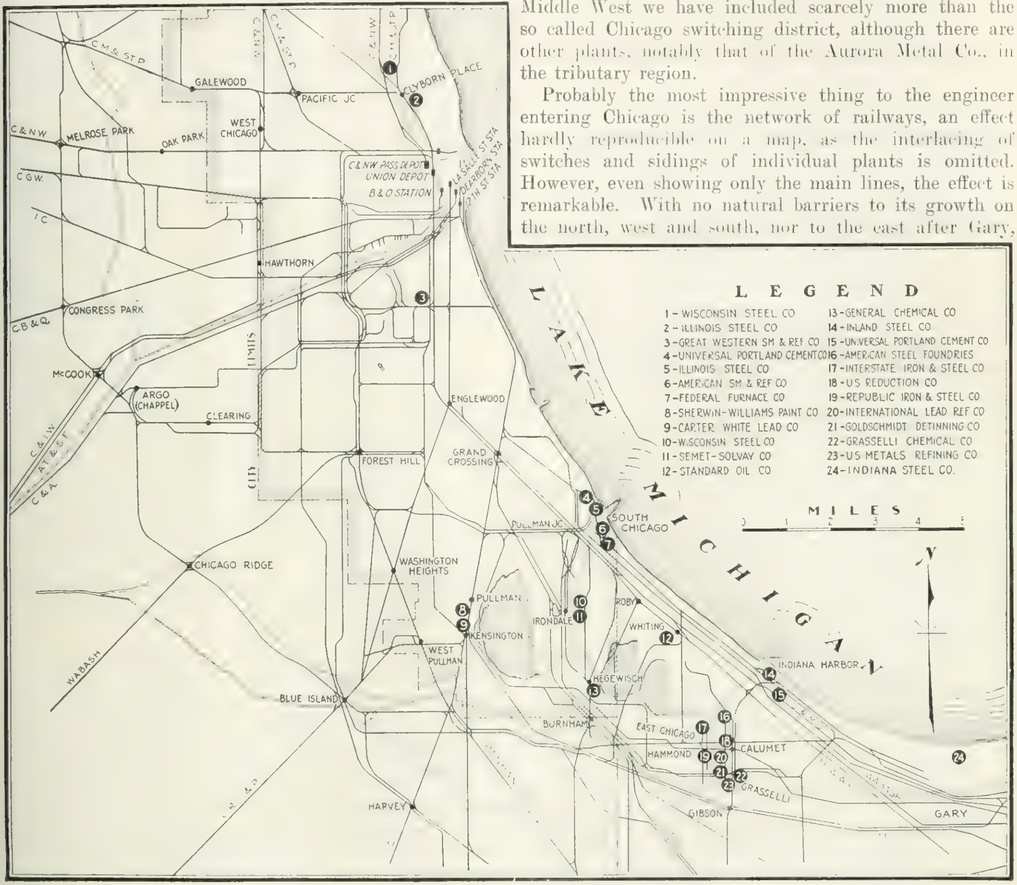
As in 1913, Juneau during 1914 recorded the most vigorous development and substantial promise of any Alaskan district. Alaska-Gastineau and Alaska-Juneau may be considered now as producers, while it seems highly probable that the U. S. interests will take over the Ebner. Other groups in the district are being examined, and representatives of many large mining companies have looked the camp over during the year.

The coal-leasing bill is expected to open up the coal fields for exploitation, and cheaper power may be looked forward to in many of the mining districts thereafter. Latest reports are to the effect that the Matanuska coal-steaming-tests made on the Maryland were satisfactory. Available coal and reasonable freight rates will unquestionably prove a boon to the Interior, encouraging the development of lode mines and bringing to placer mining a new lease of life.

Chicago, the Middle West's Metallurgical Center

In presenting the map of the metallurgical center of the Middle West we have included scarcely more than the so called Chicago switching district, although there are other plants, notably that of the Aurora Metal Co., in the tributary region.

Probably the most impressive thing to the engineer entering Chicago is the network of railways, an effect hardly reproducible on a map, as the interlacing of switches and sidings of individual plants is omitted. However, even showing only the main lines, the effect is remarkable. With no natural barriers to its growth on the north, west and south, nor to the east after Gary, with cheap fuel and iron ore, situated between the Western smelters and Eastern markets, who can estimate the coming importance of Chicago in metallurgy?



Metallurgical Map of Chicago and Its Environs

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Bismuth in 1914

Bismuth, so far as we can learn, was produced in 1914 in quantity by only two firms in the United States: The U. S. Smelting, Refining & Mining Co., as a byproduct of electrolytic lead refining; and the American Smelting & Refining Co., which extracts the bismuth (by electrolysis, it is claimed) from an enriched bullion obtained by steam pattinsonizing. It has also been stated that the National Lead Co. recovers bismuth from its residues, but this report cannot be confirmed.

The price in January, 1914, was $1.80 per lb. for foreign bismuth; $1.72 for domestic. Owing to interruption to Bolivian and Australian trade it jumped to $2.85@3, and closes the year about $2.85.

Mining in Ontario in 1914

By Thomas W. Gibson*

The value of the mineral output of Ontario in 1914 was about $50,000,000, being 3 or 3½ millions less than in 1913.

The decrease was in large part due to the war, the shock of which partially paralyzed capital, lessened demand, and so lowered prices and diminished production. The silver industry felt the blow severely, and it was feared the mines at Cobalt would be closed. However, the intervention of the Canadian Government induced the banks to make advances as against bullion, which for a short time was unmarketable. Confidence was gradually restored, but the steady recession of the price of silver, a process which had set in even before war was declared, led many of the companies to restrict their output. In any event, the yield of silver would have been less than in 1913, it being now recognized that the maximum stage of productivity at Cobalt has been passed. As the figures given below will show, the relative fall was greater in the value of the returns than in the actual output.

The influence of the war was felt also by nickel mining, but the effect was different upon the two producing companies. The Canadian Copper Co., whose matte is refined in New Jersey and whose market for the refined metal was in Europe as well as America, reduced the number of furnaces in blast from six to two, though later it raised it to four. On the other hand, the Mond Nickel Co., which sends its matte to be refined in Wales, was enabled by means of its new plant at Coniston largely to increase its output. The capacity of the Mond works is less than that of the copper company, hence there is a decrease, though not a serious one, in the quantity of nickel produced as compared with 1913.

Notwithstanding the falling off in nickel, the yield of copper, which is a byproduct of nickel, was considerably increased. The reason for this was the larger scale of the Mond company's operations, its ore containing a larger proportion of copper, though less of nickel, than the ores smelted by the Canadian Copper Co. Another result of the war was the closing of the markets in continental Europe for cobalt oxide, in the production of which Ontario now leads the world.

The year was marked by a large increase in the amount of labor offering in the mines, which is now in excess of the demand. Managers remark that for this reason it is more efficient. There was no reduction in the scale of wages, however, either for this reason or because of the introduction of the eight-hour underground-labor law, which became effective Jan. 1, 1914.

The death rate from accidents in the metal mines of Ontario remains high notwithstanding strict government inspection and investigation, as required by law, into every fatality. In 1913, the death rate per thousand in the mines, quarries and metallurgical works was 3.31 per thousand men employed and for 1914 the rate was practically the same. Some of the larger companies are employing a safety engineer to keep down accidents. In this way the Canadian Copper Co. reduced its fatalities from 11 men killed during the first half of 1913 to 3 during the latter half and to 1 in 1914. The company's safety engineer, E. T. Corkill, was appointed July 1, 1913. The Workmen's Compensation Act came into force Jan. 1, 1915, and by virtue of its provisions all accidents, fatal or otherwise, will entitle the injured person to compensation on a prescribed scale.

Gold

The yield of gold was about 270,000 oz., value, about $5,400,000. This is 50,000 oz. more than in 1913. The greater part came from the mines of Porcupine; a little less than half, say 125,000 oz., from the Hollinger mine, now rapidly claiming a place among the great gold mines of the world. Monthly dividends amounting to 39% and aggregating $1,170,000 were paid out by the Hollinger last year. A representative run for the four weeks ending Nov. 4 showed 18,645 tons of ore milled, the average value of which was $14.09 per ton. The allied Acme company is developing the adjoining Dixon and Millerton claims, and 40 stamps and a separate cyaniding plant are being installed in the Hollinger mill to treat the ore. Dome mine, the next largest producer, is essentially low-grade, but the bodies are large. Some 205,000 tons of ore were milled last year yielding about 51,000 oz., or $5 per ton. Porcupine Crown and McIntyre Porcupine milled considerable rich ore, and were important factors in the production. Tough-Oakes at Kirkland Lake continued development of its narrow but rich veins, and is building a new mill.

Silver

The output of the Cobalt mines was about 25,000,000 oz. of silver, worth $12,765,000. As compared with 1913, this is a falling off of about 4¾ million ounces in quantity and 3¾ million dollars in value. High-grade ore no longer plays the chief rôle at Cobalt, though it is by no means obsolete. Concentration of low-grade material is the chief feature of Cobalt practice; production of merchantable bars is another. Both features are embodied in the new low-grade mill opened by the Nipissing company last year. The chief producers continue to be Nipissing, Coniagas, La Rose, Crown Reserve, McKinley-Darragh-Savage, Seneca-Superior, Kerr Lake, Buffalo, etc. Townsite moved up into third place, having uncovered some very rich ore. The unwatering of Kerr Lake has proved to be a somewhat heavy job, largely because of the great depth of mud resting on the bottom. The work was not completed before winter set in. A similar process is going on at Cobalt Lake. In some of the mines there is much broken ore stoped out and awaiting an advance in the price of silver; in the vaults of others silver bars are accumulating. If the price should move up in time to influence the operations of next year, it is easily possible that the production of 1915 may equal or surpass that of 1914. The greatest depth from which silver is being obtained is at the Temiskaming mine, where a good vein was struck in the diabase at 750 feet.

Nickel and Copper

Nickel contents of bessemer matte are estimated at 22,000 tons, worth $4,900,000, and copper contents 14,250 tons, worth $2,000,000. The Canadian Copper Co. some time ago believed its great Creighton mine was approaching the point of exhaustion. Consequently, the huge but lower-grade deposit known as Frood or No. 3 mine was opened up, a town was built by the company for its workmen, and operations on a large scale begun. The diamond drills which meantime had been exploring the Creighton, reported the existence of large reserves previously unknown. Work was stopped at the Frood, and again the company is drawing its main supply from the Creighton mine. The Alexo mine in Dundonald township which had been shipping ore to the Mond smeltery discontinued consignments when war was declared, but has since resumed them.

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*Deputy Minister of Mines, Toronto, Ont.

Iron ore to the amount of about 180,000 tons was raised at the Helen, Magpie, Moose Mountain, and Canada iron mines, the value being about $400,000. Of pig iron, some 650,000 tons were made at the Sault Ste. Marie, Hamilton, Port Colborne and Deseronto blast furnaces, the value of which was $8,450,000.

Nonmetallic Materials

There is a great variety of nonmetallic substances produced in Ontario, such as building materials, including brick, lime, stone and portland cement; petroleum and natural gas, also salt, mica, corundum, talc, iron pyrites, quartz, feldspar, graphite, etc. The combined value of the nonmetals produced in 1913 was between 15 and 16 million dollars, and in 1914 was about the same, or possibly a little less.

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Mining in British Columbia in 1914

The demoralized metal market had a profound effect on British Columbia mining. This is particularly true of the interior, where the smelting companies were shut down altogether for a while, so far as known, although later some resumption of activity took place.

The British Columbia Copper Co. blew out its plant in August, and also shut down its mine. At its Mother Lode mine in the Deadwood camp, about 178,000 tons of ore was mined, at the low figure of 85.48c. on board cars. A slight increase in cost here is due to the necessity of mining more ore by stoping instead of by glory-hole methods. Up to Aug. 20 the company had smelted 295,000 tons, of which 191,000 was company ore, the balance being custom ore. Something over 4,000,000 lb. of copper was produced, 11,142 oz. of gold and 63,501 oz. of silver. The company is operating a group of claims with about 25 men at Copper Mountain, 12 miles south of Princeton, in the Similkameen district. The result of the work here indicates a reasonably assured reserve of 5,000,000 tons and more, with excellent chances for this to be increased. The Granby closed down its Phœnix plant somewhat earlier than did the British Columbia, but resumed operations again on a reduced scale; it is rumored that a gradual increase to full capacity is planned. The Consolidated Mining & Smelting Co., at Trail, resumed the acceptance of shipments in October, making partial payments for the contents of custom ore with arrangements for later complete payment.

In the Slocan district the leading company continues to be the Standard Silver-Lead. This company continued its splendid performance of the last two or three years until August, when at the beginning of the war a partial cessation of underground work was found necessary. During this period of curtailment the company shipped no lead, but attempted to take advantage of the high zinc market while it lasted, by shipping such blende as was valuable. It is reported that this attempt was later given up and all work stopped except development work.

All the Slocan mines suffered more or less reduction of operations shortly after the outbreak of the war, partly the result of financial difficulties, and partly due to the fact that the Consolidated would accept no lead ores. The resumption of operations by the latter company, under restrictions, was not in all cases satisfactory to the ore vendors, who were probably rather unreasonable in their demands. The Van Roi, which is owned entirely in England, ceased operations, although during the year it had been extracting and treating ore from a new orebody, the best so far discovered in the mine. The Lucky Thought, adjoining the Van Roi, was explored under option for the Consolidated with encouraging results.

The Silverton Mines, Ltd., owner of the Hewitt, started its flotation concentrating process in the spring. It is reported that Minerals Separation, Ltd., financed the installation of the mill, and also that the process was not so successful as had been hoped. The Slocan Star found some good ore on its lowest level and shipped some before resorting to development only at the beginning of the war.

More interest was shown in the coast developments during the year than in the interior. The Britannia Mining & Smelting Co. at Britannia Beach continued its extensive program of development and construction.

The Granby Consolidated Mining, Smelting & Power Co. blew in its Anyox smelting plant on Mar. 16, on ores from its Hidden Creek mine. Development work was carried on at the mine and surface construction was pushed practically to completion. The plant consisting of mine, smelting works, railroad and town, is an extensive modern installation. Certain troubles naturally to be expected were encountered when the furnaces were first blown in, but were rapidly overcome. The Granby company engaged in a strong campaign to develop tributary ores along the coast; to that end it took over three mines in Alaska and has another under option. It also has a working option on a group of old mines at Van Anda, Texada Island, north of Vancouver.

The Tonopah-Belmont interests have organized the Belmont-Canadian Mines, Ltd., for the purpose of carrying on mining and exploration in British Columbia. The directors, officers and staff correspond about to those of the Tonopah-Belmont itself. The most important undertaking of these interests is the taking under option of a gold property at Surf Inlet; the option, acquired in April, 1914, expires July 1, 1915. The company instituted a campaign of development work involving a considerable amount of surface construction, and it is believed that results are favorable up to date. The property is opened with adits and should be amenable to economic exploitation. It is understood that the ore is not of high grade, but that the deposit is wide and indicates considerable extension, both lateral and in depth.

In the Atlin district, in the extreme north of the province, production was about the same as heretofore, although the camp experienced rather more activity than has been its lot for some years.

Mining in Mexico in 1914

Mexico has been doubly unfortunate during the year, since her own revolutions removed the element of stability and made mining economically almost impossible, and then the European war appeared to make conditions worse, if possible.

Conditions at Cananea

At Cananea the Cananea Consolidated Copper Co. operated from the first of the year to the middle of July, except for two short intervals. Owing to lack of suitable railroad bridges and governmental or other responsible authority, it was not possible to operate the property on a regular producing basis in the latter half of 1914. However, some work was done, about 350 men being on the pay-roll at the end of the year. The pumps were kept running, hand drilling was done at various points and the works maintained in good order. The properties are in charge of George Kingdon, as general superintendent, but only a few other Americans were required on the staff at the end of the year.

Two of the Mexican properties of the Mines Co. of America resumed operations in June, 1914, and operated at about three-fourths capacity during the remainder of the year. The properties which resumed work were El Rayo, in Chihuahua, and Creston-Colorada, in Sonora. La Dura, in Sonora, and Dolores, in Chihuahua, were not operated, since railroad transportation was completely interrupted at the former and nearly so at the latter.

Smelteries in Northern Mexico

At Chihuahua the mines and smelteries were troubled a good deal by revolutionary activities and most of the mines were necessarily closed during a portion of the year. The same applies to the Parral Camp, at which a combination of transportation difficulties and revolutionary activities made cessations of operations necessary. At present only the Alvarado is running. Many of the Parral mines have been allowed to fill with water, which will have to be pumped out before production can be resumed.

It was reported about Dec. 20 that zinc and silver mining was becoming active again in the northern part of Mexico, and that the smelting plants were about to start up. The El Paso plant was running two lead furnaces on ores received from the surrounding country. The smeltery of the American Smelting & Refining Co., at Chihuahua, was running four of the lead furnaces steadily, while the balance of the furnaces were idle on account of scarcity of labor, therefore restricting the shipment tonnage of custom ores. At Torreon the smeltery of the Compañia Metallurgica de Torreon was running and receiving custom ores. The Asarco plant of the American Smelting & Refining Co. was also running again and receiving custom ores. These companies operate works treating lead-silver ores principally.

As a result of the better tone in the metal market, several of the mines of the Santa Eulalia district, near Chihuahua City, were starting operations again. The San Antonio, of the A. S. & R. Co. has been started up under lease to Schuyler Lawrence, shipping lead and silver ore to the smelteries. El Cristo Mining Co. is also taking out ore and shipping to the smelters. The two big mines of the Cusihuiriachic district are operating. The Cusi Consolidated is doing development work and taking out ore, and the Cusi Mining Co. is working, but with a smaller force than formerly and shipping to the Chihuahua smelter.

Tigre Plant Operating Continuously

With the exception of seven days, from Apr. 24 to May 1, during which time the American employees were out at camp owing to the difficulty caused by the occupation of Vera Cruz by United States soldiers, the Tigre, at Esqueda, Sonora, has been in operation continually during the year, and has not suffered in any way from the disturbed conditions in the country. During the seven days referred to, work in the mines went on as usual, but the mill was partly closed. The only mine of the district which was compelled to cease operations was El Temblor.

The North Tigre was leased to the United Mines Co., and the 50-ton mill completed. The Cinco de Mayo properties, about 15 miles northwest of Esqueda, have been operated during the year by the Constitutional authorities. Their revenue, for most of the time, was from ore produced which was shipped to El Paso.

Along the border, south from Nogales, there was some prospecting and some working of the small properties. Minas Prietas, the largest camp in the district, was in operation part of the time, and at present is increasing its scale of operations. There have been many small shipments of ores from different smaller prospects, but nothing of much interest.

Central Mexico Operations

At Zacatecas operations were held up for a considerable period, owing to revolutionary disturbances and actual fighting. La Fé Mining Co., Ltd., at Guadalupe, just below the City of Zacatecas, practically completed its construction work during the year, but operations have continued to be hampered. The mill was started early in April, but was in operation less than a fortnight when the political situation became so menacing that all work, with the exception of pumping, was stopped, and all of the foreign staff left the property, a Mexican engineer taking charge temporarily. At present the mine is kept unwatered, pending the advent of conditions giving some assurance of continuous operation. A. B. Emery resigned the management, and E. A. Strout, previously assistant at the Santa Gertrudis mine, was appointed to take his place.

Operations at the Palmarejo & Mexican Goldfields, Ltd., have been halted by the political troubles, and it is impossible to say when they will be resumed. When the revolutionary movements reach a definite end, it is hoped that the capital necessary to start milling operations will be raised. The manager is holding himself in readiness to return to Mexico as soon as conditions permit.

The Mazapil Copper Co., Ltd., in Zacatecas, has done no work during the year, and practically all operations in the district have been suspended, awaiting better conditions.

The Cia. Minera de Peñoles has not done any work at Ojuelo, Durango, since September, 1913, but blew in the smelting plant at Mapimi this fall, on custom ore, though it is not running at full capacity.

Situation at El Oro

At El Oro, in the State of Mexico, the difficulties of operation have been many. The mines all continued operations at the usual rate until the end of April, when the Vera Cruz incident necessitated all foreigners leaving the district. Mills were closed down, but in order to keep Mexican workmen employed, development work was continued. No trouble was experienced, and this work was carried out satisfactorily under the direction of the company's officials in Mexico City until about Oct. 1, when dynamite was getting scarce. About this time the Carranza administration made it plain that the mills must resume operations and production. There was serious objection to this, as some officials had assumed authority to take possession of the bullion in transit or in Mexico City, and the scarcity of dynamite prevented operations at the usual capacity.

Mills of the El Oro Mining & Railway Co., the Esperanza Mining Co., and Mexico Mines of El Oro, started up at a moderate rate, using ore which was broken and retreated tailings to some extent. These operations have been continued, though at the present moment dynamite is scarce and no supply has arrived.

The Dos Estrellas Mining Co. continued development work without making any resumption of milling operations, employing about half of their men. La Lucha mine, in the same district with Dos Estrellas, started milling operations for the first time in August, and has continued its work steadily.

The output for the El Oro mines for the year will be approximately as follows:

EL ORO PRODUCTION IN 1914

	Tons	Production
El Oro M. & R. Co.	229,200	$1,317,800
Esperanza	173,800	1,060,000
Mexico Mine	61,600	868,000
Dos Estrellas		2,180,600
La Lucha	4,500	73,700
Total	469,100	$5,500,100

The output in 1913 was 829,700 tons with a production value of $13,002,150.

The outlook for January is somewhat uncertain, but if supplies of dynamite and cyanide can be obtained, work will be continued and resumed at full capacity as soon as possible.

Pachuca Mills Running

At Pachuca the conditions have been similar to those in the El Oro district. All the American staff was driven out at the time of the occupation of Vera Cruz by United States troops, but the Real del Monte company continued on a reduced scale under their Mexican staff, at no time dropping below 700 tons per day milled. In August most of the Americans returned and work is now being gradually brought back to the old basis. The normal capacity of the Real del Monte equipment is about 1800 tons per day. The other companies closed their mills entirely for a period of two to four months, while maintaining a certain amount of underground work to keep some of their men occupied.

It is understood that Pachuca was taken by assault by Villa forces a short time ago, and that now all is quiet and the new authorities are extremely anxious for reestablishment of full-scale operations as soon as possible. There has been some shortage of supplies, but the companies have assisted each other as far as possible. Efforts are being made to provide trains for carrying necessary supplies in to the camp via El Paso.

It is worthy of mention that at no time have the workingmen employed by any of the mining companies in Pachuca taken any part in the disturbances which have occurred, but on the contrary have done everything in their power to be of protection and assistance to American employers against the irresponsible mobs not employed by the companies.

Santa Gertrudis mill was closed on Apr. 21, 1914, and resumed operations in August at a scale estimated to pay the administration and to employ a sufficient number of workmen to safeguard the property. Development on the lowest level is said to have been disappointing, but some good orebodies parallel to the main vein have been discovered. In September operations were increased to 85% of normal and there held for the balance of the year. It is not intended further to increase production until a more certain supply of cyanide can be arranged, and pending an improvement in Mexican and foreign general conditions.

Guanajuato Short of Supplies

At Guanajuato there have been a good many difficulties, but in general there have been very few cessations. The Guanajuato Consolidated Mining & Milling Co. ran the full 80 stamps up to April, but since that time only half of them have been running. The Guanajuato Reduction & Mines Co. has operated the Bustos mill and the Flores cyanide plant continuously. The Guanajuato Development Co. has operated its principal mines and mills, but development and nonproductive work have been reduced to a minimum. The Carmen mill, belonging to the Guanajuato Con., was shut down during July, August and September, but has been in operation since that time. No new work has been undertaken in the district during the year. It has been difficult to secure supplies, but somehow it has been done. At present it is possible to get supplies by way of El Paso.

Reports from the Balsas River district in Guerrero indicate that some of the American-owned properties are in the hands of rebels under Salgado, who are trying to force operations on it. With most of the properties it is impossible to do them any great harm by robbery of this sort, but at at least one of these mines, operations are being carried on on a generous scale, sufficient to supply the rebels with considerable money.

The Jalisco Properties

The Hostotipaquillo district, of Jalisco as a whole operated until about the end of April, when an attack was made by bandits at several properties. At El Favor, which closed on Apr. 25, the manager, Walter Neal, and another member of the staff, Patrick Baird, were stabbed, and two of the staff, C. B. Hoadley, an American, and G. E. Williams, a British subject, were killed by the bandits, who looted the stores and stole considerable bullion. Prior to this the company had declared two dividends, amounting in all to $70,000. Since April it has been impracticable to get supplies to the mine and no operations have been undertaken. The mill, containing 35 stamps and 5 tube mills, has a capacity of about 180 tons when grinding through 200 mesh, but it is expected that the mill capacity will be increased by application of the Field process when operations are resumed.

The Casadas and the Mololoa mines were operated during the first quarter of the year, while the Cinco Minas property of the Daly Estate started its mill in February but was compelled to cease operations after April. The Amparo mine at some distance from the others, was subject to less interference, and at the last date of communication, Nov. 7, was operating.

EASTERN GUANAJUATO

Mining and milling in the eastern part of the State of Guanajuato, particularly in the Pozos district, has been carried on with little interruption. This territory is far removed from the seat of revolutionary troubles, and since the people are generally peaceably inclined and live in an agricultural district, there has been little difficulty in continuing the work. The mill of the Cia. Beneficiadora de Pozos, under which name the new large mill of the Angustias Company has been constructed, was operated practically continuously during the year. Some difficulty was experienced as to the mill's capacity, it having fallen somewhat below expectations. Late in the year, however, a study of conditions was undertaken with the object of removing the difficulty.

The districts of the west coast have been, like all other districts in Mexico, operating under difficulties, if at all. Development at Bolaños was interrupted and nothing is being done with it at the present time. At Copala, Panuco, Rosario, Guadalupe, de Los Reyes, and many other small camps through Sinaloa, Sonora, and farther south, operations were spasmodic or entirely absent. On the east coast, the mines of the Victoria, Tamaulipas, were discontinued altogether.

At San Luis Potosi the smeltery of the Cia. Metalurgica Mexicana was closed during most of the year, and its principal supplying mines, the Victoria, at San Pedro, have also been closed. At Charcas the properties of the A. S. & R. Co. have commenced work again, and efforts are to be made to continue.

The large mines of Santa Rosalia, in Baja California, continued operations during the year with little interruption. There has been comparatively little trouble through revolutionary causes on the Lower California peninsula, and practically all mining continued as usual unless there was some other cause for interruption.

Operation of the Tezuitlan smeltery, in Puebla, Mexico, has been risky, and at the present time it is not known when operations can be resumed. The plant has been closed for nearly a year.

The Batopilas Mining Co. started work at its property in southwestern Chihuahua on Sept. 7. Both mills are running at about two-thirds capacity, and will be increased to the maximum as soon as possible.

* *

Central America in 1914

The operating properties in Central America being mainly precious-metal mines, there was little interruption from the financial situation arising out of the European war. Producing mines were consequently operated about as usual, though developing properties and new enterprises were stopped or held in abeyance.

In Costa Rica the Aguacate Mines continued the successful development of its properties near San Mateo. In the horizon drained by the seventh-level adit, the orebody was proved for about 1500 ft. in length and 225 ft. vertically, and the outlook is even more promising than at the end of 1913. Besides the regular ore of the Black vein, the company encountered a bonanza section from which a yield of at least a million dollars is assured. The ore milled in November averaged $28 per ton, and in December a "bonanza" shipment was being prepared. A 10th-level adit to cut the orebody at a depth of 300 ft. below the present workings is being driven. Some of the outlying veins on the company's property were also prospected with favorable results. The Abangarez Goldfields operated steadily until about May, when highgrading and pilfering of precipitate became so frequent that trouble ensued with the men when measures were taken to stop this stealing. In June it became necessary in the absence of local authority to call soldiers to the camp to maintain order. The company then decided to curtail operations until laws were passed to prevent these illicit losses. Only development work was therefore done at the Tres Hermanos and San Rafael during the last half of the year. Stoping of the low grade ore continued uninterruptedly at the Boston mine and was sent to the 20-stamp mill at that property. Full operations at all the properties will not be resumed until the remedial laws now before Congress are passed. La Union mine of the Panama & Costa Rica Mining Co. continued its successful career, crushing at the rate of 3000 tons per month. The ore was treated by amalgamation in the 30-stamp mill and by cyanidation in the new plant completed in 1913, the extraction averaging about 93%. Operations were resumed at the Bella Vista and Montezuma mines of the Montezuma Mines of Costa Rica. The Trinidad mine was under development with encouraging results, as was also the Sacra Familia in the Aguacate district; the Porvenir was bonded to New York men.

The principal operation in Honduras is that of the New York & Honduras Rosario Mining Co. at San Juancito. This company operated at increased capacity in 1914, treating about 108,000 tons of ore, yielding approximately 14,000 oz. of gold and 1,818,000 oz. of silver. The company gradually increased the duty of its 1850-lb. stamps until, at the end of 1914, the stamps were averaging a daily duty of 17 tons through three mesh. The company continued its geological survey of the district. Development work was done at the Sabana Grande mine on four veins; on two levels high-grade silver ore was found. The old Yuscaran district was the subject of some interest, work having been done at the Monserrate mine, preparatory to an examination. The Socorro Gold & Silver Mine, Ltd., at Valle de Angeles, started its mill about May 15 and operated throughout the year. The plant has a nominal capacity of about 30 tons per day, and in September was operating on ore carrying from 65 to 70 oz. of silver. Desultory placer operations were conducted in the department of Olancho and an American interest undertook a drilling campaign in a new district in this department.

In Salvador the two principal operations were the Butters Salvador Mines, Ltd., at San Sebastian and the Butters Divisadero Co. at Divisadero. The new shaft at San Sebastian was completed in August, and there was no interruption of production from the caving ground in the lower part of the old shaft; production at the end of the year was at the rate of about $60,000 per month from 3000 tons of ore. At Divisadero the output was increased; new equipment added at the mine and mill, including five 1250-lb. stamps, and the pipe line and oil-fuel installation were completed.

Nicaragua experienced a setback in 1914 as the Central American Goldfields Syndicate, Ltd., controlled by Camp Bird interests, ceased work, owing to title difficulties; this company had optioned the Bonanza, Mars, Siempre Viva and other properties in the Pis Pis district. The Babilonia Gold Mines, Ltd., at La Libertad started its new cyanide plant, operating on the old tailings dump while the mine was being unwatered. The Javali & Escandalo Mining Co. in the same district began the construction of a cyanide plant. The Oroya-Leonesa, Ltd., was reconstructed and the property at Matagalpa taken over by Central American Mines, Ltd. Some work was done at La Luz mine in the Cuicuinita district.

Guatamala and Panama were comparatively inactive in 1914. In Trinidad the exploitation of the oil fields was continued, bringing the total number of wells drilled up to 147. According to the inspector's report for the fiscal year, 41 wells were drilled, averaging about 1000 ft. each; 18 were productive and the total output for the year was about 563,000 bbl. The principal producers were the Trinidad Lake Petroleum Co. and the United British Oilfields of Trinidad; the latter at the end of 1914 was producing at the rate of about 800 tons per week. Important prospecting was done by Trinidad Leaseholds, controlled by the Consolidated Gold Fields of South Africa.

Cuba attracted attention in 1914 through a new copper mine in the western end of the island in the Province of Pinar del Rio; the Matahambre mine began shipping in December, 1913, and by April had shipped over 8000 tons, averaging 18% copper and 1.5 oz. silver. This mine paid for itself in the first cargo shipped, and copper prospecting in Cuba was much stimulated. The Matahambre production for 1914 was nearly 6,000,000 lb.; about 300 men were employed and the mine developments continued favorable; the unoxidized zone at the lowest adit averaged about 15% copper. The El Cobre mine of the Cuba Copper Co. was unwatered in 1914; after many years the bottom of the mine, at 1100-ft., was capable of being prospected, and chalcopyrite-ore shipments averaging 8% Cu demonstrated the value of this work; beside the shipping ore, there were found bodies of low-grade ore that is amenable to flotation. Prospecting was carried on throughout 1914 by the Davison Chemical Co., of Baltimore, at Carlotta, north of Cienfuegos, where a large body of cupiferous pyrite was being drilled. All the iron mines of Cuba operated at much reduced capacity in 1914, the Mayari mines on the north coast at one-quarter capacity and the Daiquiri mines at about one-half capacity. El Cuero iron mine of the Ponupo Manganese Co. operated for four months. No manganese ore was shipped, although one small manganese property at the end of 1914 was preparing to make shipments.

* *

South America in 1914

The northern states of South America, which produce more gold, were not so much affected by the war conditions as were the countries of the West Coast, where the mining industry was in a comatose condition in the latter half of the year, except at mines that were in the hands of strong companies.

COLOMBIA

Prospecting was not so active in Colombia in 1914 as in 1913. Despite several interruptions, the Pato gold dredge continued in 1914 its remarkable yield, returning over half a million dollars from less than one million cubic yards, the yield in December averaging over $1 per cu.yd. At the associated San Francisco property, on the opposite side of the Nechi River, the drilling proved highly satisfactory, over 7,000,000 cu.yd. having been indicated with an average value of over 70c. per cu.yd.; a dredge is being constructed.

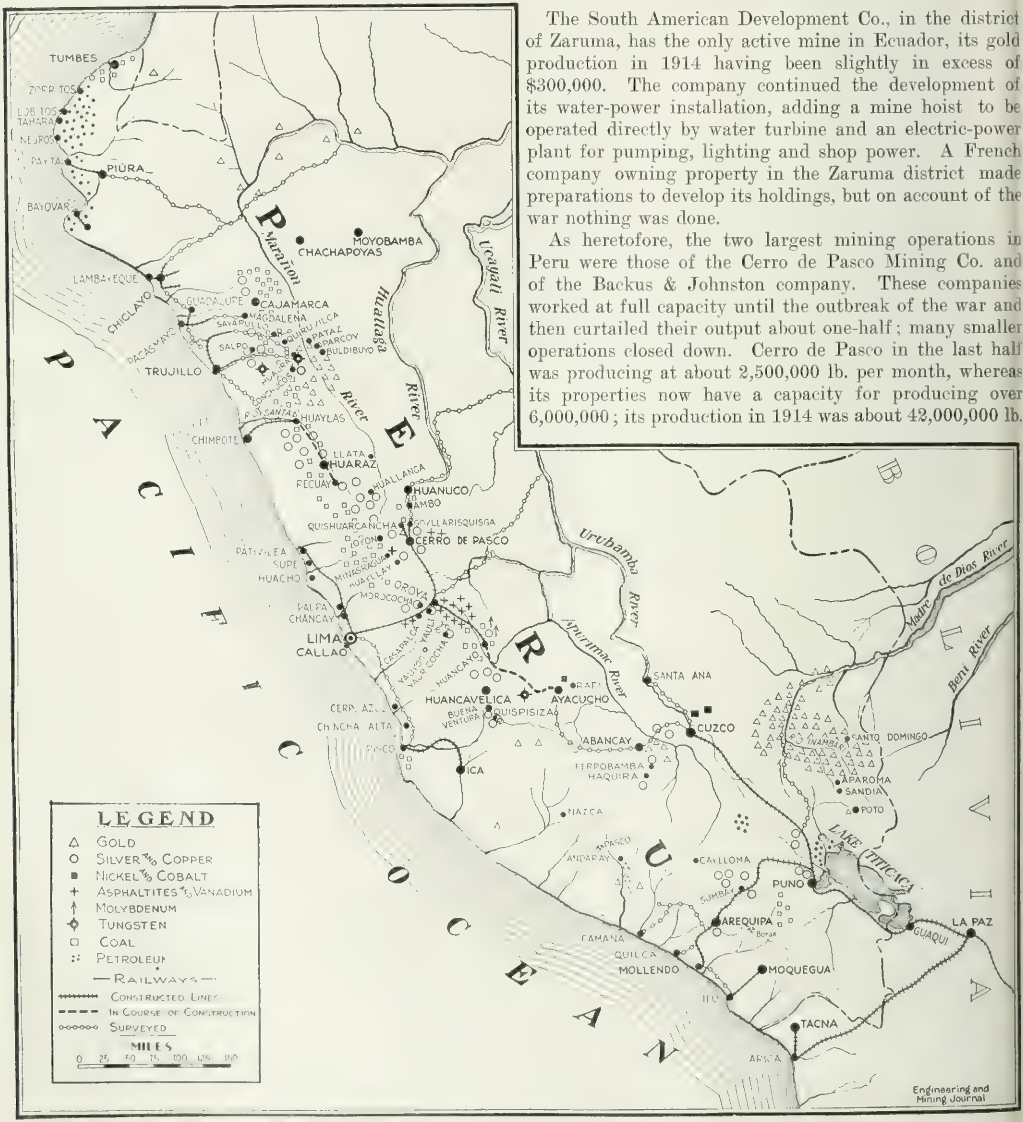
The Pochet dredge operated successfully near Pinéa, on the Nechi River, about two miles north of Zaragoza. The Antioquia-Guadalupe placer on the Porce River, near Barbosa, was tested by the Marquette-Magdelena company, a subsidiary of Breitung & Co., Ltd. McGuire Brothers, who operated La Clara placer successfully for several seasons, extended their operations during 1914, importing quipment for the operation of the Hormiguero and Miralores placers, also on the Porce. On account of rich cleanups near the Porci River bed, McGuire Brothers are making preparations to divert the course of the river and wash the old river bed; new hydraulic elevators and a 30-in. inverted siphon were ordered for this purpose. A long season was experienced at La Clara and the cleanup was about $100,000. Some new equipment was installed by the Rio Grande & Porce Mining Co. for the purpose of washing its gravel near the Hormiguero. The Vallecitos Hydraulic Mining Co. began washing at Anori late in the year, with an increased water supply; the San Benigno placer adjoining was worked in a small way. The Viborita placer, near Amalfi, was idle in the latter half of the year. Activity among the placers of the upper Atrato region was largely suspended, pending the outcome of title litigation; nevertheless, the Anglo-Colombian Development Co. began shipping the machinery for the dredge it ordered from Lobnitz & Co. for its property near Novita. The Certigue Dredging Co. made preparations in the autumn to resume operations on the river of that name, sending its engineer, R. J. H. Bradley, to visit the property.

Most of the gold and silver obtained from lode mining in Colombia is mined in the Departments of Antioquia, Caldas, Tolima and Bolivar; the production in the Choco is insignificant. Antioquia, as usual, held first place. The Zancudo mine, in the district of Titiribi, maintained its usual production of about $30,000 per month; the value of the ore is about $15, two-thirds being silver and one-third gold. The Britannia, the only other silver mine in the department, shipped its product in the form of concentrates. The Frontino & Bolivia company operated throughout 1914, milling about 2000 tons per month for a monthly yield of about $70,000; the company endeavored to increase its ore reserves and is reported to have opened good ore at depth in one of its mines. Among other active quartz mines in the department were the Otramina, Constancia, Andina and Trinidad; in addition, there are about 60 properties that make an intermittent production. In the department of Caldas, the Marmata and the Cascada were the principal producers. At Fresno, in the department of Tolima, the Frias silver mine, operated by the Tolima Mining Co., produced about 16,000 tons which, after hand picking and concentrating, yielded about 560,000 oz. of silver and lead to the value of about $22,000. In the Guamaco district, in the department of Bolivar, the Libertad mine of Messrs Small & Burdett operated and installed a hydro-electric plant with a view of increasing the milling capacity. The Concordia mine, under the management of K. C. Parrish, installed a mill. The Marquette-Magdalena Co. did development work on the Topacio lode mine, on Caceri Creek, in Antioquia, and at the Churima mine, on a river of the same name in the Choco territory. The value of mineral exports from Colombia in 1913 was reported by the *Pan-American Union Bulletin,* as $5,514,600, of which over $4,100,000 was gold and $583,995 was platinum. The gold production was about equally divided between placer and lode mines.

ECUADOR AND PERU

The South American Development Co., in the district of Zaruma, has the only active mine in Ecuador, its gold production in 1914 having been slightly in excess of $300,000. The company continued the development of its water-power installation, adding a mine hoist to be operated directly by water turbine and an electric-power plant for pumping, lighting and shop power. A French company owning property in the Zaruma district made preparations to develop its holdings, but on account of the war nothing was done.

As heretofore, the two largest mining operations in Peru were those of the Cerro de Pasco Mining Co. and of the Backus & Johnston company. These companies worked at full capacity until the outbreak of the war and then curtailed their output about one-half; many smaller operations closed down. Cerro de Pasco in the last half was producing at about 2,500,000 lb. per month, whereas its properties now have a capacity for producing over 6,000,000; its production in 1914 was about 42,000,000 lb.



PERU, SHOWING THE SITUATION OF THE CHIEF MINERAL RESOURCES

The Backus & Johnston company in 1914 completed the campaign of improvements, but reduced its output. Both companies have completed their hydro-electric power plants, and their smelting works are now largely operated by electric power. The Fernandini, Lampa and other small reduction works were operated at about three-fifths capacity during the year. Ferrobamba was not operated.

Among the gold mines, the New Chuquitambo, in Cerro de Pasco, ran steadily, treating in October 1641 tons for a recovery of 10,150 grams. Andaray-Pasco, in the department of Arequipa, and Cotabambas, in Apurimac, operated throughout the year. The new mill at the Santa Domingo mine of the Inca Mining Co., in Puno, was completed, but the company did not operate all the year. Production from the gold placers was small; Aporoma washed about 68,000 cu.yd. during the early rainy season for a recovery of 7.8d. per cu.yd.; water shortage was again experienced, and about £11,000 was recommended to be spent on increased water supply. The Marañon River Placers, Inc., a subsidiary of the Peru Gold Placers, Inc., did drilling on its ground along the Marañon River; the company had a force engaged in completing a power ditch and in other work preparatory to the equipment of its property. There was some exploration in the North by the Peruvian Mining & Development Syndicate, Ltd., on the eastern slopes of the Andes, especially along the Chinchipi and Tabaconis rivers. An examination of the placers controlled by "Swiftwater Bill" Gates, in the department of Arequipa, was begun late in 1914 for an important American interest.

The old silver mines at Caylloma were operated, but it is understood that the production was less than in 1913. The tungsten mines in the vicinity of Huaura were worked in the early part of the year, but operations were suspended later on account of the market conditions. The borax mines in the southern part of the republic were also idle at the end of 1914. As heretofore, most of the coal used in Peru was mined by the Cerro de Pasco company at Quishuarcancha and Goyllarisquisga. The petroleum output was reduced toward the end of 1914, but the Standard Oil Co. increased its interests in the field on the northern coast of Peru; the International Petroleum Co., Ltd., was incorporated to accomplish the consolidation of the London & Pacific, the West Coast and the Lagunitos; the Standard interests also have a large holding in Negritos and in the Lobitos Co., the stockholders of which will be given an opportunity to join in the consolidation. Until late in the year, the Zorritos properties of Faustino G. Piaggio & Co. operated as usual; an engineer representing a Dutch petroleum interest examined these properties in 1914. Drilling was in progress on the Cardalitos land north of Payta.

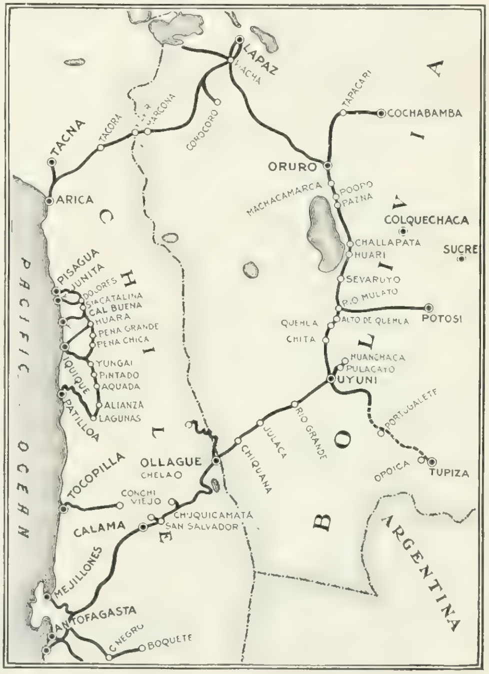
Bolivia

On account of the fall in price of the principal metals produced in Bolivia, 1914 was a poor year for most mining companies. Tin producers began restricting production when the price began declining in May and, after the war broke out, the large producers were also compelled to curtail; the tin situation in Bolivia will be dealt with at length in a subsequent issue. The copper producers, Corocoro United and Corocoro of Bolivia, also reduced their output, and silver production from Huanchaca, Potosi and Oruro was likewise restricted. The financial crisis released much labor and gave the gold mines a chance to go forward with their developments, notably the Olla de Oro, at Umabamba, and the Incaoro, at Pallaya, both of which increased their milling capacities.

Evidences of petroleum were discovered at Espejos Springs, near Santa Cruz, on the Eastern slope. The exports of Bolivian mineral products (concentrates or high-grade ore in most cases) through the ports of Antofagasta and Mejillones, for the first eight months of 1914, were reported by U. S. Consul O'Rear as follows: Tin, 26,021 metric tons; copper, 202; bismuth, 163.52; wolfram, 145.78; antimony, 120.77 metric tons. In 1913, 14,594 tons of tin *barrilla* were shipped.

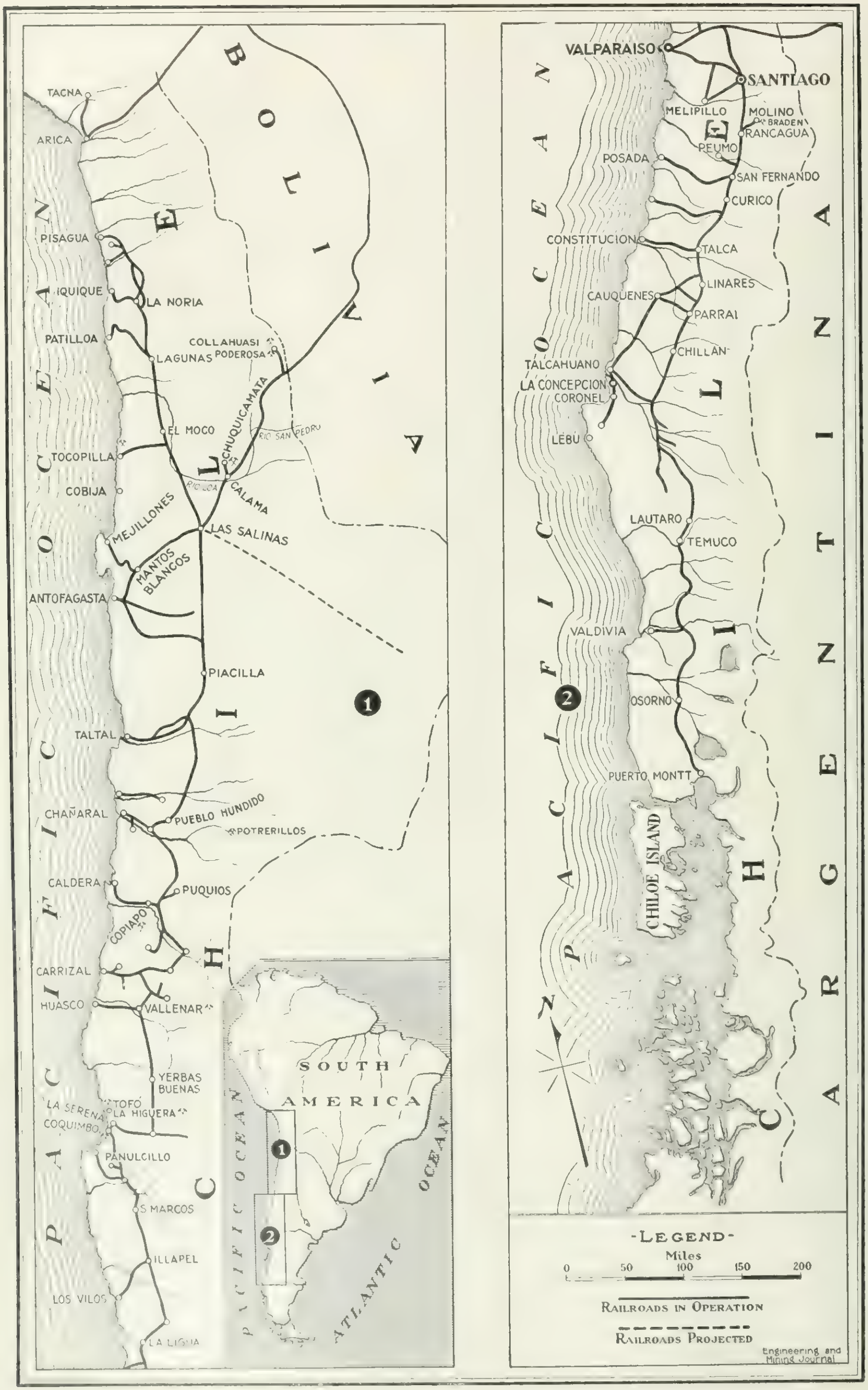
Chile

Chile, toward the close of the first six months of 1914, was reaching a prosperous condition, due to the increased nitrate and copper productions. The European situation changed matters to such an extent that the reduction of the country's income was of serious moment. The rate of nitrate production since Aug. 1, 1914, is approximately 50% of the first seven months' average. The province of Tarapaca suffered most severely; over one million tons of refined product is stated to be lying in the various nitrate ports. The only American nitrate company in the industry, the Dupont Nitrate Co., suffered no setbacks; its present production is at the rate of 600,000 quintals (46 kg.) per annum.



Bolivia and Northern Chile

At the three leading metal mines of Chile, the Chuquicamata and Braden copper mines and the Tofó iron mines, work was not abated on account of the war or the financial stress arising therefrom. Most of the smaller



The Mining Regions of Chile—Based on a Map Furnished by the Pan-American Union copper companies curtailed operations after August and some stopped completely. Exceptions to these were the Catemou, Naltagua, Chañaral and the Copiapo companies and the Central Chile Copper Co., at Panulcillo, where important improvements were made, outlying properties optioned and a new power plant erected; in the north, at Collahuasi, the Poderosa and the Société Francaise des Mines de Cuivre mined their high-grade ores; the French company erected a small experimental plant to concentrate the low-grade siliceous ore now on the dumps. The Braden Exploration Co. explored its Potrerillos group of copper claims, about 90 miles back from Chañaral, and also made preliminary examinations of two properties in the vicinity of Santiago.

The enterprise of the Chile Copper Co., at Chuquicamata, was prosecuted vigorously in 1914, between 2000 and 3000 Chileans being employed on the work besides 200 or 300 Americans and Europeans. The prostration of the nitrate industry, owing to the European war, threw many laborers out of employment and furnished the Chuquicamata mines with an abundant supply of labor, enabling construction work to go forward with such expedition that the operating officials at the end of 1914 estimated that the plant would be ready for operation about Mar. 31, 1915. The equipment for the power station at the port of Tocopilla and for the electric substation at the mill was made in Germany, and when the war broke out, a large part of this equipment was on board more than a dozen English and German steamships afloat in the Atlantic and Pacific Oceans, and part of it was still in Europe; fortunately, however, neutral ships were obtained and all of this material was gotten out of these steamships and out of Germany, and most of it is delivered. All of the equipment for the railway, the transmission line and the mine and some of the mill equipment was made in the United States and the installation of same was nearly completed. Officials of the company state that Chuquicamata is now the largest known deposit of copper in the world, and expect before long that it will be the largest and cheapest producer of copper in the world. The development of the mine by drills was continued in 1914 and the tonnage developed now exceeds 300,000,000; the exact amount reported by the company's engineers on Dec. 6, 1914, was 297,000,000 tons, averaging over 2% copper.

The Braden Copper Co. continued its operations, increasing its developed tonnage and improving its metallurgical treatment. At the end of December, 1913, Consulting Engineer Pope Yeatman reported 78,000,000 tons of 2.5% copper ore, classified as developed, probable and possible; the work of 1914 materially increased this tonnage. The company produced at the rate of about 2,400,000 lb. of copper per month. One of the features of the metallurgical improvement was the installation of the preliminary nodulizing kiln, of which three were shipped; the first kiln did good work and led the company to anticipate satisfactory results in preparing the flotation concentrates for treatment in the blast furnaces.

Exploration work by means of tunnels materially increased the ore reserve at Tofó iron mines, which are now being developed and operated by the Bethlehem-Chile Iron Mines Co. Tunnels in the ore at about 500 ft. below the top of South Hill disclosed the interesting fact that there had been no increase in the sulphur content of the ore at this depth. In 1914, about 63,000 tons of ore were shipped by means of the aërial tramway to Cruz Grande and thence by steamer to the United States and Europe, the latter ore being consigned to Europe to fulfill some contracts entered into by the precedent French company. An important feature of the 1914 work was the development of the water rights of the San Juan group of copper mines at La Higuera, from which a supply of 300,000 gal. per day is ultimately expected. Shipments in 1915 are expected to aggregate 200,000 tons. Tofó developments will be more fully presented in a subsequent issue. Some other important iron properties, especially the Pleito and Zapallo mines, were optioned in 1914, but owing to the extraordinary conditions prevailing, these negotiations came to naught.

East Coast Activities

In the Argentine Republic, the mining industry was not especially active in 1914. The established mines, such as tungsten, borate, tin, etc., operated about as usual, although the principal copper mine, the Famatina, is understood to have been idle. There was not much activity in oil drilling following the recommendation for nationalization of the Comodoro Rivadavia fields by Engineer Platz, who submitted an exhaustive report.

In Uruguay, the geological survey was continued under Dr. M. A. Lamme. The only active mining property was that of the Uruguay Consolidated Gold Mines, at Corrales, in the department of Rivera; this company was reconstructed, having gone into liquidation late in 1913.

The most active mining properties in Brazil in 1914 were, as usual, its two important gold mines, the St. John del Rey and the Ouro Preto. These gold properties were benefited by the surplus of labor released from construction work after the war, and the fall in exchange more than counterbalanced any increase in shipping expenses. The St. John del Rey crushed at the rate of about 200,000 tons for the year, the first half having averaged 95,000 tons, yielding 47s. 5½d. per ton. The most interesting work in the mine was the sinking of the "G" shaft to horizon 20, i.e., 600 ft. below the lowest working level. The Ouro Preto company, owing to having encountered a poor zone in 1913, had to be reconstructed in 1914, and plans were made to mill on a larger scale, gradually increasing to 10,000 tons per month. The August crushing was 6900 tons, yielding 2591 oz. The cyaniding costs at both of these mines are unusually low. Some investigations were made in the Turyassu gold region and an American exploring party was engaged along the Rio Tocantins.

In the Guianas mining was active and the gold production probably exceeded that of 1913. Late in that year the dredging fleet received an addition in the Mataroni dredge on the Rivière Approague; in Dutch Guiana, the Guiana-Callao Gold Mining Co. increased its mining rights to cover an area of 5000 acres, and made plans for increasing its milling equipment; in British Guiana the gold and diamond shipments in the first half of the year exceeded those of 1913, but the diamond production declined after August.

Venezuela

The South American Copper Syndicate, operating the Aroa group of mines, started its new smelting plant in the spring of 1914, but the preliminary difficulties incident to starting the new works, carried the company operations into the period affected by the war and the year was not a prosperous one, as production was then reduced to a minimum. Besides the old Aroa mine, the company was preparing to stope ore in the Aroa North and the Titiara mines. In the latter half of the year, mining was restricted to a production just sufficient to pay for the operations. The Cumaragua company of Caracas continued the exploration of its group of mines in the Aroa district, power drills having been installed; the old copper mines at Buria, near Nirgua, were also under development. El Amparo mine, of the Rio del Oro Co., Ltd., 12 miles east of Guasipata, in the State of Yuruary, increased its production in the latter part of 1914. The October cleanup was 863 oz. and in November, 628 oz. Good ore was encountered on the No. 2 level in November. Drilling for petroleum was continued by several companies. A new mining code was promulgated in August and, by an executive decree of Sept. 19, deposits of coal, petroleum and asphalt were made inalienable.

Borax and Borates

Borax production in California during 1914 was less affected by the war conditions than any of the other minerals. The mining of borate ores went steadily forward with little check, even in the latter months of the year, both at the mines of the Sterling Borax Co., at Lang, Calif., and at the mines in Death Valley of the Pacific Coast Borax Co., the two important American producers. In fact, there was considerable construction work done at the Death Valley mines. A new branch of the Tonopah & Tidewater Ry., which is controlled by the Borax Co., about 20 miles long through a rough country, was built to its Biddy McCarthy and Monte Blanco deposits. This represented approximately an expenditure of $400,000 and opens up some of the finest deposits in the Death Valley section, which hitherto had not been accessible on account of poor transportration. The Pacific Coast Borax Co. also built during the year a large calcining plant at Death Valley Junction, on the T. & T. road, to roast the low-grade ores before shipment to its refineries.

No new borax mines were developed during the year and the refining of borate ores into borax and boracic acid is confined to the plants at Bayonne, N. J., Brooklyn, N. Y., New Brighton, Penn., and Chicago, Ill., with the exception of a small amount of refining which is done at San Francisco for the Pacific Coast and Japanese trade.

The war in Europe has temporarily interfered with the European business, which is controlled almost entirely by Borax Consolidated, at London. This company, in addition to its English and French refineries, has refineries in Austria and supplies all the German refineries with their borate ore from Chile.

With Turkey also precipitated into the conflict, this temporarily ties up the mines on the Sea of Marmora, controlled by the English company, which have been an important source of supply for the French and Austrian refiners for many years, as they were worked before the South American deposits had been developed. The dislocation of foreign business conditions has resulted in considerable export of both refined borax and boracic acid from this country, particularly into Canada, which formerly was supplied from England. Without going into figures it is safe to say that the stimulus of the export business has more than offset the falling off of business in this country and production of borate ores for 1914 was fully up to the 1913 output.

The A. S. & R. Co. in Mexico in 1914

By S. W. Eccles*

The operation of the mines in Mexico belonging to the American Smelting & Refining Co. has been considerably interfered with in 1914. At the time of the landing of the American troops at Vera Cruz, all operations were suspended temporarily, but as soon as it was apparent that no crisis was to be precipitated, operations were resumed at several of the properties. Interruptions to traffic, particularly on the branch lines of the Mexican Ry., made it difficult to obtain the necessary supplies and to move the ore produced to the smelter. During the year none of the plants suffered any damage because of the Mexican revolutionary troubles. All Mexican factions have respected the property rights and the rights of all foreign employees. At the different properties most of the foreign employees have been retained, as well as the nucleus of the Mexican laboring force.

At Santa Eulalia the mines are producing almost a normal tonnage, making daily shipments to the Chihuahua smeltery. At Santa Barbara preparations are being completed to resume mining and milling.

From Sierra Mojada shipments are being made to the smeltery at Chihuahua. The Velardeña mines are working and shipping continuously to the smeltery at Asarco. Work has recently been resumed at the mines at Angangueo and Tepezala. From other properties at Charcas. Bonanza and Cuatro Cienegas, some shipments are being made.

It is believed that operating conditions will soon become normal in Mexico, and if so the properties should resume operations with a very large output of profitable ore in the near future.

Opening of the Alaska Coal Lands

On New Year's Eve Secretary Lane, according to an announcement by the Department of the Interior, signed the regulations by which the coal lands in Alaska, outside of the Bering River and Matanuska fields, are opened in 10-acre tracts to the people of Alaska. The regulations are simple, calling for nothing excepting the staking of the ground and application to the local receiver for the use of it, which is to be granted for two years. The Government makes no charge.

Western Australia 1913 Mineral Production

The mineral output of Western Australia in 1913 consisted of the following items, arranged in order of descending value: Gold, 1,314,043 oz. (£5,581,701); coal, 313,818 long tons; copper ingot, matte and ore, 1321; tin ingot and ore, 481; lead ore, 3169 long tons; silver, 188,020 fine oz. (£23,420); pyrites, 10,216 long tons; all else, approximately £215.

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Mining in the Transvaal in 1914

By H. F. Marriott*

At the end of 1913 the outlook for the mines of the Rand for the succeeding year was better than ever before in the annals of the industry. The hard work put into details of organization, and the improvements in methods of mining and lay-out of development during the previous few years, had slowly but surely rendered the mines more capable of regular output which could be fairly closely estimated for several years ahead. But 1914 was scarcely begun when a change in the aspect of affairs took place. In January a strike of railway employees occurred and threatened to spread to other industries and involve the whole country in a revolutionary agitation. Profiting by their experience of the previous year the government immediately handled the situation with such energy and firmness that the revolutionary movement was quickly and effectively suppressed. The majority of the mining population proved its desire to be law-abiding by remaining at work once it was assured of adequate protection. The defection of a certain number of employees was not sufficient to do more than cause a short diminution of output, and the value of firm government was shown by the industrial peace which obtained during the remainder of the year.

TABLE I. TRANSVAAL GOLD PRODUCTION

Witwatersrand District

Year	Tons Milled	Value	Value per Ton Milled, Shillings	Outside Mines, Value	Total Value for Transvaal
1884-89	1,000,000	£2,440,000	48 8	£238,231	£2,678,231
1890.	730,000	1,735,491	47 4	134,154	1,869,645
1891.	1,154,144	2,556,328	44 2	367,977	2,924,305
1892	1,979,354	4,297,610	43 3	243,461	4,541,071
1893.	2,203,704	5,187,206	47 0	293,292	5,480,498
1894.	2,830,885	6,963,100	49 2	704,052	7,667,152
1895	3,456,575	7,840,770	45 2	728,776	8,569,555
1896	4,011,697	7,864,341	39 2	739,480	8,603,821
1897	5,325,355	10,583,616	39 7	1,070,109	11,653,725
1898	7,331,446	15,141,376	41 3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48 8	661,220	15,728,693
1900	459,018	1,510,131	65 8		1,510,131
1901.	412,006	1,014,687	49 2	81,364	1,096,151
1902	3,416,813	7,179,074	42 0	74,591	7,253,665
1903	6,105,016	12,146,307	39 8	442,941	12,589,248
1904	8,058,295	15,539,219	38 5	515,590	16,054,809
1905	11,160,422	19,991,658	35 8	810,416	20 802,074
1906	13,571,554	23,615,400	34 8	964,587	24,579,987
1907.	15,523,229	26,421,837	34 0	981,901	27,403,738
1908.......	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909.......	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910.	21,432,541	30,703,912	28 5	1,297,823	32,001,735
1911.	23,888,258	33,543,479	28 1	1,498,006	35,041,485
1912	25,486,361	37,182,796	29 2	1,574,765	38,757,560
1913.	25,628,432	35,812,605	27 8	1,545,435	37,358,040
1914 (est.)	25,873,176	34,151,183	26 4	1,444,731	35,595,914

From Table I it will be seen that the estimates for the year show a slight increase in the tonnage milled but a decrease in the output of gold from that of the previous year. The drop in yield per ton milled was doubtless in part attributable to the fact that during the disturbed period development had to give place to the effort to sustain the tonnage output, and therefore lower-grade stopes were called on to supply more than their previous quota to the mills.

No company suspended operations during the year. The Cinderella Consolidated and the Jupiter, which ceased milling in 1913, did not recommence production. The new producers were in the Eastern Rand district, and will, therefore, be referred to in detail in the section dealing with that part of the Witwatersrand.

Only one company amalgamation took place during the year. It was agreed to raise the capital of the New Kleinfontein Co., Ltd., by 181,540 new £1 shares, and that that company should take over the entire concern of the Benoni Consolidated Gold Mines, Ltd., and the gold section of the Apex Mines, Ltd. Proposals for the absorption of the Robinson Gold Mining Co., Ltd., by the Crown Mines, Ltd., were brought forward but were not carried through.

In contradistinction to this period of inactivity in rearrangement of working units, however, a policy of control of much wider significance was brought to light and widely discussed. The scheme brought forward involved nothing less than the amalgamation or unification of the whole of the Rand. The matter was the subject of comment in both government and business circles, and came before the Dominions Royal Commission during its visit to the country. But there the matter has for the time being ended.

Several undertakings in the Eastern Rand progressed satisfactorily. The Van Ryn Deep declared its second dividend in June, the amount being 2s. 6d. per share as against 1s. 6d. per share declared at the end of 1913. At the end of October the Government Gold Mining Areas commenced production. Fifty stamps were first dropped, the remaining 50 being brought gradually into operation. The battery of the Modderfontein Deep Levels will be at work in 1915. The seven-compartment shaft of the Daggafontein Gold Mining Co. intersected the reef during the year at a depth of 3580 ft. and was stopped when it reached 3618 ft. in depth. The assay results obtained from the shaft were higher than those afforded by the bore-holes. At the Springs Mines the proportion of profitable development for the second quarter of the year was given as 51%, and the profitable development at the Brakpan Mines was declared as increased to 48% during the first half of the year. Development at the Geduld Proprietary Mines gave satisfactory results. During the quarter ended Mar. 31, samples taken over 1245 ft. gave 35.7s. over 35.2 in., and for the quarter ended June 30 the results over 1375 ft. of development were 30.2s. over 38.4 inches.

In technical matters, while no great departure was made from the usual methods, improvements and progress of a minor character were recorded.

Of the various circular shafts in course of equipment that of the Crown Mines attained the greatest rate of progress. At the end of September the shaft was stopped, for the time being, at a total depth of 2505 ft., or 69 ft. below the 16th-level station. The average rate of sinking was about 156 ft. per month, and the average cost, exclusive of surface equipment, £16 2s. 11d. a foot. Mechanical shoveling machines were introduced on the Rand during the year. At the Crown Mines, in a drift 12x10 ft., 10 carloads of two tons each were removed in 3½ hours.

The Whiting hoists at the Turf Mines shaft of the Village Deep, Ltd., gave trouble at the greater depths to which they were called on to work owing to the internal strain set up in the engines by the rope coils on the reels. Their replacement by drum engines was considered, but in the meantime it was ascertained that by substituting electric power for steam and by using only one coil round the reels instead of three, the efficiency of the engines was largely increased, and they were thereafter able to cope satisfactorily with the work required to be done.

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The value of the method of supporting the ground above the worked-out areas by sandfilling the old stopes was again demonstrated in no uncertain fashion. A movement of ground occurred in the Village Main Reef which temporarily disabled the main hoisting shaft and there is no doubt that, had the mine not been protected to a considerable extent by sandfilled areas, the safety of the present workings would have been seriously jeopardized.

The further equipment of the Modderfontein B. Gold Mines included a battery of 16 Nissen stamps. Previously, four Nissen stamps had been at work at the City Deep and this new installation was the first material outcome of the results thus obtained on the Witwatersrand.

A feature of interest in the proposed new equipment for the New Modderfontein was the reversion to single-treatment tanks in the cyanide plant design, separate collecting tanks being done away with. This was considered advisable owing to the good classification of sands and slimes now capable of attainment by means of cone classifiers.

A method of overcoming the dust evil occasioned by the great tailings dumps was successfully applied in several instances during the year. Common salt is added to the slimes solution and the mixture sprayed over the surface of the dumps. The hygroscopic action of the salt keeps the coating sufficiently damp to prevent the sand from drifting.

TABLE II. STAMPS AND TUBE MILLS

	Stamps at Work	Tube Mills at Work	Duty per Stamp per Day
1909 December	9250	148	6.8
1910 December	9150	184	7.2
1911 December	9565	244	7.9
1912 December	9440	277	8.4
1913 December	9170	278	8.7
1914 September	9296	283	8.9

An important water-supply scheme was sanctioned by the Union Parliament during the year. The Rand Water Board was empowered to borrow up to £1,250,000 for the purpose of constructing an impounding reservoir and barrage across the Vaal River, and to recover contributions from the beneficiaries, the liability of the mines being 46¼% of the cost. The supply of water for the Rand from this source is estimated at 10 to 20 million gallons daily.

TABLE III. LABOR EMPLOYED IN TRANSVAAL GOLD MINES

		Whites	Natives	Native Death Rate per 1000
1910		25,376	191,784	35.72
1911		25,108	194,286	31.01
1912		24,334	206,121	28.83
1913		22,797	162,181	26.61
1914	Jan.	20,715	166,817	
	Mar.	21,768	177,112	
	May	22,086	181,416	
	July	22,324	182,469	
	Sept	22,088	183,911	12 mos. end. Sept. 19.32

Interest during the year centered largely in the reports of several commissions. The first to appear was that of the Sunday Observance Commission, published in February. It recommended, amongst other things, that milling on Sunday should cease within a period of three years.

The eagerly awaited report of the Economic Commission appeared in March. Closely affecting mining were the recommendations to widen the field of employment for workers other than whites, to substitute the system of day's-pay-cum-bonus in place of the contract system, the working of three shifts or the introduction of longer intervals when working two shifts, and the recognition of the principle of one day's rest in seven.

The Dominions Royal Commission conducted the South African part of its inquiry during the year under review. Its third interim report, dealing with the trade of that country, was issued in London in July. Special interest attaches to it on account of the information it contains about the undeveloped areas and the so called "life" of the Rand. With regard to the mining industry, it made recommendations respecting skilled white labor, the recruiting and scope of native labor, and the relation of the Government to the industry.

The report of the Select Committee on the Miners' Phthisis Act, issued in June, recommended a large increase in the compensation to be paid to Class A sufferers, the provision of a fund for helping the widows of victims, and the widening of the sphere of usefulness of the Phthisis Board.

The report of Surgeon-General Gorgas, made on behalf of the mines, concerning sanitary conditions on the Witwatersrand, appeared at the end of March. It recommended an increase of floor space to about 50 sq.ft. per individual by means of the village-hut system, with the introduction of families, a central hospital for sick natives, and the establishment of a central sanitary bureau.

The abolition of the "color bar," i.e., the limitations imposed upon the usefulness of the colored worker, was widely advocated, but no legislation to that end has yet been passed.

In August, on the outbreak of the present war, the Witwatersrand gold-mining industry was faced with the problem of realization on the gold produced and the obtaining of supplies. With regard to the first, arrangements were concluded whereby a continuance of delivery of the bullion to the Bank of England is assured. With regard to the second, it was agreed between the majority of the groups to pool supplies other than the stocks actually on the mines on Aug. 4. The South African Mining Groups Buying Committee was formed to arrange for the continuance of supplies of the chief imports required for use by the mining industry, and succeeded satisfactorily in so doing. It may be of interest to state that the value of the stores consumed by the mines of the Witwatersrand in 1913 amounted to £10,128,800.

DIAMONDS AND BASE METALS

The output of diamonds was stopped on account of the war, the De Beers and Premier companies closing down their mines on Aug. 7.

TABLE IV. DIAMOND OUTPUT

	Carats	Gross Receipts Total	Gross Receipts per Carat
1910	2,090,068	£1,317,715	12.6s.
1911	1,843,341	1,628,876	17 7
1912	2,131,406	2,386,979	22.4
1913	2,156,897	2,726,663	25.3
1914 (Jan.-June)	895,570	860,126	19.2

The continued fall in the selling price of tin during the year brought about a restriction of operations and a diminution of output from several of the Transvaal tin fields. The shipping ore produced during the eight months ending Aug. 31, 1914, however, was 2715 tons as against 2217 tons for the corresponding period in 1913.

There was a large expansion in the output of copper, 9593 tons of shipping ore being produced during the first eight months of the year. The production for the whole of the previous year was only 5755 tons. The Messina Copper Co. was still practically the only producer of the metal in the Transvaal, and the development during the year was stated to continue to open up large quantities of high-grade ore.

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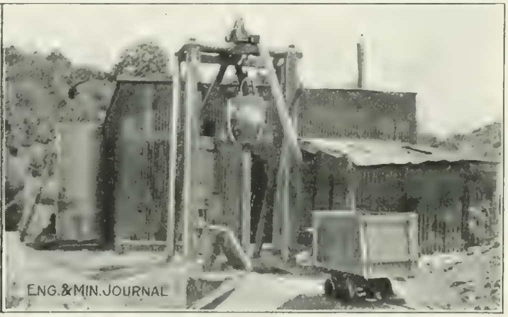
The Pinos Altos District, New Mexico

By Ira L. Wright*

SYNOPSIS—One of the old mining districts of New Mexico, in which a sharp revival occurred in 1914, owing to the opening of some high-grade gold veins. Gold was discovered in 1860, in placer deposits, and veins found soon afterward, but the ores generally are complex and may contain gold, silver, copper, lead or zinc, or combination of these metals. Metallurgy is difficult, and the future of the district depends on finding a satisfactory process.

Pinos Altos is one of the oldest mining districts in the state of New Mexico, and in times past has been the scene of great activity. In recent years the camp, while not completely abandoned, has gradually declined. The discovery of pockets of high-grade gold ore in the last year has caused a renewal of interest in the district, which has produced a total of about $5,000,000 and still has possibilities. The district is in the eastern part of the Pinos Altos Mountains, in northeastern Grant County, New Mexico. It is nine miles northeast and a thousand feet above Silver City, the shipping point for its ores. A good wagon road connects the two places.

Mammoth Tailings Mill, Pinos Altos, N. M.



Bell & Wright Shaft on Pacific No. 2 Claim

Gold Discovery in 1860

Placer gold is said to have been discovered here in 1860 by a man named Birch and the camp was called Birchville. The next year the first lode was discovered. It is still worked, now known as the Pacific vein. Other veins were soon found and opened. Within two years 30 lode mines were in operation and 300 men employed. At this time the mining was done principally for "chispas," or nuggets, obtained in the surface quartz. In 1862, depredations of the Indians, and the Civil War excitement, caused the camp to be abandoned by Americans. The Mexicans remaining renamed the place Pinos Altos. After the war, operations were resumed and the work carried on successfully for some years, the ore being treated in a 15-stamp mill. In 1869, the surface ores became exhausted and the Pinos Altos Gold Mining Co., which was carrying on most of the work, suspended operations. A little mining continued to be done, but nothing of importance was accomplished until 1883, when an amalgamating and concentrating mill, the first in the territory, was erected. Due to incompetent management the mill was a failure at first, but in 1885 Bell & Stevens assumed control and made a decided success of the venture. In 1896, the Hearst estate, of San Francisco, entered the camp and operated actively for some time, finally selling to the Comanche Mining & Smelting Co., in 1903, the mining property together with the concentrating and smelting plant at Silver City which they had built mainly for the purpose of treating Pinos Altos ores. In 1907, the Comanche Mining & Smelting Co. failed and mines and smelter were closed. Shortly after, the Comanche was consolidated with the Copper Gulf Development Co. into the Savanna Copper Co., which still owns all property held by the Comanche. At present the Pinos Altos holdings of the Savanna Co. are under lease to I. J. Stauber and I. L. Wright.

Varied Geology of the District

The west side of the Pinos Altos Mountains is made up principally of quartzite, limestone and sandstone, while the crest and eastern slope consist of igneous rocks of which granodiorite, diorite and diorite porphyry are most prominent. These have penetrated the sedimentary, Paleozoic rocks on the west and have so tilted them that the sediments in general have a strike ranging from north-northeast to north-northwest, and dip at varying angles to the west. Local variations of both strike and dip are found and are commonly related to smaller injected portions of the principal intrusive rocks. Because of the proximity of the large bodies of zinc ore to these smaller intrusions it is believed that the injections have had a direct bearing on the formation of the ore, although the limestone has not been extensively altered. Neither the absolute nor relative age of the three types of igneous rocks is known. However, all three are covered to the north of Pinos Altos by a Tertiary volcanic flow of rhyolite or dacite, locally called malpais. The fissure veins in the igneous rocks have a nearly north and south strike. In the western portion of this part of the district they dip to the west at an angle of about 70° from the horizontal and in the eastern portion about the same to the east. The distance between the walls of the veins varies from a few inches to 10 or 12 ft., the ore being nearly always accompanied by gouge. Cross faulting has occurred in several places in the camp, some veins being displaced by as much as 40 ft. In places I have seen, this faulting has had a distinctly enriching effect on the ore

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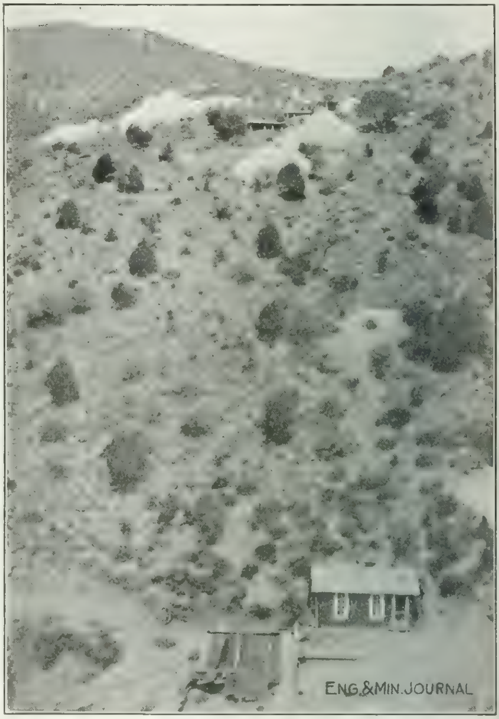
*Mining engineer, Pinos Altos, N. M.

Mineralogy of Deposits

The mineral deposits fall into two classes: fissure veins in the intrusive rocks, and replacement lodes or pockets in the limestone. The two classes show more points of resemblance than of difference, the chief distinction being that the intrusive rocks carry higher values in gold and silver and more lead. The veins as a group are characterized by a decided similarity in their mineral content. In all of them are found quartz, pyrite, chalcopyrite and calcite. Most of them contain in addition sphalerite and galena and in some of them barite and rhodochrosite are present. Gold and silver exist in all. The replacement deposits are for the most part on the west side of the district. They are made up of black jack, pyrite and chalcopyrite, carrying small quantities of gold and silver. The average assay is about 18% Zn, 1.3% Cu, 3 oz. Ag and 0.03 oz. Au. Much carbonate of lead carrying some gold and silver is found at or near the surface.

The larger part of this west portion of the district is held in two groups. One is owned by the Empire Zinc Co., which now has a large tonnage of ore blocked out and is still developing. It will shortly erect a plant for the treatment of this complex ore. The other group is owned by C. Amory Stevens, of New York. Some development has been done, but the property is now idle. The fissure veins in the eastern portion of the district are held under a great many locations and patented claims, the Savanna Copper Co. being the largest single owner. Among the more prominent veins are the Tampico, the Pacific, the Arizona, the Mountain Key, the Mina Grande, the Golden Giant and the Atlantic. The Tampico, owned by Savanna Copper Co., has not been extensively worked but assay records show values of about $20 in gold and silver, with varying percentages of copper, lead and zinc. The average width is about 12 in. The Pacific vein is the longest and widest in the district, having been worked at various places for at least a mile, and its width varying from a few inches to as much as 10 ft. So many grades of ore have been mined from it that it is impracticable to give an average value. However, throughout its length the ore is of the same complex character as are all other ores in the region.

The principal mines on the vein are the Silver Hill, owned by Silver City men; the Langston, owned by the C. & O. Mining & Milling Co.; the Pacific No. 2 and the Hearst, owned by the Savanna Copper Co.; and the Aztec, owned by St. Louis men. The total production of these mines has been upward of $2,000,000. All of them are now working. The Gillett, a spur of the vein, was worked by the Hearst estate to a depth of 900 ft., producing high-grade gold ore to that depth. Although the vein was somewhat smaller there the same character of ore persisted. Bell & Wright, operating the Pacific No. 2 mine on the Pacific Vein, encountered high-grade gold ore along a fault, and in three months of this year, took out 1835 lb. of ore which netted $21.56 per lb., besides making regular shipments to the El Paso smeltery of ore which netted from $20 to $100 per ton. This fault occurs in the south end of the Pacific No. 2 claim which joins the north end of the C. & O. Mining & Milling Co.'s property. John Oglesby, who owns an interest in this company, sank a shaft at their northern boundary and encountered extremely high-grade gold ore a few feet away from his shaft at a depth of 200 ft. It is understood that about 1500 lb. of this ore has been extracted



Hillside above Livingston Shaft. Oglesby and Bell & Wright Shafts in Background to date. A. C. Bettis, who is operating the Silver Hill mine under lease, has also reported a strike of high-grade ore. George Brown, operating the Aztec mine, has been making regular shipments of heavy sulphide ore carrying from $25 to $30 in gold, silver and copper. The Arizona has been worked at various places for a distance of about 1500 ft. There are two veins in the mine, the width of the larger being from 10 in. to 2 ft., and the value of the ore about $20 in gold, silver and copper. The smaller vein carries from 2 to 5 oz. gold and varies from 4 to 6 in. in width. It lies near enough the larger one to be worked in the same stope in most places.

The Mountain Key has been worked to a depth of 700 ft. and has produced about $500,000. A shoot of ore on the 500-ft. level carried a great deal of free gold. The Mina Grande vein has been worked for fully 3000 ft. The ores are extremely variable in different shoots, some being high in gold with little or no zinc sulphide present and others being almost pure rosin blende. The width is from 1 to 3 ft. The Mina Grande and Mogul claims on the south end of the vein are owned by the Savanna Copper Co., while the Kept Woman mine, located on the north end of the vein, is owned by Peterson and Esplin and is now being operated by them. The Atlantic vein has been worked to a depth of 700 ft. At one time, an amalgamating and concentrating mill was operating on the property. The ore plated about $15 per ton. The sulphide consists largely of black jack, the zinc contents averaging 15% or more. The Savanna Copper Co. holds the Atlantic, the Deep Down and the Anna claims on this fissure. The Golden Giant vein is about 10 in. wide. Considerable ore running $40 per ton in gold has been mined from this vein. A company composed of Oklahoma men is planning to open it in the near future and treat the ore in their mill situated on the Mammoth property, a short distance away. They will start their mill at present on a pile of old tailings which is said to be rich enough for treatment. Besides the veins mentioned there are numerous smaller ones ranging in width from 4 to 12 in., all of them carrying the same complex ore. There are reports of rich pockets of gold having been taken out of almost every one.

To the northwest of the area traversed by these veins which carry complex ore lies a zone of fissure veins of high-grade copper ore containing silver. Up to the present time, no veins large enough to be worked by other than small leasing operations have been discovered. To the southeast of the area of these same complex-ored veins lies the Silver Cell mine owned by the Dimmick Bros., of Pinos Altos. It has produced something over $100,000. The ore occurs in the fissure veins and occasional pockets of extremely rich native silver are encountered. The property is now being operated by Silver City men.

Although the recent strikes of gold ore have attracted the most attention, as is usually the case, the future of the camp undoubtedly lies in the successful treatment of the complex ores. At present the ore mined from the fissure veins is being hand-sorted for shipment to the copper smelters, the operators aiming to eliminate as much barren quartz and zinc as possible. From this sorting occasional cars of zinc ore which average 45% are obtained. Most of the zinc from the fissure veins is of the rosin variety and contains no gold or silver. When black zinc does occur it usually carries gold and silver. Notwithstanding close sorting, the separated ore which is shipped to the smelters usually contains from 5 to 15% zinc. This is, of course, worse than wasted since it occasions a loss from unnecessary freight and smelter charges. From 3 to 10% of lead is also contained in the ore and from this mineral the shipper receives no returns. Practical tests that have been made of the ore show that it is readily amenable to treatment by the Huff electrostatic separator or a magnetic process. A recent test made by the American Zinc Ore Separator Co., of Denver, using a Plumb pneumatic jig and a Wilfley table for concentrating and the Huff machine for separating zinc from copper and iron in the concentrator, gave a recovery of more than 70%. The crude ore and concentrates assayed as follows:

SEPARATION TEST ON PINOS ALTOS ORE

	Au	Ag	Cu	Pb	Zn	Fe
Crude Ore	0.12	16.54	3.52	8.05	12.70	10.70
Lead Concentrates	0.25	35.80	0.39	75.00	1.50	3.73
Iron-Copper Concentrates	0.32	43.88	15.10	5.84	5.70	24.40
Zinc	0.06	7.50	....	.....	58.10	.....

Another test made by Messrs. A. R. & C. R. Wilfley, of Denver, gave practically as good results by first roasting the crude ore, then subjecting the roasted product to the Wetherill magnetic machine and finally treating the tailings on a Wilfley table. These tests have made it quite evident that if better milling facilities were at hand the profit from Pinos Altos ores would be considerably greater than is now the case and the possibilities of the district would be widened.

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Technical Changes at Miami in 1914

By J. Parke Channing*

The most important improvement in mining work during the year was the installation of artificial ventilation by means of a pressure fan of about 70,000 cu.ft. capacity. This was installed and put in operation the first of June, and an immediate improvement in working conditions took place. This was reflected in the increased efficiency obtained from the working force, with a consequent reduction in cost. Previous to this so large an amount of compressed air was used for ventilation that compressed-air hoisting had to be suspended, but the installation of the fan reduced the amount of compressed air required to such an extent that hoisting was again resumed with air, doing away with the necessity of operating the boiler plant at the main shaft.

Mine-rescue and safety-first work were given considerable attention during the year, and a crew of men was trained in oxygen-helmet work and a large number in first-aid. The additional attention given to this feature of the work has resulted in a considerable reduction in the number of accidents during the year.

For the concentrator, plans were completed, based on experiments made in previous years, for increasing the efficiency of the process, largely by finer grinding and additional table treatment. Section 6 was remodeled and operated on this plan with the result anticipated, and work on the balance of the mill is at present under way. When remodeling of the plant is complete, the capacity will be increased to about 1200 tons per day.

The modifications in each section are based on the assumption that its normal capacity will be increased to 700 tons, with as high an extraction as is possible with the present advancement in the art. The storage in the upper part of the mill will be increased by filling in the space between the six cylindrical bins, thus making one large bin the whole length of the mill. The intermediate rolls and the Hardinge mills will not be changed. A certain number of the sand tables will be double-decked, and a large reject from these tables will be reground in an 8-ft. Hardinge mill, the same being provided with an extra-long cylinder. The product from this Hardinge mill will be elevated by two elevators and run into two five-spigot classifiers. This product will run to two 8-ft. Callow cone tanks, the lower discharge being treated on regular slime tables. The overflow will be settled in Dorr tanks, two to each section, 46 ft. in diameter and 10 ft. deep, and the product from these treated in suitable machines. This will necessitate the installation of elevators for this slime material in the lower part of the mill. The only radical change in the layout of the mill will be as above noted, the use of 16-in. belt elevators on the sand floor and 24-in. belt elevators on the slime floor.

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Canadian Klondyke Mining Co.

The Canadian Klondyke Mining Co. operated its fleet of four bucket-elevator dredges in the Bonanza Basin, near Dawson, Yukon Territory, for about nine months of 1914. No. 1 dredge has 7½-cu.ft. buckets, while the other three dredges have 16-cu.ft. buckets, though one of these has been increased to 17 cu.ft. by adding a few inches to the lip of the bucket. The dredging began on Mar. 28, and the first cleanup was on Apr. 4. All four dredges were operating at full capacity by about May 15, and the yields up to the middle of July were highly satisfactory, usually averaging over 3000 oz. per week. In the latter part of July a break in the power ditch caused an interruption to dredging, and another interruption occurred on Oct. 10, when dredge No. 2 sank, and was out of commission for the rest of the season; raising of the dredge was begun in December. Early in November there was another break in the power supply, due to ice, and dredge No. 1 was cleaned up for the season on Nov. 17. Dredges Nos. 3 and 4 were put in operation again at this time. No. 3 was shut down on Dec. 4, while dredge No. 4 operated until late in December. The season's cleanup to Dec. 12 was 66,189 ounces.

Some work was done in 1914 on the properties of the Canadian Klondyke's sister company, the North West Corporation, in the Indian River section; this included the stripping of overburden and the acquisition of further claims to round out the property. Up to this date the earnings of the Canadian Klondyke have been applied to meet the interest on the bonds of the North West Corporation; to provide a preliminary plant to start gold production, a further £50,000 to £100,000 is required.

Yukon Gold Company

The Yukon Gold Co. is operating eight gold dredges at Dawson in the Klondike district of Yukon Territory, one in the Iditarod district of Alaska, and three in California. In addition to the dredging operation, the company operates a group of hydraulic mines at Dawson, which are supplied by water from the Twelve Mile River and tributaries. The company also operates its own hydroelectric plant, which furnishes power for its Dawson operations. During the operating season which closed Oct. 23, the Dawson dredges produced $2,599,000, and the hydraulic mines produced $544,000, making a total for the Dawson operations of $3,143,000. The dredge at Iditarod operated to Nov. 11 and produced a total of $734,000 for the season. The Pacific Gold Dredging Co., the California subsidiary, produced $255,000 to Dec. 1. This company recently purchased a portion of the Drexler estate on Butte Creek near Chico, and has completed the equipment of the property with a 6-ft., close-connected, California-type dredge.

Illinois Oil in 1914

By Raymond S. Blatchley*

The sharp decline in the oil production of Illinois in 1912 and 1913 was notably checked during 1914. This condition may be considered as a settling to steady production with a very gradual decline, unless newly discovered pools reverse the situation. The estimated production for the year is 21,500,000 bbl., as against 23,893,899 bbl.[1] in 1913 and 28,601,308 bbl. in 1912. The following table covers the annual production from 1905 to 1914:

ILLINOIS OIL PRODUCTION, 1905-1914[2]

Year	Bbl.	Value
Previous	6,576	$26,592
1905	181,084	116,561
1906	4,379,050	3,274,818
1907	24,281,973	16,432,947
1908	33,686,238	22,649,561
1909	30,898,339	19,788,864
1910	33,143,262	19,669,383
1911	31,317,038	19,734,339
1912	28,601,308	24,332,605
1913	23,893,899	30,971,910
1914	21,500,000	23,800,000
Total	230,888,767	$180,797,580

The production for 1914 was estimated by adding the pipe-line runs of the Ohio Oil Co. and the Tidewater Pipeline Co., assuming that the December runs were equivalent to those of November and reckoning the tank-car shipments at about 3,000,000 bbl., as against 2,820,348 bbl. for 1913, according to Day. The tank-car shipments were made from Lawrenceville, Flat Rock, Bridgeport, Stoy, Robinson, Bakers Lane, Sandoval, Sparta, Carlyle, Plymouth and Casey. The following table gives the pipe-line runs and stocks of the Ohio Oil Co., and the runs of the Tidewater Pipeline Co., by months, according to the *Oil City Derrick*:

ILLINOIS OIL PRODUCTION FOR 1914

Month	Runs, Bbl.		Stocks, Bbl.
	Ohio Oil Co.	Tidewater Pipeline Co.	Ohio Oil Co.
January	1,476,394.28	136,011.37	5,918,686
February	1,195,597.81	115,582.96	5,784,015
March	1,528,837.55	135,560.74	6,223,031
April	1,390,452.32	126,602.14	7,150,198
May	1,504,391.51	135,527.72	7,786,331
June	1,479,989.35	130,366.68	8,478,977
July	1,470,290.98	107,896.22	9,007,231
August	1,440,384.54	89,411.73	10,533,486
September	1,413,095.46	101,512.23	11,281,404
October	1,415,361.03	94,421.01	11,880,143
November	1,302,338.67	88,773.80	12,066,758

The above table shows steady runs by the chief marketing companies, and the stocks of the Ohio Oil Co. show a decided monthly increase from the first of the year. Over-production of oil in Oklahoma is said to have flooded the markets of the country, and as a result the Illinois companies have been compelled to store surplus oil from the first of the year at the average rate of about 19,600 bbl. per day.

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[1] Day, D. T., "The Production of Petroleum in 1913," "Mineral Resources of the U. S.," Calendar year 1913, Part II, p. 1017.

[2] Loc. cit., except figures for 1914.

A general decline in prices of Illinois oil took place from the middle of April. This was due to over-production of the Cushing, Okla., field and the present war situation, which has curtailed much of the export trade of the country. Such a fall in price has made the oil operators less inclined to new development during the year. The annual value of Illinois oil was reduced below that of 1912. The following table shows the decline in price of Illinois oil:

FLUCTUATIONS IN PRICES PER BBL., OF ILLINOIS OIL IN 1914

Date	Price per Bbl	Date	Price per Bbl.
Jan 1.... . ..	$1 45	June 17.......	$1.12
April 18.	1 40	Aug. 5...	1.07
April 24	1.35	Aug. 7...	1.02
April 28.. . ..	1 30	Sept. 14.	0.97
May 1 .	1.25	Sept. 23.	0.92
May 5 .	1 20	Oct 26	0.89
May 12.	1.15	Dec. 1...	0.89

SOUTHEASTERN ILLINOIS OIL FIELDS

The Clark, Cumberland, Coles and Edgar County fields (shallow oil territory) showed a low but steady yield. Some new territory was added to the outskirts of the old pools in Cumberland County, while in the general shallow field several leases which were early abandoned because of low yields, were drilled and many of the old wells were redrilled profitably. The combined daily output of the shallow fields was about 5000 bbl., as against 9000 in 1910.

NINE-YEAR RECORD OF ILLINOIS OIL WELLS

Year	Wells Completed	Wells Producing	Initial Output, Bbl.	Dry Holes	Average Yield per Well, Bbl.	Total Production Bbl.
1906	3283	2793	113,012	490	40 4	4,397,050
1907	4988	4260	139,163	728	32 6	24,281,973
1908	3574	3019	78,960	555	26.1	33,686,238
1909	3151	2593	89,756	558[1]	34.0	30,898,339
1910	2139	1671	93,256	468	55 8	33,143,362
1911	1364	1059	66,919	305	63 1	31,317,038
1912	1256	986	65,686	257	66 6	28,601,308
1913	1749	1439	46,663	310	32.4	23,893,899
1914[2]	1526	1162	37,879	364	32 6	21,500,000

[1] Including 70 gas wells.
[2] Eleven months.

On January 1, 1914, it was estimated that 22,987 wells had been drilled in Illinois. Of these 3732, or 16 2%, were barren. In the first eleven months of 1914, 1526 wells were drilled, with 364, or 23 8%, barren. The total up to December 1, 1914, was 24,513 wells drilled, with 4096 or 16 7%, barren.

The Crawford County field, the largest in area of the Illinois pools, showed little or no improvement in production through inside location drilling. The town-lot field of Robinson, opened at the close of 1913, was almost completely drilled early in 1914, and at the present time there are about 185 wells. Several of the original wells yielded initially about 150 bbl. per day, but the crowding of the wells soon caused a rapid decline of the pool. The present daily production of the Crawford County field is about 15,000 bbl., as against 30,000 bbl. in 1910 and 100,000 bbl. in 1907.

About the middle of April added life was given to the Lawrence County field in the opening of the Murphy pool in Section 5, Dennison Township. The original well produced 3100 bbl. per day from the McClosky sand. The field has been extended since, and the production of the county has almost kept pace with that of 1913. Much drilling was done in the late spring and summer, but at the present time there are not over 25 strings of tools at work in the whole county, owing to the stagnation of the markets. The Lawrence County pool produces from its seven different sands about 35,000 bbl. daily, as against 45,000 bbl. in 1910.

But little work has been done in Wabash County, as only six new wells with small initial productions were added to the 36 wells of 1913. The field yields about 500 bbl. per day.

MISCELLANEOUS AREAS

The Carlyle and Sandoval pools, respectively, of Clinton and Marion Counties, showed no improvement for the year, as only a few insignificant additions were made. The settled productions declined slightly.

Four small wells, with a total initial production of 15 bbl., were added to the Carlinville pool, Macoupin County. The daily yield of the field is about 100 bbl.

A new field was opened on Apr. 30 in McDonough County, about two miles northeast of Plymouth, Illinois. The first well yielded about 75 bbl. of light oil from a depth of 447 ft. The shallow depth, small amount of casing, and low cost of development were attractive to the operators, and, consequently, a rush took place in which large bonuses were paid for leases. At the present time there are 128 producing wells in a small area of 2½ square miles. The total initial daily yield of the field reached 3600 bbl. which since has dwindled to 660 bbl. This pool is the highest, geologically, in the state, as the oil comes from a dome in the Silurian rocks.

In 1914 barren wells were drilled near Pesotum, Mahomet, Allerton, Ohlman, Nakomis, Sorento, Staunton, Ava, Mode and Collinsville.

Petroleum in Texas and Louisiana

By A. J. Hazlett*

The total amount of petroleum produced in Texas and Louisiana in 1914 was 37,446,572 bbl. This was a gain of over 9,000,000 bbl. as compared with 1913, when the combined production of both states was 28,445,749 bbl. Texas produced 20,586,377 bbl. in 1914, and Louisiana 16,860,236 bbl. This was a gain for Texas over 1913 of 5,042,291 bbl. and a gain for Louisiana of 3,958,532 barrels.

The following comparative tables show the production of petroleum in all Texas and Louisiana districts for the years 1913 and 1914:

TEXAS AND LOUISIANA OIL PRODUCTION

Texas

Districts	1913	1914
Wichita County	8,848,127	8,776,065
Petrolia	421,666	442,797
Corsicana ..	154,671	139,786
Moran	.	86,617
Northeast Texas	274,007	213,714
Batson .	710,743	748,770
Humble .	1,511,630	2,940,399
Goose Creek	301,577	189,626
Markham . .	303,378	164,444
Orange County	18,610	38,297
Saratoga	955,430	819,769
Sour Lake	1,293,883	5,373,780
Spindletop	671,745	573,310
Miscellaneous .	42,579	79,003
Totals	15,544,046	20,586,377

Louisiana

Districts	1913	1914
Caddo .	9,826,120	8,767,330
De Soto	195,512	5,148,563
Vinton ..	2,006,024	1,696,245
Edgerly	62,368	768,313
Jennings .	766,379	413,502
Miscellaneous	45,300	66,282
Totals	12,901,703	16,860,235

Following a year of discovery, 1914 in the petroleum history of Texas and Louisiana was remarkable for the large increase in production over late years, partly from the developing of new pools and partly from deeper drilling in Gulf Coast districts. In 1913 four new pools were discovered: De Soto and Edgerly in Louisiana and Moran and Orange in Texas. During 1914 these pools were developed. De Soto led with a production of 5,148,563 bbl.; Edgerly had 768,313 bbl.; Moran, 86,617 bbl. and Orange County, 38,297 bbl. The daily production of De Soto reached its highest point in June, since which time it gradually declined. Edgerly proved an erratic field, the production one month being quite large and correspondingly low the next. The wells start off large but quickly decline or go to water. Notwithstanding these discouraging features, the pool has the earmarks of a rich spot which future work alone will determine. The production at Edgerly for the year was 768,313 barrels.

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The development of the Moran district has been slow, due to the fact that most of the territory near the discovery well is controlled by one company. Late completions would indicate that it will develop into a field of some extent. The total production for the year was 86,617 bbl. The Orange County discovery has been the most disappointing of any of the pools discovered in 1913, the entire production for the year amounting to only 38,297 bbl. From an expenditure of over a half million dollars in drilling operations, only one producing well has been discovered in the district. From a depth below 3000 ft. it has been producing nearly 100 bbl. a day for over a year. Outside of these new pools the other big increases in production came from deeper drilling in extensions to the Humble and Sour Lake pools in the Gulf Coast division. Humble produced 2,940,399 bbl. and Sour Lake, 5,373,780 bbl. Most of the other districts showed a decrease as compared with 1913. This was particularly true of Markham and Goose Creek in the Gulf Coast division of Texas, Vinton and Jennings in Louisiana and practically all the districts in the North Texas division and all the old districts in Caddo parish in northwestern Louisiana.

TEXAS AND LOUISIANA OIL-WELL DATA

Texas

Districts	Comp.	Daily Prod.	Dry	Gas
N. E. Texas	14	410	4	1
Wichita County	479	19,478	152	5
Burkburnett	102	2,784	23	1
Clay County	130	1,978	33	13
Corsicana	17	29	5	0
Batson	60	1,220	10	2
Dayton	7	400	4	0
Goose Creek	46	2,990	10	0
Humble	90	27,392	29	3
Markham	6	25	2	2
Orange County	9	350	7	0
Saratoga	16	480	4	2
Sour Lake	162	112,826	43	3
Spindletop	35	1,231	9	0
Wildcats	42	819	28	8
Totals	1,215	172,412	363	40

Louisiana

Districts	Comp.	Daily Prod.	Dry	Gas
Anse la Butte	6	340	3	0
Edgerly	52	39,235	21	0
Jennings	22	567	7	0
Vinton	32	42,795	10	1
Welsh	11	215	4	0
Mooringsport	56	2,487	16	3
Oil City	62	7,565	5	5
Jeems Bayou	59	5,047	7	4
Pine Island	16	120	7	6
Monterey	35	1,726	13	2
Vivian	12	295	4	1
Harts Ferry	22	2,070	1	1
Hosston	17	1,535	3	1
Lewis	15	370	2	2
Blanchard	6	000	5	1
Cross Lake	4	000	3	1
Bossier	3	000	3	0
De Soto	128	73,972	29	6
Red River	29	15,360	11	1
Sabine	12	1,655	6	2
Wildcats	33	255	25	3
Totals	632	195,609	185	40

So far as oil is concerned, there were no discoveries of any new pools in either Texas or Louisiana during 1914, although as it closed it looked as if one or more new pools might be developed in 1915. At Minealoa, in Wood County, a test was reported showing some oil. Tests were also reported in Liberty and Fort Bend Counties, which might develop into something interesting later. Near Corpus Christi, in southwestern Texas, early in December a monster gas well broke in on the drillers and from a depth of over 2000 ft. blew the tools out of the hole and, later, the casing. The well is now "running wild," it being estimated that it is making from 40,000,000 to 50,000,000 cu.ft. of gas. The gas blew out a hole into which the derrick and all the machinery has disappeared except the boiler. In Zapita County in July a gas well was discovered 32 miles from any other wells, estimated as a 20,000,000-cu.ft. well.

There has been considerable activity in natural-gas circles in both Texas and Louisiana in 1914. The Lone Star Gas Co., which supplies most of the towns of North Texas with gas, expended over $1,000,000 in extensions to its lines and building a new compressor station at Petrolia. In the Mexia field in Central Texas the Barnsdall interests are laying a line from the field to Waco, a distance of 30 miles, and the Driscoll interests are laying a line to Corsicana, a distance of 40 miles. In Louisiana the Reserve Natural Gas Co., a Dawes promotion, laid a 16-in. line from Mooringsport to the De Soto development, a distance of 55 miles. The company is capitalized at $3,000,000. More ambitious natural-gas projects for 1915 include proposed lines to New Orleans and Houston.

The year was prosperous in refinery circles, several of the large refineries being fortunate in securing important export orders for several of the warring nations in Europe. During the year, the Magnolia Petroleum Co. built a new refinery at Fort Worth at a cost of $1,000,000, and will probably greatly enlarge its plant at Beaumont, having recently bought a tract of land adjoining its present plant for $150,000. The Gulf Refining Co. and the Texas Co. are each making important additions to their Port Arthur plants, calling for large expenditures. The Wichita Valley Refining Co. is a new company to start during the year. At Dallas, the Oriental Oil Co. recently put in a new wax plant. At Orange, Tex., the old Orange Refining Co.'s plant started running again. At Baton Rouge, La., the Royal Dutch Shell and the White & Sinclair interests just closed a deal for a refinery site, for which $53,200 was paid. It is said the refinery will have a daily capacity of 25,000 bbl. This will probably mean a new pipe line from Oklahoma to Baton Rouge at a cost of approximately $10,000,000.

Texas and Louisiana have felt the market reductions during the year less than any other sections, as most of the oil in the Gulf Coast division is purchased by the marketing companies and pipe lines under contract instead of the credit-balance system. As most of the contracts are made at the beginning of the year for one, two and three years, many of them are still in force and some will carry over through another year. It is a safe estimate that 75% of the oil for the whole year has been selling at not less than $1 per bbl., and that the entire production of the two states for the whole year will average the producer 85c. per bbl. Both states were also immune from price reductions for several weeks after other sections had suffered reductions. The credit balances are now practically one-half what they were a year ago, when the ruling price was around $1.05 per bbl. The highest contract price reported in the Gulf Coast division during the year was \$1.07⅞ per bbl. for Batson and Saratoga oil. Fuel-oil prices have been cut in two, having fallen from \$1 and \$1.20 per bbl. a year ago to 55 and 65c. per bbl. now. Of the 90,000 bbl. daily production in Texas and Louisiana, 60,000 bbl. are light or refinable oil and 30,000 bbl. are fuel oil.

In drilling operations there were 1847 wells completed in 1914. Of this number 548 were dry holes and 80 were gas wells, leaving 1219 producing wells which developed an initial daily production of 368,021 bbl. In 1913 the two states completed 2033 wells, of which 633 were dry and 86 gassers, leaving 1314 producing wells which had an initial daily production of 310,508 bbl.

An accompanying table is a summary of the drilling operations for the year 1914, in Texas and Louisiana, the last week in December being estimated.

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California Oil in 1914

By M. L. Requa*

The oil industry in California during 1914 was, so far as the average producer was concerned, rather less satisfactory than 1913. Prices tended downward, with the lowest quotations by the Standard Oil Co. in November and December, varying per barrel at the well from 37½c. for 14-gravity, to 60c. for 31-gravity and lighter.

The noticeable change has been in the decline in price of the lighter-gravity oils, there being now only 7½c. per barrel difference between 14° and 30.9° gravity oil in San Joaquin Valley fields, due to the greatly increased production of these oils in Midway and Whittier-Fullerton. The volume of heavy fuel oil has been but little augmented, although even of this there is an over-supply, as witnessed by the shutting down of many properties in Kern River and the curtailing of oil received by the Independent Oil Producers' Agency from its members. At the present time the shut-in production in the state is estimated at not far from 15,000 bbl. daily. To this must be added the surplus into storage of probably 15,000, making the actual present daily surplus not far from 30,000, compared to a daily average surplus of 10,000 bbl. in 1913; 17,000 bbl. in 1912 and 30,000 bbl. in 1911.

The affairs of the General Petroleum Co. were in an unsatisfactory condition during the year. At the present time the company is in default in its bond interest with no immediate expectation of payment. The control of the property seems to be returned to American hands. The connection of Andrew Weir with the company is said to have terminated, although rumors of litigation are rife and exactly what the ultimate outcome will be is uncertain. The property is valuable and will undoubtedly be reorganized in some way and its operations continued. The European war is responsible, not only for the exit of Mr. Weir from the affairs of the General Petroleum, but also for failure on his part to complete the proposed financing of the Union Oil Co. The prospectus of the proposed new company was published in London the day war was declared and, of course, resulted in no business being done. An extension has been granted until next year, but it is not thought anything will result therefrom. For the present at least, the plans of the General Petroleum Co. for controlling the Union Oil Co. have resulted in nothing, and if anything is accomplished in the future, it seems highly probable that it will be along widely different lines than those contemplated under the De Sabla option.

Midway has produced several notable gushers during the year, the most notable being Lakeview No. 2. This came in May 10 and produced approximately 3,000,000 bbl. up to Oct. 24, at which time the hole collapsed. The well is thought to have come to the end of its activity, and, like the famous Lakeview No. 1, it was during its life entirely beyond control. The derrick was destroyed early in the game and when the well finally ceased flowing there was nothing save a crater-like opening, in the center of which the oil spouted like a geyser.

Other notable wells in this field are: The Standard Oil Co., on Section 36, 3000 bbl. of 28-gravity oil at 2500 ft. in February, and 2500 bbl. in March, practically at the same depth; the Rickard Oil Co., on Section 28, 6000 bbl. of 23-gravity oil at 2800 ft., also in March. In May, the General Petroleum Co. brought in a 2500-bbl. well of 24-gravity oil on Section 32, at about 2900 ft. The General Petroleum also redrilled two wells on Section 32, one producing 2000 bbl. and the other 1500 bbl. of about 26-gravity oil, at depths of 2400 to 2900 ft.

The North American Consolidated, on Section 2-32-23, brought in a 1200-bbl. well at about 3400 ft in May, and the Boston Pacific in the same month on Section 32-21-24 brought in a 1000-bbl. well at about 3000 ft., of 28 gravity.

CALIFORNIA'S OIL PRODUCTION IN BARRELS

	1914	Increase or Decrease
San Joaquin Valley:		
Coalinga	15,666,988	— 3,430,212
Kern	5,866,837	— 5,468,761
Midway-Sunset	48,595,472	+ 10,824,117
McKittrick	3,614,036	— 1,009,797
Belridge-Lost Hills	4,811,139	— 322,395
	78,554,472	+ 593,252
Coast:		
Santa Maria	4,228,244	— 697,601
Fullerton	6,145,016	— 132,583
Salt Lake	2,132,141	485,785
Whittier-Coyote	7,750,111	+ 4,103,952
Ventura	808,598	79,052
Newhall	119,123	2,690
Los Angeles	303,660	80,692
Summerland	52,200	— 7,200
	21,539,096	+ 2,618,349
Totals for the state	100,093,568	+ 3,211,601

Does not include oil used as fuel in the fields, which amounts to approximately 5,000,000 bbl. In addition to this there is shut-in production amounting to approximately 6,500,000 bbl., so that the total potential yield of the state may be taken as 112,000,000 bbl The present storage in the state is about 85,000,000 bbl.

In July the Miocene, on Section 32-12-23, brought in an 8000-bbl. well at 3100 ft., and the Midlands Oil Fields in the same section brought in a 5000-bbl. well at about 3400 ft. In September the Standard Oil Co., on Section 36, redrilled one of its wells, bringing it in at 3000 bbl., and in October the same company brought in a 1600-bbl. well on Section 22, at 3200 ft.

The action of the Independent Oil Producers' Agency in having a valuation made of the properties comprising the agency is, perhaps, the most significant action of the year. More and more the small producers are coming to see the desirability of consolidation, and this step is believed to be only preliminary to the recommendation of some plan that will have for its object the combining of these companies into one corporation that will take the place of the present agency. This work is now well advanced and, while nothing has as yet been announced, it is believed that within a few months a very definite and complete statement will be presented covering the future possibilities of the oil industry in California.

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*Mining engineer, Crocker Bldg., San Francisco, Calif.

In the development of the Southern California field during 1914, interest centers chiefly around the operations of the Standard Oil Co., the Union Oil Co. and other concerns in the Whittier-Coyote district.

The Standard Oil Co. in January had one active drilling well at Whittier and 10 active and two idle in the Coyote district. At the end of October the Standard was operating 19 in Coyote and four in the Whittier division.

In May the Standard Oil Co. in the Coyote district brought in a 1500-bbl. well of 26-gravity oil in 3460 ft. on the Emory lease, and on the same lease a 3000-bbl. well of 30-gravity oil in 3400 ft. in the month of August; in September, a 1200-bbl. well of 29-gravity oil and in October a 1000-bbl. well of 29-gravity oil on the Murphy lease at 3500 ft. In November the same company is credited with a 3000-bbl. well on the Emory lease. of 29-gravity oil.

The Union Oil Co. early in the year developed a 3000-bbl. well of 23-gravity oil in 2900 ft. in the Fullerton district, and in the Coyote district on the Graham Loftus lease it got a 2000-bbl. well of 22-gravity oil at 3400 ft., followed by an 1800-bbl. well in March.

The St. Helens Petroleum Co., in the Coyote district, developed in April an 1100-bbl. well of 22-gravity oil at 3267 ft. These are the principal developments in the southern California field and have added tremendously to the importance of this district and have proved the wisdom of the Standard Oil Co. in erecting a refinery at El Segundo.

The European war has had a serious influence upon the export business of both refined and fuel oils from California, which business has not yet returned to normal conditions. Because of this closing of the Pacific, the oil surplus of the state became extremely large and necessitated the Independent Oil Producers' Agency seriously curtailing the amount of oil taken from its members.

* * *

Mineral Production of France and Algeria in 1912

The official figures of mineral production of France and Algeria have recently been reported as follows by the Minister of Public Works (*Oest. Zeit. f. B. u. H.*, Oct. 24, 1914): Coal (anthracite and bituminous), 41,145,000 metric tons; iron ore, 19,160,000; silver-lead ore, 13,953; zinc ore, 45,929; pyrites, 282,202; copper ore, 242; manganese ore, 5576; antimony ore, 11,018; gold ore, 165,380; tungsten ore, 193; bitumen, 312,000; sulphur, 1000; graphite, 600; salt (rock and sea) 1,099,000; peat, 43,000; bauxite, 258,929 metric tons. The total value of these products was 778,010,600 francs.

The metal production of France in 1912 was as follows: Aluminum, 10,200 metric tons; antimony (regulus and oxide), 5106; copper, 11,907 metric tons; gold, 2797 kg.; pig iron, 4,939,194 metric tons; lead, 31,086; nickel, 1725 metric tons; silver, 63,736 kg.; zinc, 62,651 metric tons.

The production of Algeria was valued at 28,461,500 francs, and was composed of the following: Iron ore, 1,189,992 metric tons; silver-lead ore, 19,500; zinc ore, 71,000; copper ore, 123; antimony ore, 1661; rock salt, 26,800 metric tons.

Minerals in the Dutch East Indies

A recent report from U. S. Consul B. S. Rairden at Batavia, Java, gives a statement of the mineral production of the Dutch East Indies in the year 1913. The production of the tin mines at Banka during 1913 was 34,481,168 lb., and of the Billiton (private mines) 10,064,816 lb. Some 4,938,800 lb. of Billiton tin were sold at Batavia during last year. Government tin is shipped to the Amsterdam market for sale, and during 1913, 32,127,525 lb. were exported for Government account. There were no shipments of tin to the United States direct during last year.

The Ombilien coal mines (Government mines) in southwest Sumatra increased their output from 408,204 tons in 1912 to 411,083 tons in 1913. The Puloe Laut coal mines (southeast Borneo) have been purchased by the Netherlands India Government during the past year for, it is stated, about $1,280,000. The Samarinda (East Borneo) coal mines also belong to the Government and produce a fair quantity of inferior coal, used locally.

The general output of the few gold mines during 1913 was considerably below that for the previous year, and the only two mines giving any results were the Redjang Lebong, Sumatra, producing during 1913 $1,050,000 worth of gold, and Simau (near Redjang Lebong), producing $880,000 worth. While the production of the Redjang Lebong is decreasing each year, that of Simau shows a slight increase. There are two gold mines in the Celebes which, during 1913, produced some gold; the Paleleh, with an output valued at $365,000, and the Totok, $330,000 worth.

The oil industry in Netherlands India (Borneo and Sumatra) continues successful and the output is increasing each year. The yield for 1913 is reported as 1,503,660 tons.

* * *

Copper Producers' Association

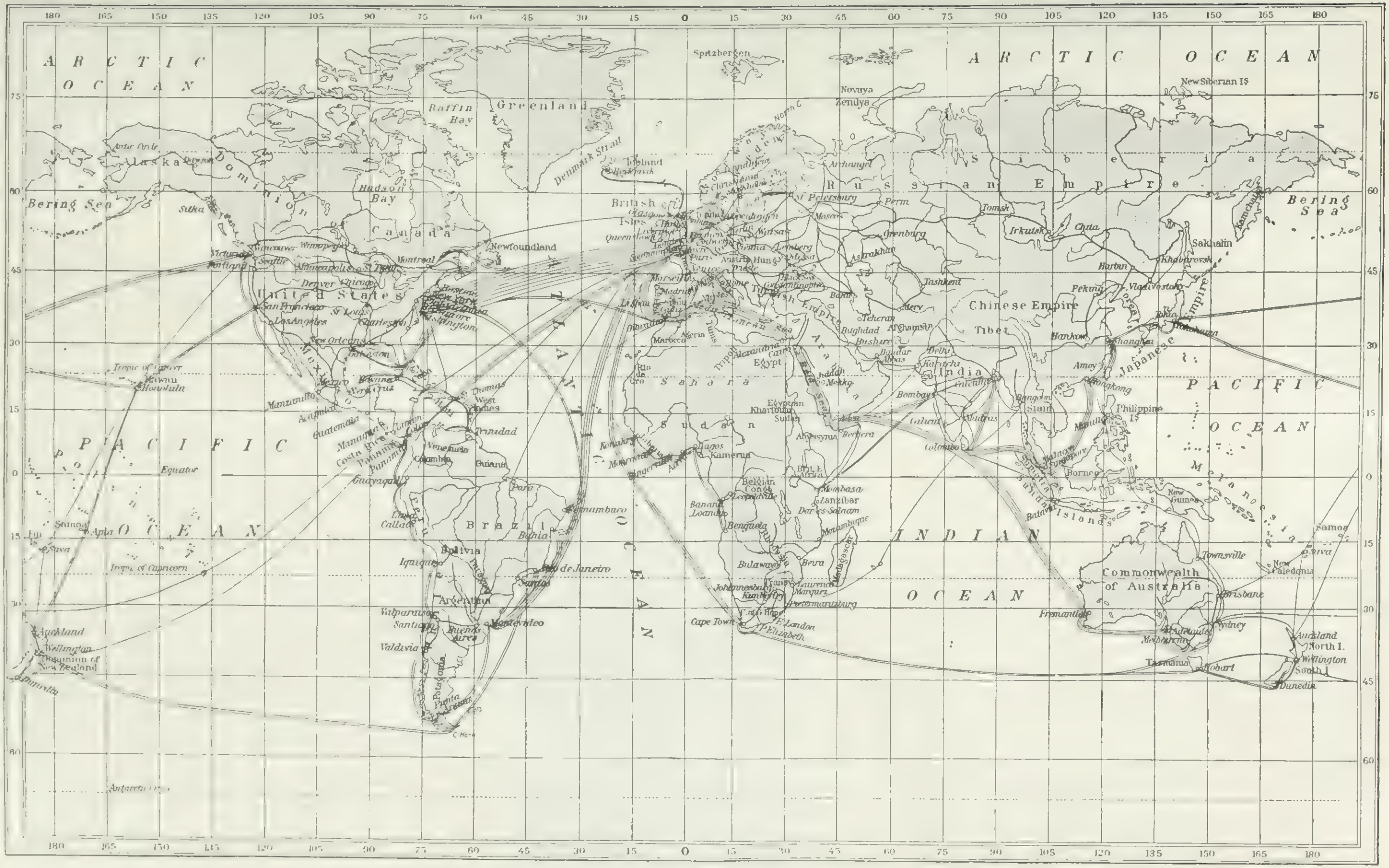
The following are the latest statistics of the Copper Producers' Association, to which the statistics of Henry R. Merton & Co. respecting the stock in Europe are added:

	United States			Visible Stocks		
Month	U S Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.		
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.....	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII	138,074,602	58,904,192	78,480,071	52,814,606	71,904,000	124,808,606
VIII	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr. '13	1,622,450,829	767,261,760	869,062,784	.		..
I, 1914	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III	115,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV	151,500,531	63,427,633	82,345,216	64,609,319	46,435,200	111,044,519
V	112,308,287	55,592,170	72,710,477	70,337,001	52,371,200	122,708,201
VI	141,345,571	46,227,353	73,350,196	84,342,641	61,062,400	145,405,041
VII				106,110,663	64,220,800	170,331,463
VIII					66,499,880	
IX					*68,277,440	
X					*66,234,560	
XI				. . . .	*73,059,840	
XII				....	†49,817,600	

*German stock estimated

†German stock omitted

Note—Visible supplies in Europe do not include copper afloat



THE MAINSTREAMS OF SEABORNE COMMERCE

The shipping routes are, in width, proportioned to the value of the merchandise carried over them in the last 10 years. A line from New York to Para, Brazil, is omitted. Four Red Sea-Mediterranean lines are continuous and not broken, as shown. (From "The Americas," published by the National City Bank, N. Y.)

Copper Mining at Collahuasi

ANTOFAGASTA CORESPONDENCE

The copper mines of the Poderosa Mining Co. and the Société Francaise des Mines de Cuivre are in the Collahuasi district in Northern Chile, near the Bolivian border. The mines are situated in a very dry and barren region in the Andes, at an altitude of 4800 m. (approximately 16,000 ft.). The copper occurs in the ore in many different forms, the principal minerals being chrysocolla, cuprite and chalcocite, though malachite, brochantite and olivenite are also found. The ore extracted usually averages from 20 to 25% copper and is exported to Europe or the United States through Antofagasta, with which the mines are connected by rail. The surrounding country at Collahuasi has been fairly well prospected, but owing to its inaccessibility and consequent high cost of transport, only high-grade ore containing from 30 to 40% copper can be worked profitably at any distance from the railroad.

The fuel used throughout the district is *yareta*, a resinous variety of moss with roots of a fibrous nature; this grows in the neighboring mountains and has about one-third the calorific power of coal. This fact, together with the rarity of the atmosphere, makes steam raising a costly item. Labor is plentiful but is not especially efficient, though wages are high. All drilling is done by hand as the trials with air drills have not been successful so far, due to the difficulty in obtaining compressors to work at such an altitude efficiently, unless specially designed; also to the fact that the native labor has not yet been educated in the use of mechanically operated drills.

INSTRUCTION IN USE OF BREATHING APPARATUS

FIRST-AID TREATMENT FOR DISLOCATED HIP

A small experimental concentration plant has been erected by the Société Francaise des Mines de Cuivre to treat the large dumps of low-grade siliceous ore $(CuO\,SiO_2 + 2H_2O)$ which the company has accumulated; there are, however, many difficulties to be overcome before a plant of this description can reach its proper efficiency. An aerial ropeway has been erected to connect the mill with the mines; the tramway is affected by the great variation of temperature at this altitude, necessitating the employment of a far greater horsepower than would be required under ordinary circumstances, owing to the fact that the moving parts are generally frozen at night, and thus require extra power to put the machinery in motion.

The difficulties of living in this district are very great for Europeans, as the mountain sickness, locally called *poona*, is prevalent, and unless heart and lungs are perfectly sound, it is impossible for the ordinary European to live and work for any length of time at these heights.

First-Aid Work in Platteville District

Through coöperation between the U. S. Bureau of Mines and the Wisconsin State Mining Trade School, at Platteville, Wis., instruction in first-aid work was given last fall to students of the school and to mining men in the district. Mine-rescue car No. 7 was sent down from Ironwood, Mich., and the several mining companies sent such of their men as they desired to have receive training, to the school for the purpose. Instruction in rescue work was given by W. W. Sullivan and that in first-aid by J. H. East, Jr. Forty men registered for the rescue training and 73 for first-aid.

At the completion of the training a demonstration was given, which was participated in by teams chosen from both mining men and students. In the mine-rescue demonstration, the practical use of the self-contained breathing apparatus was shown. The north wing of the mining-school basement was used as a model mine, being filled with smoke and ammonia gas. Exploration of this mine was effected, and an exhibition given of the Schaefer method of artificial respiration for men overcome with gas. This demonstration was a thorough success.

Following the exhibition in Platteville, the rescue car was taken to Benton and Livingston, Wis., and Galena, Ill. A team chosen from the students accompanied the car, giving at each place a demonstration under the supervision of the staff of the car.

Anglo-Colombian Development Co., Ltd.

According to the 1914 report of the Consolidated Gold Fields of South Africa, the prospecting operations carried on at the Anglo-Colombian property, near Novita in Colombia, have disclosed over 27,000,000 cu.yd. of dredgeable gravel containing gold and platinum. The dredge has been shipped and it is anticipated that it will be at work in April, 1915. In addition to the dredging ground, an area containing 8,500,000 cu.yd. has been proved and may be hydraulicked or let on tribute to the natives.

Tin Mining in Bolivia

By M. G. F. Soehnlein*

SYNOPSIS—A review of Bolivian mining with special reference to the situation of the tin-mining industry as a result of the world-wide disturbance of marketing conditions in 1914, and the steps that were taken to tide over this crisis. Further beneficiation of tin ores being considered. In Bolivia, tin mining is still in the high-grade stage, most of the ores mined averaging over 10% metallic tin. The Huanuni mine will be the first to work on a large scale ores carrying only 2 to 3% tin; a 300-ton concentrator is now being erected.

During the first four months of 1914 the serious and steady decline in the price of tin caused great anxiety to mine operators in Bolivia, many of whom tried to meet the situation by increasing their production. But when the price fell to £150 and less early in May, several smaller concerns were forced to suspend operations, and the exportation of tin ore declined below the average of the previous year.

Labor Shortage Relieved

There is one factor in Bolivian mining that caused a good deal of trouble to operators in more prosperous days, but now tends to be a great help to the industry. The scarcity of labor and the rivalry of mining companies to secure sufficient workmen have led to an enormous increase in wages, but this did not induce the people to improve their standard of living. It only gave cause for more feasts and holidays, and enabled the people to spend more money on liquor. Consequently, they worked less than before and the mine operator had to put up with inefficient and uncertain labor at a high price. For instance, five years ago ordinary peons in the Oruro district were earning about B. 1.50 per day (1 boliviano = $0.38); in 1913 it was hard to secure men for B. 2.50 per day, and in the outlying districts from B. 3 upward was paid. Hand drillers in the mines earned in 1913-14 between B. 4 and B. 7, and machine men could make from B. 6 upward. A good carpenter or blacksmith was hardly contented with B. 5 per day, whereas when earning B. 3.50 five years ago he reckoned he was doing well.

When in May, 1914, many smaller mines suspended or reduced operations, more workmen were available, and several of the large concerns reduced the wages of their working forces from 10 to 15%. The people did not suffer to any extent from this measure, because they were earning a good deal more than they needed and had been accustomed to spend the balance in a way which was even pernicious to themselves. Then came a slight reaction in the tin market in the first days of July, and hopes again went high, but with the beginning of the great war in Europe everything collapsed. There was no market for tin ore; all credits and consignment contracts were suspended.

Banks Supported Operators

Bolivia was struck by this blow while preparing for the celebration of her independence day, Aug. 6, which makes any idea of work for industrial enterprises impossible for about a week. Fortunately the government in coöperation with the four local banks, Banco Nacionál de Bolivia, Banco de la Nación Boliviana, Banco Francisco Argandoña and the Banco Mercantíl—the latter, by the way, is owned by Sr. S. I. Patiño, whose Uncia and Huanuni mines produce more than 30% of the whole tin output of Bolivia—arranged that mines which were in financial difficulties could be financed by one of the above mentioned banks to the amount of B. 29 for every quintal (46 kg.) of 60% *barrilla* produced. Besides, the export taxes were not to be paid by the miners until they sold their products. It was fortunate that this crisis occurred during the days following the Bolivian independence day, because it gave mine operators time to consider what measures they were to adopt.

Several companies seriously contemplated shutting down all work, because, although the banks would be able to finance them for some time, nobody could foretell how long this paralysis of business was going to last, and it is rather risky to accept advance on one's product if it is not certain that it will afterward fetch a price high enough to cover the advance. Many Bolivian workmen were dismissed from the Chilean nitrate fields, and returned to their native country, and the supply of labor became so abundant that wages went down with a jump to their former level. Some mining concerns accepted the assistance of the banks, the stronger ones kept on working with their own resources on a reduced scale, being careful to incur as little expense as possible, and all stored their concentrates. Another factor that has come to the aid of the miner is the lowering of the exchange rate of the boliviano. The nominal value is 19⅕d., but during the last years it has been fairly firm at 18⅜d. At present it has gone down to 15½d.; in fact it changes every day, because few London drafts are for sale, as there is little tin ore sold in England. The mining companies generally have their reserves in gold in the banks, and, therefore, the low exchange rate assists them in keeping down expenses. Among the working classes no suffering has arisen from the lowering of wages, but, of course, many people are unemployed.

New Smelting Works Considered

The high prices that were paid in New York for tin in August evoked a good deal of enthusiasm here, but had, of course, nothing to do with the price of tin concentrates, because nobody would smelt them, and there were no transportation facilities during the first few days of the European conflagration. It was, therefore, suggested that steps be taken by the government or a combination of local mines to build a smelting works in Bolivia. This sounds reasonable enough, but any one familiar with Bolivian conditions knows that there are great difficulties connected with the execution of this idea. There has been an animated discussion of the subject in the local daily papers by technical and semitechnical people. Perhaps the best and most practical argument against it is that the principal mine owner in Potosí, Louis Soux, used to smelt his concentrate in water-jacket blast furnaces until

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*Ingenio de Machacamarca, via Oruro, Bolivia.

1912, the year of completion of the railroad from Rio Mulato to Potosí. From that time he found it more profitable to ship his concentrate to Europe for smelting.

It is said that during the present crisis, tin smelting in Potosí has been resumed, but that does not prove the economy of smelting in Bolivia, because if one has the choice between two evils, selling nothing, or selling at less advantage than before, surely the latter is selected. Further, tin smelting is said to be a simple process, but it is remarkable that although the processes of reverberatory or blast-furnace smelting are well known, no visitors are allowed in tin-smelting works all over the world, be it in England, Germany or the Far East. This seems to point to the fact that there are some details of tin smelting on which the success of the enterprise entirely depends. The tin bars produced in Potosí are of rather inferior quality, passing seldom 97% metallic tin, and it might not be easy to sell these to a public that is accustomed to Banca and Straits bars containing over 99.9% tin.

Some operators, among whom was Señor Patiño, made use of the plentiful supply of cheap labor to increase their production, since it was found that the ore could be regularly shipped to England. All the concentrates from the Uncia and Huanuni mines used to go to Hamburg, and a good deal of it must be lying tied up in German ships that have taken refuge in neutral ports.

At present, more confidence exists in the future of the tin market, since several lots of Bolivian tin concentrates that were stored in Liverpool have been sold to the smelters at better prices than anticipated, and representative foreign firms are again making or renewing consignment contracts with the mines, shipping the concentrates to England. Yet the position is far from satisfactory, because the tin ore is not readily sold, but is stored in Europe to abide its time of selling.

It may be interesting to publish the following calculation of the value of a ton of 60% tin concentrates of good quality, laid down at the station of Machacamarca, on the railroad from Oruro to Antofagasta. The station of Machacamarca has been selected, because this is the point from which nearly half of the Bolivian tin ore is shipped, being the outlet for the mines of Señor Patiño, the Cía. Minera de Oruro, and the Morococala mine of Penny & Duncan.

VALUE OF ONE TON OF 60% TIN BARRILLA

Value of one ton of 2240 lb. of 60% metallic tin (price of tin, £130)		£78 0s 0d
Less smelting charge		12 0 0
		£66 0s 0d
Value per metric ton of 1000 kg.		64 19 2
Less commission for marketing (2½% of value)		1 12 4
Net value of 1000 kg. in Liverpool		£63 6s 10d
Deductions		
Railroad freight Machacamarca to Antofagasta, about 900 km., B. 64.50 per metric ton	B. 64 50	
Transport to ocean steamer in Antofagasta	4 0	
22 Lobonite ore bags at B. 0.50	11 0	
	79 50 @ 18d	£6 1s 7d
Export duty B. 35.0 @ 19 1-5d		2 16 0
Ocean freight and insurance Antofagasta to Liverpool		4 0 0
Total		£12 17s 7d

Value of one ton of 60% barrilla [illegible] $244 U.S. Cy., or £50 9s 3d

Smelting charges may vary a good deal; ores containing antimony, arsenic, lead, or more than 1½% sulphur in the form of pyrites are subject to heavy penalty. Lower-grade concentrates from the Potosí district, where generally only 50% ore is exported, pay as much as £20 per ton for smelting, and the clean ore from Totoral district can be smelted for only £7 per ton. Some smelters adopt a sliding scale of return charges, going up and down with the price of tin. The above example of the charges which a ton of concentrates must bear may, of course, vary considerably. The 2½% commission for marketing is rather high, and the larger concerns do not pay half so much; as everywhere, it is the small producer that has the largest expense.

The railroad (Ferrocarril de Antofagasta á Bolivia) has recently lowered its tariff, because it is alleged that it was cheaper to ship concentrates from Oruro to Viacha, and thence by the Chilean government railway to Arica, a port in northern Chile. No exact figures can at present be given about the cost of shipping by this road, but even with the reduced tariff of the Antofagasta railway it seems to be cheaper because some continue shipping via Viacha.

MOLLENDO NOT AN IMPORTANT TIN PORT

It has been said in some of the American technical papers that Mollendo is an important outlet for Bolivian tin ore, but only the rather small quantity that is produced in the La Paz district goes to that port, and probably not more than 10,000 quintals per month are exported in normal times. The greater part of the ore must necessarily go to Antofagasta or Mejillones, a few miles further north. At the latter place the sea is much calmer, and there are few, if any, losses of bags of concentrates during trans-shipping to the ocean steamer, which happens frequently in Antofagasta.

In view of the high cost of transportation it would seem a great advantage if the tin content of the concentrates could be raised to more than 60%, and this question has received more attention than in past years when, on account of the high price of tin, mining companies made good profits anyhow. To accomplish this, electro-magnetic separation is being introduced at the leading mines in addition to jig-and-table concentration.

TIN MINING IN HIGH-GRADE STAGE

The tin-mining industry of Bolivia is still entirely in the high-grade stage, most of the concentrates being produced from ores with more than 10% metallic tin; a considerable proportion of the exported ore is hand-picked from the vein matter, without having undergone any treatment. The tonnage worked is small; there are not more than two mills in the country that work over 100 metric tons per 24 hr., and probably the largest does not even crush 150 tons. The Huanuni mine will be the first to work low-grade ore, running from 2 to 3% metallic tin, on a larger scale, and a 300-ton concentrator is under construction. Of course, ore of this grade has been worked before in Bolivia under favorable circumstances on much smaller scale, and has even paid handsomely to a few operators, but these cases are exceptional. The Colavi mine near Potosí is an instance of this, but when tin fell below £160, this mine closed down.

It is reported that Señor Patiño and the Cía. Estañífera de Llallagua have arrived at an understanding about the ownership of a very important piece of mineral land, which was claimed by Señor Patiño to be part of his Uncia mine, and by the Llallagua company to be its property. Many lawsuits had been fought over this ground, and for the last four years it was a constant source of trouble for both parties.

The silver-mining industry which centers principally in Huanchaca, Potosí and Oruro, did not enjoy a very prosperous year in 1914. Silver was much lower in price than in 1913, and after the beginning of the trouble in Europe, there was no market for silver ore, or the precipitates from lixiviation processes. This condition, however, was not lasting; the silver precipitates could be far more easily disposed of than tin concentrates, so that no serious difficulties arose for the silver mines. Smelting the 15 to 45% silver precipitates in Bolivia has been considered, but the high cost of fuel and chemicals more than offset the advantage gained by easier marketing, and smelting silver at the mines would only have been resorted to if the sale of precipitates had been impossible for a long period.

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The Tofó Iron Mines in 1914

By C. A. Buck*

As is generally known, these mines are situated near the coast of Chile, about 30 miles north of Coquimbo. They were originally opened in a small way by a French company, which also operated a steel works at Corral, in southern Chile. The Bethlehem Steel Co., through its subsidiary, the Bethlehem-Chile Iron Mines Co., took over the operation of the property in 1913 and has been prosecuting development and construction work besides mining and shipping a certain amount of ore. Hubert Merryweather, formerly with the Juragua Iron Co., a Cuban operation, also owned by the Bethlehem Steel Co., is vice-president and general manager.

The general surroundings of Tofó are shown on the accompanying map. Some photographs illustrating the main features were shown in the Engineering and Mining Journal of July 25, 1914, and in *Iron Age* of May 11, 1914, there was published a general description of the mines.

Operations proceeded steadily at these mines in 1914, the handicap due to the general disturbance caused by the European war being to a great extent neutralized by the abundance of labor now available in Chile. Ordinarily, the labor question there is a serious one, but due to the closing of many nitrate operations, labor in all parts of Chile is now plentiful.

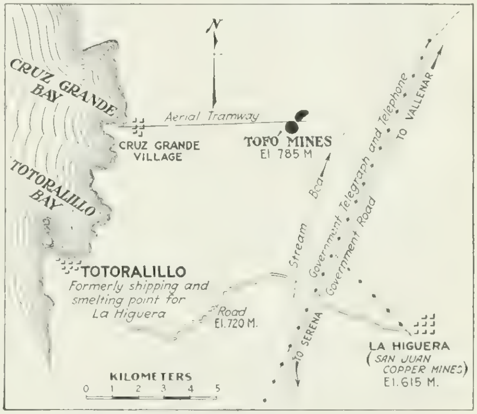
Exploration work by means of tunnels was carried on at Tofó in 1914 and ore reserves were materially increased. Much ore was also put in sight by some cuts made in road construction. Tunnels are now in ore at an elevation 150 m. lower than the top of South Hill. It was thought possible that ore from the lower part of the orebody might show some increase in sulphur content, but happily this was not the case. Thus a sample from the lowest tunnel analyzed as follows: Fe, 67.47%; Mn, 0.12; P, 0.008; S, trace; SiO_2, 2%. Some exploration tunnels in the mantle of float ore on the eastern edge of the deposit also increased the tonnage of float ore in sight.

Shipments of ore continued in 1914 as conditions permitted. The ore shipped was transported to Cruz Grande by aërial tramway and loaded into vessels by the cantilever loading bridge, illustrated in the Journal of July 25, 1914. This cantilever has now been fitted with a conveying belt 36 in. wide, replacing the buckets installed by the French company. It is expected that this will greatly reduce the loading time and expedite shipments correspondingly.

In 1914 there were shipped to Philadelphia six cargoes, aggregating 42,000 tons, and to Europe three cargoes aggregating 21,000 tons, making a total of 63,000 tons. The ore consigned to Europe was to fill some contracts entered into by the French company. Three of the cargoes consigned to the United States came through the Panama Canal, the S.S. "Oldfield Grange" being the first to use the waterway for the purpose of bringing iron ore to the United States.

A typical cargo analysis (natural) of the ore is as follows, the cargo selected being that of the S.S. "Twickenham": H_2O, 0.10%; Fe, 67.60; P, 0.043; SiO_2, 2.21; Cu, 0.009%. It is now hoped to ship 200,000 tons to Philadelphia in 1915, and gradually to increase this amount till the permanent installation is completed, when an annual production of 1,500,000 or 2,000,000 tons is planned.

An important feature of the 1914 work was the development of a water supply. In 1913, water rights of the San Juan group of copper mines, at La Higuera, were acquired, and an abundant source of water was developed. From old records it is expected that the ultimate amount available will be about 300,000 gal. per day. An electric pump was installed, a pipe line laid to Tofó, concrete storage tanks erected and the water is now in use. It has been found to be of a satisfactory character, the only bad feature being a rather high percentage of calcium sulphate. A water-treatment plant will shortly be installed to insure a quality suitable for boilers and drinking purposes. Curiously enough, the water that had stood in the San Juan workings for years, contained practically no copper.



Sketch Map of Tofó Iron Mines and Vicinity

A contract was let to Snare & Triest Co., of New York, for installing a basin dock in the Bay of Cruz Grande. The basin will be excavated approximately 40 ft. deep: 200 ft. wide and 900 ft. long. The basin is in the form of a slip where boats can enter for the loading of iron ore. At one side of the basin will be erected a steel dock 340 ft. long. This dock will have pockets holding 30,000 tons of iron ore, which can be loaded through chutes by gravity into the boats in a short time. The dock will be of similar construction to many of the ore docks in ser vice on the Great Lakes. The railroad tracks on top of the dock are at an elevation of 123 ft. above low-tide water, and the railroad running from the mines will approach the dock from a higher elevation and will not require any up-grade hauling of the ore.

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*President, Bethlehem-Chile Iron Mines Co., South Bethlehem, Penn.

A contract was made with Slaughter & Ross, of Chile, for the construction of the railroad that will transport the ore from the mine to the dock. The main line of the railroad will be about 15 miles long, 13 miles of which will be of a uniform 3% grade, the remaining two miles varying from level track to a 2% grade. A 3% grade was considered the maximum grade that should be used in view of the heavy trains that will be operated. The mine has an elevation of about 2300 ft. above sea level and on a direct line is about four miles from the dock at the Bay of Cruz Grande. A railroad of the above length has been surveyed in order not to get a grade of over 3%. It will be standard-gage (4 ft. 8½ in.), of first-class construction, with 100-lb. rails, tie plates, oak ties, rock ballast, etc.; it will be a single-track road with four passing sidings, each 1050 ft. in length. The country through which it is built is mountainous and principally rock. Approximately 50% of the road will consist of curves; the sharpest will be about 350 ft. in radius. There will be no tunnels or bridges, but the approach to the dock will be a steel double-track trestle.

The railroad will be electrically operated, using a catenary overhead-trolley system, which will furnish direct current at 2400 volts to 110-ton electric locomotives. The total weight of the locomotives will be on the drivers. These locomotives will have a continuous tractive effort of about 37,000 lb. at 11 miles per hour, which will enable them to haul up the 3% grade, in continuous service a train of 21 ore cars of 420 tons total weight. The most interesting feature of the electric locomotives is the regeneration of power when they are descending the grade with loaded trains. The power thus regenerated will be sent back into the lines to assist in hauling the empty cars up the 3% grade. This regeneration also reduces the duty on the air-brake system in retarding the descending trains.

At the Bay of Cruz Grande, a modern steam-turbine electric power plant will be built. The General Electric Co., of Schenectady, N. Y., has the contract for the installation of the apparatus for this plant, as well as the electrification of the railroad. The present plant will consist of two steam turbines, each of 3500-kw. capacity, which will generate alternating current at 2300 volts, three phase, 60 cycles. The auxiliaries of the steam turbines, such as circulating-water pumps, vacuum pumps, hotwell pumps, and boiler-feed pumps, will be motor-driven. The present boiler equipment will consist of four boilers of 110 hp. each, set in batteries of two boilers each. They will generate steam at 200-lb. pressure and 100° F. superheat. Oil will be used for fuel, although the boilers will be constructed so that coal can be used if desirable. A 300-kw., 600-volt, 60-cycle, three-phase alternating-current turbine will be used to provide power for the station auxiliaries and to supply power for the load at night, which will be small (principally lighting).

Power will be transmitted to the mine from the power house by a 22,000-volt transmission system, which will consist of two duplicate transmission lines on the same poles. Two banks of transformers, consisting of three single-phase transformers per bank, will be used in the power house and also at the mines for changing the voltage from 2300 to 22,000. Each bank of transformers will be connected in delta on the primary and secondary windings, and each bank will have a capacity of 2000 kv.-a. Power will be furnished the railroad by two motor-generator sets, situated in the power house. Each motor-generator set consists of a 1400-kv.-a., 2300-volt synchronous motor direct connected to two 500-kw., 1200-volt direct-current generators, connected in series, so as to give 2400-volt direct current with a capacity of 1000 kw. normal load.

The machinery in the machine and blacksmith shops will be motor-operated. The large ore crushers at the mines will be driven by electric motors. The crushing plant will consist of a 5x7-ft. jaw crusher, working in conjunction with two No. 9 gyratory crushers. The drills for mining purposes will be electrically operated.

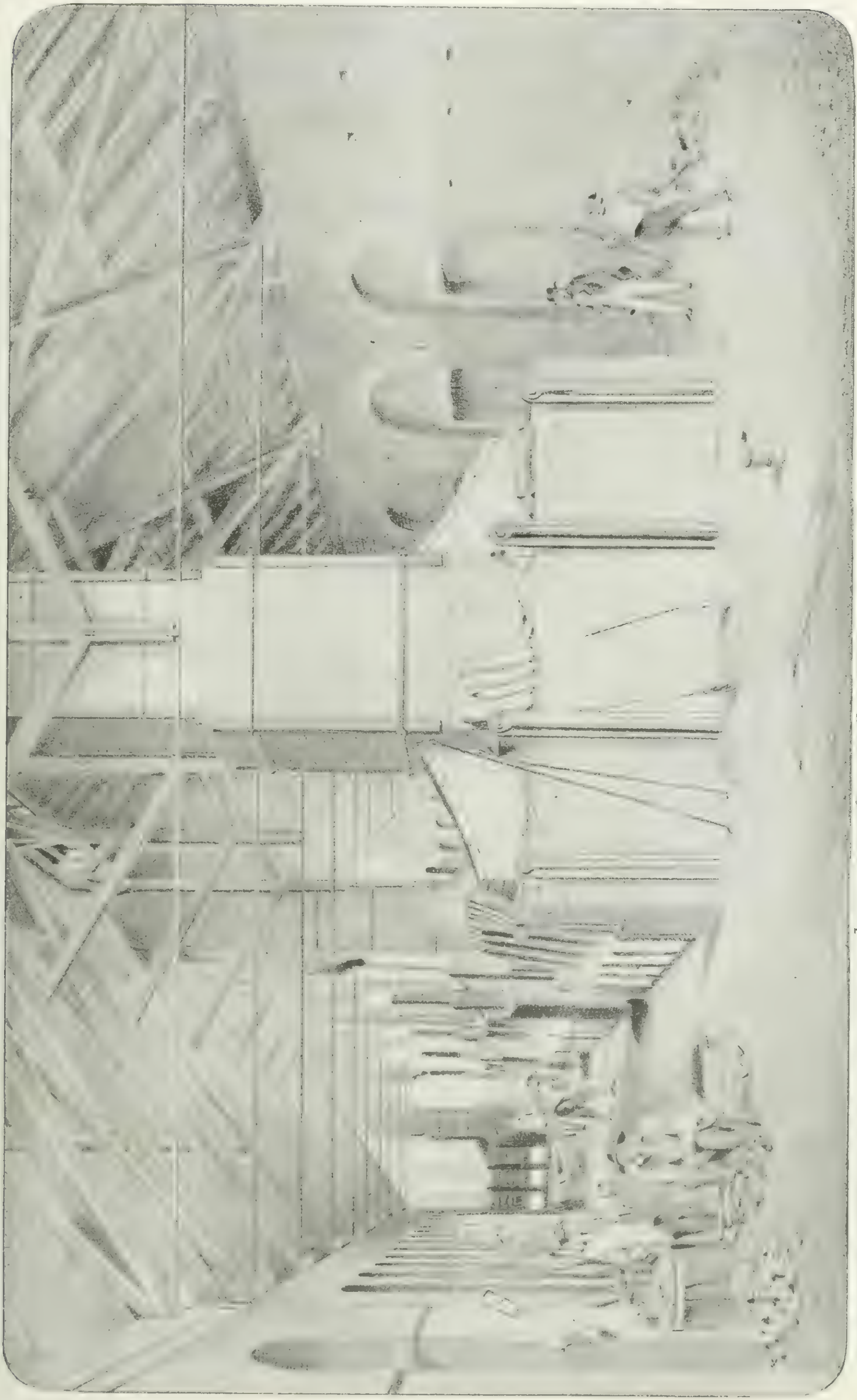
On account of the comparatively high cost of fuel in Chile, it is more economical to produce power in the main central station and to use electrically operated apparatus wherever possible, instead of having apparatus operated by steam from small isolated boiler plants which have a poor fuel economy. For this reason the mining and transporting of the ore will be done by electrical apparatus wherever it is possible.

The Mines and Smelting Works of Poland

When Poland was partitioned about 150 years ago, a portion was taken by Russia, a portion (including Silesia) by Prussia, and a portion (chiefly Galicia) by Austria. In language and habits, however, this region has always remained Polish, at least among the peasants, irrespective of the recent national boundaries. Western Galicia is officially Polish and Cracow, the ancient capital of Poland, has been the locus of the Polish national university, the historical museum, the shrine of St. Stanislaus, the burial place of Kosciusko, and the center of Polish national aspirations. In Upper Silesia, as the southeastern corner of the ancient province of Silesia is known, the administrators, merchants and tradesmen are largely German, but the peasants and workmen are about 90% Polish, and the wayfarer through the industrial districts and the countryside finds that no language but Polish is understood.

Mines of zinc ore were known in this region in fairly early times and the ore was used to some extent for the manufacture of brass by the cementation process. Zinc smelting was introduced in 1798, when Johann Ruhberg, a metallurgist from the Harz, who had visited England and learned the art there, adapted a glass-furnace at Wessola to the purpose. After about 10 years of experimentation zinc smelting began to be a regular art in Upper Silesia, the first industrial plant being the Lydogniahütte at Konigshütte. In subsequent time Upper Silesia became the greatest zinc-producing district of Europe, indeed of the world, a position that it held until displaced by Joplin and Broken Hill.

The ore deposits of Upper Silesia, which occur in Triassic dolomite, are of great magnitude. They occur in basins running about east and west, one very important basin extending through Stadt Dombrowa and Scharley. Another, which is chiefly the source of the blende, lies on a line passing through the city of Beuthen. The

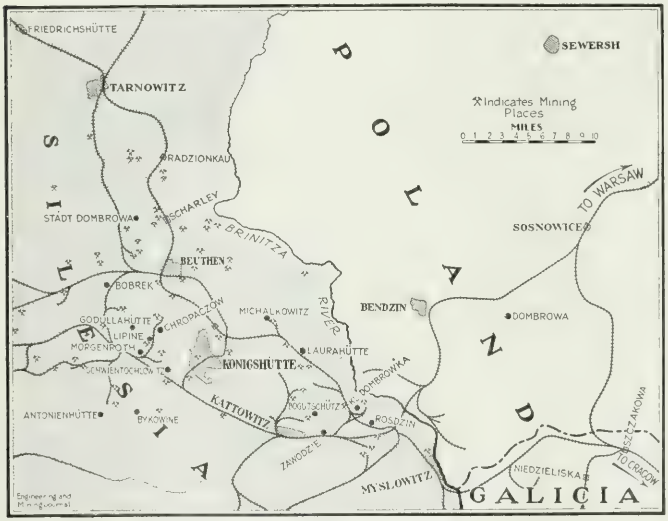


INTERIOR OF A SILESIAN ZINC SMELTERY OF ABOUT 1850

Drawn by Arthur Ormay from a water-color by Frederick A. Thum.

zinc mines of this district produce lead as well as zinc. Adjacent to the zinc-lead deposits are rich and extensive coal measures which furnish the fuel for the metallurgical industry, zinc, lead and iron smelting being practiced here on a large scale. If Düsseldorf and nearby cities in Westphalia constitute the Pittsburgh district of Germany, Beuthen and vicinity is the Birmingham. The zinc-lead and coal mines and the corresponding smelting works cluster thickly on every hand and are in immediate proximity to the Russian boundary. The important towns of this region are shown on the accompanying map, most of the places indicated being the sites of zinc-smelting works. At Rosdzin there is besides the zinc smeltery a very important lead smeltery and at Tarnowitz is the lead-smelting works that is classic in metallurgical literature.

The deposits of zinc ore and the coal measures extend eastward into Poland. In Poland there are two zinc-smelting works, one at Constantin and one at Dombrowa, near Bendzin; and there are famous mines at Olkusz, a little to the east of the limit of our map. In Galicia, Austrian Poland, zinc smelting is done at Niedzieliska, shown on the map, and at Siersza and Trzebinia, which are not shown on the map.



Portions of Poland, Silesia and Galicia

The large engraving on the preceding page is a view of the interior of a Silesian zinc smelting works of about 1850, which was prior to the era of gas-firing and modern mechanical improvements. Frederick A. Thum, the distinguished metallurgist of the Balbach Smelting & Refining Co., who died a few weeks ago, was in Silesia in his early years and while there drew the picture from which our engraving is reproduced. After his death his son, William Thum, manager of the Grasselli refinery of the U. S. Metals Refining Co. discovered this picture among his father's papers and allowed us to reproduce it. Frederick A. Thum was noted for his combination of skill as a mechanical draftsman and as an artist. His working drawings always had an artistic element about them. The drawing that we have reproduced was done in water-colors, and was a very effective piece of work, being enlivened by the orange flames in the furnaces, with here and there the characteristic bluish-green coloration of burning zinc. The limitations of our methods prevented reproduction in color, but Arthur Ormay, our chief draftsman, made a pencil copy of the original, doing a remarkably creditable piece of work, which permitted a photograph to be made for the use of the engraver.

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Pyrites in 1914

The production of pyrites in 1914, while declining in several states, was well maintained on the whole by the restriction of importation from Europe, and several companies had the best year in their history. The recession in the fertilizer business in the latter half of 1914 would have had a more serious effect on the mining of pyrites had not the rise of shipping rates reduced the importations from Spain, Portugal and Norway to about one-half the quantity imported in the previous year.

Virginia continued to lead in pyrites production, the largest individual operator being the Arminius Chemical Co., with an output of about 53,000 long tons; the Sulphur Mining & Railroad Co. also operated its property at Mineral, though at somewhat reduced capacity; the Boyd Smith mine, situated between these two properties, made no production in 1914, but the owners expect to place the mine on a producing basis as soon as normal conditions prevail. The Cabin Branch Mining Co., at Dumfries, made its usual output and the pyrrhotite mines in the southwestern part of the state were also operated.

In New York, the principal producer, the St. Lawrence Pyrites Co., at De Kalb Junction, made the greatest output in its history, shipping out 56,000 tons of concentrate and 2000 tons of crude ore; the mill ran throughout the year with the exception of about three weeks, during which extraordinary repairs were made.

In California, which stands third among the states producing pyrites, the output is largely from cupriferous pyrite from Keswick and the market was not benefited by the restriction of European importations, as was the case in the Appalachian states. In the Middle States, aside from Wisconsin, which produces marcasite, the pyrites production is mainly a byproduct of coal mining and fluctuates with that production and the market demands. Arkansas made a small production of crude ore, which was used in nearby plants. In Georgia the production remained small.

The Northern Pyrites Co., at Northpines, Ont., had a satisfactory year shipping its concentrates to Lake and Mississippi Valley plants, though some of the output also reaches Eastern plants. The company increased its output in 1911, and changed from wood to coal fuel.

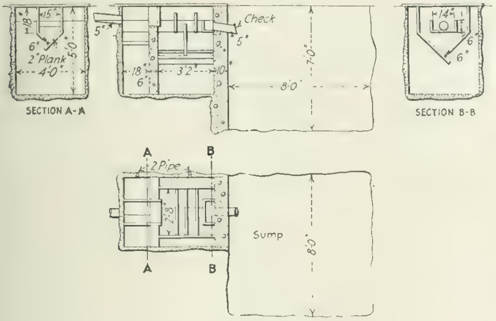
Details of Practical Mining

Septic Tank for Underground Latrine

By H. G. Pickard[*]

The septic tank shown in the accompanying sketch was designed by me for the Mond Nickel Co.'s Frood Extension mine at Sudbury. The Ontario mining law requires the provision of underground closets, and the Provincial health laws forbid the discharging of untreated sewage into running streams.

At the best the ordinary box closet is a nuisance, and there are many objections to running untreated sewage through the pumps to the surface. To overcome the objections to these types of closets, it was decided to introduce a septic tank. The stools flush automatically and discharge through a pipe into the tank, which may be located at any point provided there is sufficient fall from the tank to the pump sump. The sketch shows the ideal location, since the excavations for sump and tank may be taken out at one operation.



Arrangement of Septic Tank

With septic tanks, as ordinarily constructed, it is found necessary to clean out the sediment that is deposited from once to twice a year. To obviate the necessity of doing this cleaning by hand, iron pipes having their ends drawn to flat nozzle are inserted in the concrete lining of the tank. The pipes are bent so as to deflect a stream of water toward the centers of the chambers. A bypass from the pump connects with the wash pipes, and sediment may be washed into the sump, where it will remain long enough in suspension to be discharged by the pump before settling. The tank shown was designed to accommodate a force of one hundred and fifty men per day.

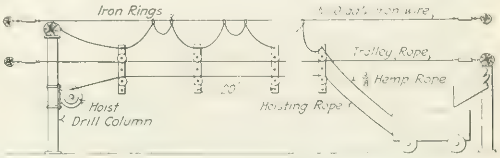
*

The Precipitation of the Oxides of the Rare Metals from Their Solutions is said to be greatly increased by slight pressures in excess of atmospheric. The application of this to the recovery of vanadium, tungsten, uranium oxides, etc., is covered by Royal S. Davis in U. S. pat. No. 1,119,929.

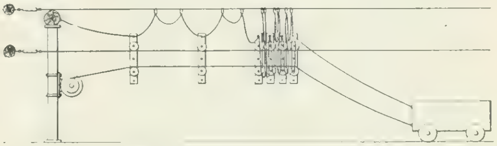
Substitute for Rollers in Incline

By H. H. Hodgkinson[*]

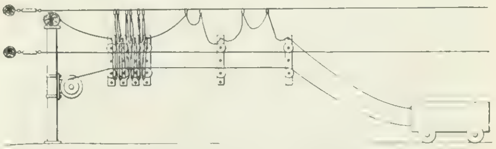
To pull rock or ore up grade in cars for 300 or 400 ft., a small drill-column hoist was used, having a rope speed of 80 ft. per min. with a pull of 500 lb.; it was found, however, that the hoist on being tested to the limit had a pull of over 1000 lb. at about half the speed. Because of the weight to be pulled and the small diameter of the hoist drum, a ¼-in. galvanized plow-steel rope was used. So small a rope had to be kept from dragging upon the ground or it would soon have worn out. Rollers were first tried for keeping the rope off the bottom, but proved unsuccessful, inasmuch as the weight of the rope was not enough to revolve them. Furthermore, although they were only about 12 ft. apart, the rope dragged on the ground between them when the car was lowered.



CAR READY TO BE HOISTED



CAR BEING HOISTED, TROLLEYS AND HEMP ROPE CLOSING UP



CAR BEING LOWERED, TROLLEYS OPENING OUT

Diagrammatic Representation of Haulage Installation

Therefore, as a substitute for the rollers, an old ½-in. hoisting rope was stretched from the point where the cars were loaded to the point where they were dumped, firmly anchored at each end and tightened by means of two turn-buckles. This rope was 8 ft. above the center of the track; on it double-wheel trolleys were hung at 20-ft. intervals; the upper wheels traveled on the ½-in. rope, while the lower wheels carried the ¼-in. hoisting rope. As the car was hauled up, these trolleys all advanced along the ½-in. rope until the car reached the dumping point. The trolley wheels were ⅝x3-in. pulley-block wheels with ½-in. bolts as shafts; the yoke was made of ⅜x2-in. iron.

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[*] Dumfries, Va.

[*] Mining engineer, Franklin Furnace, N. J.

The grade, however, was not great enough to cause the trolleys to travel down the incline. In order to make them take their respective positions again, a No. 10 galvanized iron wire was suspended at the same elevation and parallel to the ½-in. rope, but 3 ft. to one side, and was also tightened. In order to avoid confusion, it is shown in the illustration as placed above the ½-in. rope. On this wire were placed two small iron rings between each pair of trolleys. A ⅜-in. hemp rope was then used to connect trolleys and rings in series as shown. The last trolley, that nearest the car, was connected to the car by means of the same rope.

The descending car by means of the hemp rope pulled the trolleys back down the ½-in. rope and spaced them properly. The rings on the small wire looped up the hemp rope and took up its slack so that it did not become tangled, or drag on the ground.

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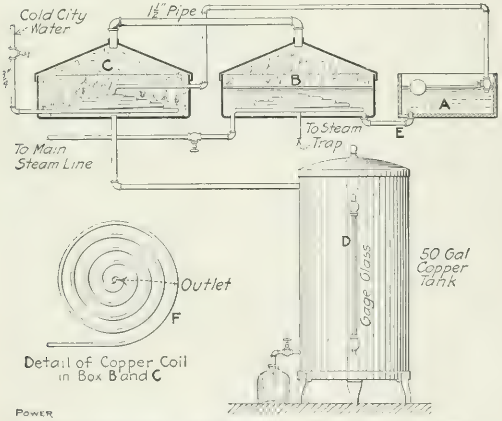
Water-Distilling Apparatus

Apparatus for distilling water for drinking purposes is described in *Power* by C. E. Anderson. It may offer suggestions to mines where safe drinking water is hard to obtain.



APPARATUS FOR EVAPORATING DRINKING WATER

The wooden box *A* contains a copper-ball float and valve for regulating the height of water in the box *B*, so as to cover the steam coil about 1 in. The water from *A* flows by gravity to the box or evaporator *B*, through the connecting pipe *E*.

The evaporator *B* and the condenser *C* are round copper pans about 28 in. diameter by 8 in. deep, tinned on the inside and lagged on the outside with 1-in. magnesia-asbestos pipe covering. In the bottom of each is a coil of ¾-in. copper pipe well tinned on the outside. The top of the evaporator has a snug fitting, funnel-shaped copper cover, with a 1½-in. outlet at the top, connected by a 1½-in. pipe with a similar arrangement on the condenser.

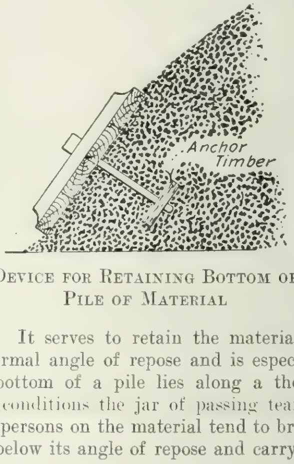
One end of the coil in the evaporator is connected to the main steam line with a globe valve between the coil and header, while the other end is connected to a steam trap. As the water boils in the evaporator it passes up and out through the 1½-in. pipe connection at the top and into *C*, where it is condensed when it comes in contact with the cold-water coil in the bottom. The condensed water then passes out by gravity through a 1-in. line in the bottom into the copper tank *D*, which is an ordinary 50-gal. tank, such as is used by lunch counters and restaurants to hold ice water.

The cold water in the coil in the condenser is not wasted. It is piped over to *A*, thereby saving a few heat units and materially helping the evaporator, as the water coming from the condenser coil is fairly warm.

*

Anchor Boards for Dump Bottom

The device illustrated is one described in the *Electrical World* as applied to a coal pile. It should prove equally applicable to piles of other material such as ore or waste. Its construction and installation are evident from the illustration. It serves to retain the material somewhat above its normal angle of repose and is especially useful where the bottom of a pile lies along a thoroughfare; under such conditions the jar of passing teams and the climbing of persons on the material tend to bring it to an inclination below its angle of repose and carry it into the thoroughfare.



DEVICE FOR RETAINING BOTTOM OF PILE OF MATERIAL

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Myers-Whaley Machines on the Rand*

The Myers-Whaley company last summer furnished two shoveling machines to the Crown Mines on the Witwatersrand. One machine was put in operation Aug. 3 in the 13th level from No. 7 shaft, the tunnel being 14 ft. wide and 10 ft. high. The second machine was started on Aug. 17, in the 16th level from No. 5 shaft.

The material in the first level mentioned was hard, and the drilling was slow. Previous to the installation of the machine, it had required from 5 to 7 hr. to muck out at the face and set up the drill columns, and during that time little muck was being sent out. After the installation of the machine, the muck was entirely loaded into cars, the face cleaned up and the columns set in 3 hr. The tram cars were heavy, and being loaded rapidly by the machine, they required a comparatively large crew for shifting them; six or seven Kafir boys were used for this purpose. After the mucking, these boys were employed in the stopes and on other work. The drilling and shooting in this heading required about 24 hr. per round, and the increase in speed was 3 or 4 hr. out of 30, or a net increase of about 10 per cent.

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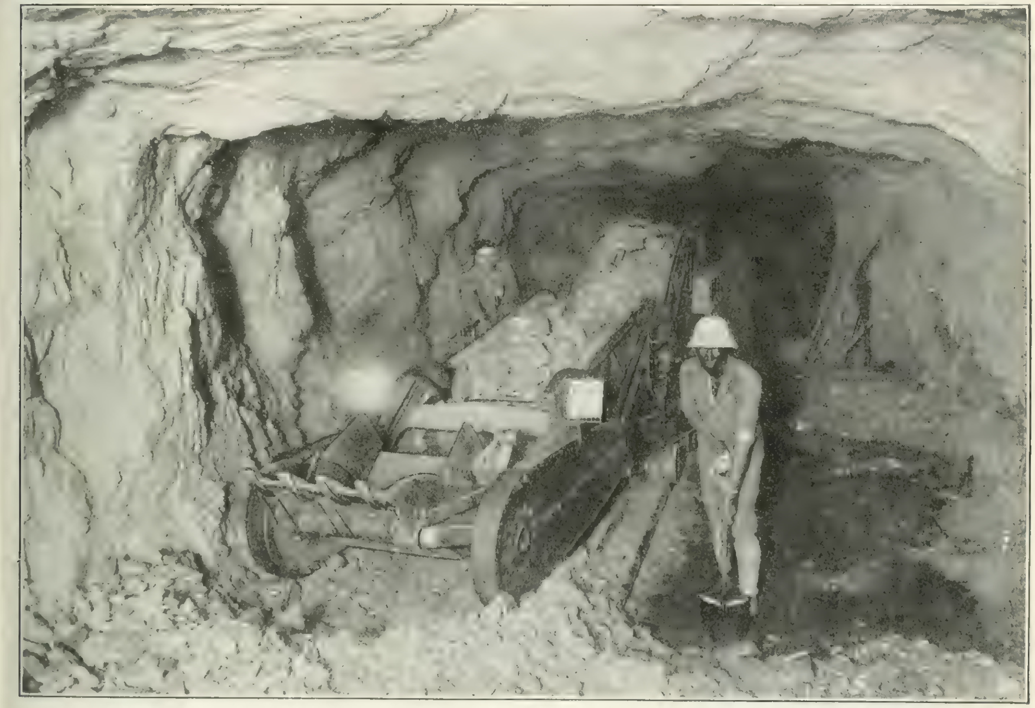
*From information furnished by the manufacturers

In the second heading, also 14x10 ft., the material was much softer, and the drilling and shooting of one round consumed 9 hr. The time for cleaning up with the machine was about 2 to 2½ hr., making the saving in time of mucking of about 3 to 4 hr., and a net gain in the speed of driving of about 25%. Previous to the installation of the machine, the heading had been advancing about 130 ft. per month, which was increased immediately upon the installation of the machine to about 170 ft.

Kafir boys were taught to operate one of the machines, and have been operating it satisfactorily ever since its installation. On the other machine, Hindoos were first tried, but they proved indolent and unreliable. and a white man was afterward put on.



A Myers-Whaley Machine Mucking Out the Face of a 10x14-Ft. Drift in the Crown Mines

The actual economy is a little hard to arrive at, as the number of Kafir boys used on hand mucking varied with the day's labor supply; if boys were needed some place else in the mine, two or three might be taken from the drift, or if there were two or three extra, they might be used in the drift. It varied also with the time that had elapsed since the blast. That is, immediately after the blast, more boys might be sent in to hurry up the mucking-back at the face, and after that was accomplished they were sent back to the stopes. In this way, the number of boys has been noticed to vary from six to 14. The average may be taken as 10, working over a period of 10 hr. They were paid 2s. 6d., or about 62c. for 8 hr. The muck boss was paid 16s. per shift of 8 hr. The cost is then 77.5c. per boy for 10 hr., or $7.75 for boys, $4.85 for muck boss, a total of $12.60. On the machine, the muck boss was the operator in No. 7 shaft, and had a crew of eight boys. The machine cleaned up in an average time of 3 hr. The cost was therefore: Boys, $1.78; muck boss, $1.44; total, $3.22.

The machines are operated on a 500-volt direct current; each weighs approximately 17,000 lb. The shovel which takes up the material and delivers it to the conveyor is mounted on a jib which swings laterally, reaching 10 ft. on each side, and is therefore able to reach all parts of the face from one track. The rear conveyor also swings laterally, and can load on one or more tracks behind the machine. In one of these headings, double tracks were laid behind the machine and cars loaded on both tracks. In the other heading, a single track was used, and cars were loaded and pushed out one at a time. Both arrangements worked well.

*

Book Varnish for Tropics

The following ingredients make a varnish that has been found very useful in protecting books from mold and from roaches, says the *Canal Record*: Bichloride of mercury, two parts; orange shellac, 20 parts; oil of turpentine, 250 parts, and the balance up to 1000 parts, 95% ethyl alcohol. Mix thoroughly, shake before using, and apply with a rag. This varnish is, of course, highly poisonous when taken internally.

Details of Milling and Smelting

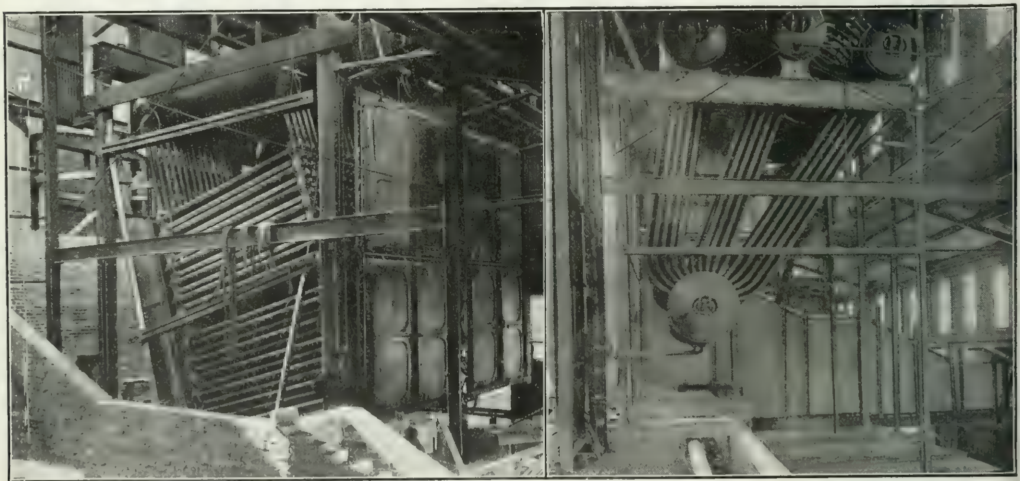
Reverberatory Waste-Heat Boilers

By Lindsay Duncan*

The loss of heat units in industrial processes is so obviously an economic crime that the question of the desirability of installing waste-heat boilers in the flue system of reverberatory furnaces affords little ground for discussion. However, I propose to present some records of results in the Steptoe smelting works as an indication of the returns which may reasonably be expected from an investment of this sort.

Some Essential Features of Design

The flue setting of the boilers should be such as to afford the gases as direct a passage as possible from the throat of the furnace to the dust chamber at the base of the stack. Any type of boiler that causes the gases to make two or more passes is unsuited for a waste-heat installation.



Two Types of Waste-Heat Boilers in Course of Installation at the Steptoe Works

A modern reverberatory furnace is large enough so that a satisfactory installation will consist of two boilers per furnace. The boilers should be placed in parallel, not in series; the flue and damper system so arranged that either one or both boilers may be cut out without interfering with the operation of the furnace. The accompanying diagram shows a typical installation. The correct amount of heating surface per furnace depends upon the temperature and volume of the gases and hence upon the fuel consumed. Good practice calls for between 1 and 1.3 sq.ft. of boiler-heating surface per square foot of furnace area at the skimming line.

The boiler-feed lines and feed pumps should be in duplicate and every precaution taken to insure a continuous supply of water to the boilers. Compressed air and not steam must be used to blow the dust from the tubes as the latter will unite with the sulphides in the flue dust and form sulphuric acid with disastrous results.

Cost of Plant

The actual cost of a battery of two 400-hp. waste-heat boilers installed at the Steptoe works was as follows:

Boilers and erection	$12,214.48
Brick setting, flues and dampers	1,675.98
Steam and water piping	2,735.32
	$16,625.78
Per boiler-horsepower	20.78

This does not include steam and water lines to the power house, the feed pumps, heaters, nor the building over the boilers. Taking these all into consideration the cost per boiler-horsepower of a complete plant will be about $25 per installed boiler-horsepower. Due to furnace repairs and boiler-washing, a boiler will be out of service 25% to 30% of the time, hence the installation cost is about $35 per operating boiler-horsepower.

Operating Costs

To handle a plant with six 400-hp. boilers under steam requires a water-tender for three shifts and a tube-blower for two shifts.

Water-tenders, 3 @ $3.50	$10.50
Tube blowers, 2 @ $3.25	6.50
Operating labor per day	$17.00

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*Mechanical engineer, Steptoe Valley Smelting & Mining Co., McGill, Nev.

The repairs and boiler washing were $5,610 per annum.

Operating labor, $17 × 365	$6,205.00
Repairs	5,610.00
Total for 2400 boiler horsepowe	$11,815.00
Per year per boiler horsepower	$4.92

To summarize the costs per operating boiler-horsepower-year.

Interest—$35 @ 6%	$2.10
Depreciation @ 8%	2.80
Amortization @ 7%	2.45
Operation and repairs	4.92
Total operating cost per boiler-horsepower-year	$12.27

Returns on Investment

The value of the steam generated depends upon the market for power and the costs of the fuel burned under power-house boilers. At the Steptoe works, California crude oil costing $1.65 per bbl. is burned in the reverberatories while slack coal at $4.45 per ton is used in the power house. Due to storage shrinkage and loss in handling, the coal shows a net loss of 8%, making the actual cost of coal as fired $4.84 per ton.

During the first six months of 1914 there averaged 5.9 boilers in service which evaporated 324,457,191 lb. of water from 140° F. to 160 lb. gage—an average of 109,985,488 lb. per boiler per year. This corresponds to 125,733,674 lb. from and at 212° F. Under ordinary conditions with the slack coal used at McGill, an evaporation of 9.25 lb. of water from and at 212° F. can be obtained so that each waste-heat boiler would represent an equivalent coal consumption of 125,733,674 ÷ 9.25 = 13,582,020 lb., or 6791.01 tons. At $4.84 per ton, this would amount to $32,868.49, or $82.17 per year per boiler horsepower in service.

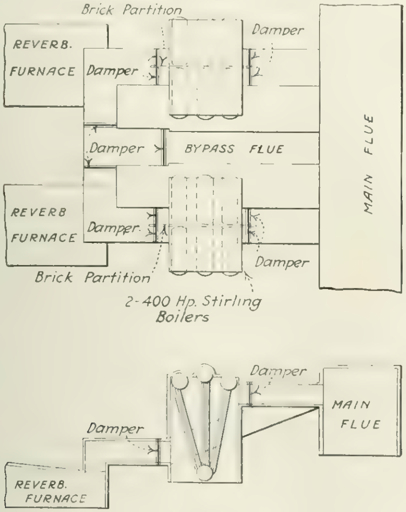

Diagram of Waste-Heat Boiler and Connections

However, another phase of this problem occurs in that the rate of steam flow is irregular. Charts from a recording steam-flow meter show that a fluctuation of 20% above or below the average may be expected. With waste-heat boilers furnishing a comparatively small proportion of the total steam—say one-fourth or one-third—this fluctuation is not serious, but when they furnish over one-half of the total steam, the coal-fired boilers have to be fired irregularly and a low evaporation is bound to result. A deduction of from 10% to 20% should be made from the waste-heat credit on that account. Steam lost by line condensation or used for atomizing or for the preliminary heating of oil fuel should also be deducted from the reverberatory credit. These items will amount to about 15% of the steam generated so that the returns to be expected per boiler-horsepower in operation will be as follows:

Gross value of steam	$82.17
Less 15%	12.32
	$69.85
Fixed and operating charges	12.27
Net returns per boiler-horsepower year	$57.58

So it can be seen that a handsome return may be obtained by the installation of these boilers.

Operating Conditions

The primary purpose of a reverberatory furnace is to produce matte, not steam, so that draft and fuel regulation are governed by metallurgical conditions instead of by the power required and should be under the charge of the reverberatory foreman. The power-house foreman should have charge of the water-tending, tube-blowing, boiler-washing and repairs. To get good results these two men must work in harmony.

At the Steptoe plant, feed water for the waste-heat boilers is measured by a Wilcox water weigher and delivered to a separate hotwell from which the waste-heat feed pumps take their suction. The feed-pump discharge passes through two closed heaters and then into the boilers. Pumps and feed lines are in duplicate. The returning steam is measured by a General Electric recording meter.

I believe that the flow-meter record is the correct basis for calculating the steam credit, as the meter is accurate and such uncertainties as line condensation, boiler blow-off, safety-valve discharge, steam for oil heating and atomization, etc., are eliminated. The meter should, of course, be checked by the water weigher and any discrepancies investigated.

Wooden Piston Rings for Pump

Wood is recommended for the piston rings of the water end of a vacuum pump, by C. R. McGahey, writing in *Power*. When properly put in it allows the pump to run with little friction. The wood should be hard and close-grained so as not to split easily. The method of applying such rings is shown by the illustration; they should be made to fit perfectly between plates 1 and 2. The spring used to force the blocks against the cylinder walls is best made of brass ribbon about No. 20 gage, which will not rust out. A set of these blocks should last several years if properly made.

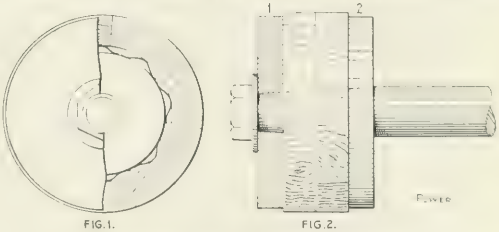

FIG.1. FIG.2.

Plunger with Wooden Packing

Tonopah in 1914

By Frederick Bradshaw*

Tonopah's output of the precious metals for 1914 was practically the same as for 1913. During the year 12 mines produced approximately 129,886 oz. of gold and 11,776,537 oz. of silver from 547,979 tons of ore, while in 1913 the production of 11 mines was 120,189 oz. of gold and 11,973,540 oz. of silver from 551,710 tons.

The value of the product, about $9,015,000 in 1914 as compared with $9,725,000 in 1913, shows a decrease of about $710,000 on a closely comparable tonnage output. It is noteworthy that in 1914 the gold-silver ratio was higher than in previous years (1 : 90.5 in 1914, and 1 : 99.6 in 1913). The increase in the 1914 gold outturn of about 9700 oz. would have over-balanced the decrease of 197,000 oz. in the silver outturn had the price of silver been the same for the two years. The greatly reduced price received for silver, 54.78c. per oz. in 1914 as against 59.79c. per oz. in 1913, is therefore responsible for the decreased gross value of the 1914 production.

The estimated itemized production for 1914 in tons, ounces of gold and ounces of silver and the approximate gross values are tabulated herewith:

1914 PRODUCTION OF TONOPAH

	Tons	Oz. Gold	Oz Silver	Estimated Gross Value
Tonopah Belmont Dev. Co..	179,706	43,864	4,182,537	$3,189,318 04
Tonopah Mining Co of Nev. ..	144,323	37,275	3,206,275	2,446,000 00
Tonopah Extension Mg Co ..	62,489	14,670	1,389,000	1,058,000 00
Jim Butler Tonopah Mg. Co... .	38,466	12,117	1,053,189	821,121.40
West End Cons Mining Co	55,850	11,190	1,072,882	793,242 72
Montana Tonopah Mines Co ...	44,267	6,230	456,707	383,963 44
Tonopah North Star T. & D. Co.	5,232	1,462	145,314	110,650.00
Tonopah Merger Mining Co....	4,760	1,417	122,412	98,552 25
Halifax Tonopah Mining Co	3,983	804	80,555	58,018 48
MacNamara Mining Co.	8,021	631	45,471	38,697 62
Tonopah Midway Mining Co	832	202	20,033	15,626.41
Mizpah Extension Co	50	24	2,162	1,551 49
	547,979	129,886	11,776,537	$9,014,741 85

Dividends paid by Tonopah mining companies in 1914 aggregated $3,013,803. The Tonopah Belmont Development Co. paid $1,462,500; the Tonopah Mining Co. of Nevada, $1,000,000; the Tonopah Extension Mining Co., $283,030, and the West End Consolidated Mining Co., $268,273. Dividends paid by Tonopah mining companies to date total $21,063,061. The total production of the mines to date is $70,182,357.

Consequent upon the European war, a great depression in the silver market prevailed after July. With a few exceptions, the Tonopah mining companies after July stored their silver. The gold is sold, but since gold values are but 30% of the total, the proceeds from its sale by no means meet the operating expenses.

Aside from the silver situation, the European war has had a widespread effect in shortening of mining supplies, and particularly in the curtailment of cyanide-mill supplies. To date, however, this effect has not been felt in the Tonopah district and no stoppage of operations has resulted from inability to secure supplies.

During the year the Tonopah Belmont Development Co. operated its 500-ton cyanide mill to full capacity. In the mine, developments on the Favorite vein proved a remarkable deposit of high-grade ore, while many other veins were exploited with gratifying results. The cyanide mill of this company at Millers, Nev., operated continuously as a custom mill and is at present being remodeled and improved, meantime running at half capacity. This company is developing, under option and bond, a large medium-grade gold property in British Columbia.

The Tonopah Mining Co. of Nevada developed much new ground and has found new ore. The company's 500-ton cyanide mill at Millers, Nev., originally a plant in which about half of the tonnage was leached as sand and the other half was slimed, agitated and filtered, has been remodeled and, by the addition of tube mills, made into a 400-ton, all-sliming mill. The counter-current system of continuous decantation is used and better extractions have been attained. The company owns control of the Tonopah Placers Co., which is successfully operating gold dredges at Breckenridge, Colo. The company is also developing promising gold properties in Nicaragua.

The Tonopah Extension Mining Co. during 1914 increased its ore reserves so that these are at present greater than at any previous time. It increased its 30-stamp mill by the addition of 10 stamps, two tube mills and eight concentrating tables and is at present milling 250 tons daily. At the new shaft a new Nordberg hoist and a 1500-cu.ft. motor-driven direct-connected air compressor and many other improvements were installed.

The Jim Butler Tonopah Mining Co. during the year opened large ore deposits in its Stone Cabin claim and these were continuously operated through the Desert Queen shaft. The Wandering Boy shaft of this company was operated continuously until November, when work was stopped for the retimbering of the shaft, which has been completed. The year was the most prosperous one in the life of this company. The ore reserves are vastly greater and the physical condition of the property greatly better than at any previous time.

The West End Consolidated Mining Co. completed the enlargement of its mill, adding 10 stamps and a tube mill. New orebodies have recently been opened in the Ohio claim to the northwest of the old mine workings.

The Montana Tonopah Mines Co. continued regular operation until September, when, because of the low price of silver, milling was discontinued, and a campaign of development started.

The Tonopah North Star Tunnel & Development Co. continued regular operations and shipments. The Tonopah Merger Mining Co. continued regular shipments until August, when a large flow of water caused suspension of operations. Pumps are now handling the water and work is progressing. The Halifax Tonopah Mining Co. continued deep development until December, when retimbering of the shaft became necessary. After completion of this work, which is now in progress, the regular operations will be resumed. The MacNamara Mining Co. temporarily suspended operations in August. The Tonopah Midway Mining Co. continued development for most of the year. A part of this property has been under lease to the Montana Tonopah. The Mizpah Extension Co. continued development and made some small shipments. Recently this property has been taken over by the Tonopah Mining Co.

The Tonopah Victor Mining Co., the Rescue Eula Mining Co., the Monarch Pittsburgh Mining Co., the Umatilla Tonopah Mining Co., the Buckeye Belmont Mining Co., the Cash Boy Mining & Leasing Co., the Gypsy Queen Mining Co., the Tonopah East End Development Co. and others have prosecuted development through all or part of the year.

The area of the known ore deposition in Tonopah has been increased easterly and westerly for a considerable distance. To the east the Mizpah Extension Mining Co. found ore in the "lode porphyry" and to the west the Tonopah Extension Mining Co. proved large bodies of high-grade ore in a contact replacement. The major axis, easterly and westerly, of the proven ore zone is over 2½ miles in length and will probably be further extended.

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*General superintendent, Tonopah Belmont Development Co., Tonopah, Nev.

The Comstock Lode in 1914

Virginia City Correspondence

During 1914 the Comstock was not so prosperous as its friends would like to see it. The principal event was the initiation of pumping operations in the Gold Hill mines by the Sturges interests, which control the Yellow Jacket, Crown Point and Belcher mines. Two Byron Jackson centrifugal pumps, similar to those installed by me on the 2500-ft. level of the C. & C. shaft, although of somewhat smaller capacity, were started in the old Belcher incline at the 1400-ft. level, which corresponds to the Sutro Tunnel and the 1600-ft. level of the Virginia mines.

Progress was made in cleaning out the old incline and in lowering the water. By April the old 1600-ft. level had been recovered and prospecting was carried on upon the 1500- and 1600-ft. levels, low-grade ore being also taken, as formerly, from the vicinity of the upper workings, but not of a high enough grade to pay all the expenses.

A promising body of ore has since been developed upon the 1500- and 1600-ft. levels in the Belcher mine, mill samples of which run from $8 to $10 per ton. This ore is what is known as the "White Rock," or "Gold Vein," and lies to the west of the old bonanza stopes, where the values were both gold and silver in about equal proportions. In places this orebody is 60 to 80 ft. wide. The assays vary considerably from place to place and the length thus far worked has not been much greater than the width.

The significance of the discovery, however, lies in the fact that this is the first time since 1886 that any work has been done below the 1400-ft. level. The Gold Hill mines were flooded in 1880, and after being pumped out, were again flooded in 1881. The water rose slowly, and some work was done below the 1400-ft. level, mostly in taking out ore then in sight, up to 1886, when the Combination shaft in Virginia City stopped pumping. In that year the water in the Gold Hill mines rose rapidly, and after that up to the present year, work was confined to reworking again and again the old orebodies above the Sutro tunnel level.

Immense masses of quartz exist in the Gold Hill section of the Comstock and there is no reason why, with the lowering of the water, other orebodies, especially of the gold ore, should not be found in the Belcher, Crown Point and Yellow Jacket and other mines, of a higher grade than that recently encountered.

The principal difficulty encountered by the Sturges interests in working the Belcher ore, and the same will apply to other orebodies, is that the mines are not at the present time opened up for economical mining operations. The ore is treated in the Yellow Jacket mill and it is handled seven times, through winzes, levels, inclines, shaft, etc., before it is delivered in the mill bins. The Sturges interests have spent a large amount of money in exploration, and they now find that they must spend a further amount in order to place the mines in condition for operation at a profit.

The Morrow interests have continued prospecting operations near the surface in the Confidence, Challenge and Imperial, and near the tunnel level in the Overman. Lowering of the water in the North End mines has made a gradual reduction in the Overman mine, which will soon be able to prospect, if its owner so desires, below the tunnel level.

The Caledonia has been prospecting its ground through the New York shaft, which was acquired when the Caledonia mine changed hands, and the company was refused permission to work, as formerly, through the Overman shaft. The new shaft has been connected with the Caledonia workings and the vein has been explored in various places above the tunnel level.

In the Virginia City mines during the first half of the year, there was little work done, owing to the differences of opinion in regard to the management of the pumping association, which were continued from last year. The Mexican company, having withdrawn from the association, operated a lease upon the Monte Cristo mine, which is owned by Charles Butters & Co., Ltd., up to the end of May, the ore being trammed to the Mexican mill. The Mexican company, finding the Monte Cristo ore unprofitable below the 250-ft. level, ceased operations on the above date. Early in 1914, the company acquired some interests in the camp of Rochester, in Humboldt County, but an adverse decision by Judge Harrington in regard to a contract which it had made with the Rochester Mines Co. for the construction of a mill at that camp, caused it to refrain from any active work.

In July the differences between the Mexican and Union companies and the brokers who controlled the pumping association were compromised, all suits against the Mexican company, its directors, and Whitman Symmes, its superintendent, being withdrawn, Whitman Symmes at the same time withdrawing the suits which he had brought against the brokers who were in control of the North End mines and the pumping association. It was expected that this compromise would lead to a rapid revival of work in the Virginia City mines and the lowering of the water 200 ft. more to the 2700-ft. level, which was necessary for opening up new ground for exploration. Scarcely had operations begun, however, when the European war broke out, and the San Francisco Stock Exchange was closed. The Mexican company had funds in hand, but the other Virginia City companies were depending upon assessments, which are generally paid in through the stock brokers, and which it was impracticable to collect while the stock exchange was closed.

The reopening of the stock exchange has not as yet proved of the benefit it was expected, as the pumping association had not, until recently, taken any action toward lowering the water to the 2700-ft. level. Apparently the public that pays the assessments believes that there is a good gamble in new ground which is open for exploration (or rather old ground which has not been explored since the mines were flooded in 1883). A plan has recently been submitted to the pumping association by Superintendents W. E. Sharon, Whitman Symmes and Thos. F. McCormick in regard to lowering the water to the 2700-ft. level, and will be shortly acted upon by the pumping association If mining at the north end is to be revived, it will have to be done along the lines suggested.

At the present time Union is exploring upon the 2650-ft. level. It has thus far been possible to handle the water encountered by means of winze pumps, on account of the distance of the territory worked from the old workings. In October Mexican was just beginning to do similar work upon the 2650-ft. level, when a fire in the old stopes which were being timbered with airways, ready to be filled with waste, caused the loss of access to that level. The fire has since been extinguished, and Mexican recently encountered what may be the upper tip of a good body of $30 ore upon the 2300-ft. level, to the south of the Mexican stopes.

Charles F. Duval, lessee of the Chollar and Potosi, and of the Butters mill, operated steadily upon low-grade ore in the outcrop and the upper levels of these mines. In the neighborhood of 200 tons per day of $4 rock is being handled.

The Techow and Waterhouse lessees on the Sierra Nevada outcrop on Cedar Hill intermittently operated their mill upon the low-grade gold ore taken from near the surface.

The Comstock-Phœnix, in Six-Mile Cañon, milled during the greater part of 1914 and is now doing some exploration work upon the 500-ft. level.

Kootenay Notes

By S. S. Fowler*

In the three Kootenay divisions, namely, the Fort Steele, the Nelson and the Slocan-Ainsworth, production proceeded up to early August on a scale somewhat larger than in 1913. The refusal of the Consolidated Mining & Smelting Co. in August to accept ores on existing terms forced most of the silver and lead mines to close or to curtail production. The Sullivan, however, continued operations and at the close of the year, as for some time previously, afforded the chief ore supply of the Trail lead furnaces. The Standard Silver-Lead shipped for a while but later suspended all operations, except development. The Bluebell did not work after the early part of August. Several of the small mines, however, continued to produce, particularly those whose products were especially desirable. The lead production for the year, as well as the silver, was well below that of 1913.

In the Nelson division, the Motherlode and Queen mines on Sheep Creek maintained their output of gold, while other smaller mines operated more or less intermittently. The Emerald, H. B. and others produced some lead, both galena and oxidized, and shipped a little zinc carbonate. The most interesting event in this vicinity was the development of molybdenite deposits on certain claims on Lost Creek, south of Sheep Creek. The deposits are understood to be in veins in rocks of the Rossland Volcanic group, and are said to afford promise of important production in the near future. The Silver King and Molly Gibson mines were shut down when the price of silver dropped.

The completion of the Kootenay Central Ry. by the Canadian Pacific, extending from Golden on the main transcontinental line through the upper Columbia and Kootenay River Valleys to the Crow's Nest line at Covalli, will unquestionably tend to open up the silver-lead and other deposits in the Selkirk Mountains, the development of which has been retarded by their isolation.

In the Ainsworth division the Consolidated operated the Highland mine and mill, and No. 1 and other smaller properties during the first part of the year but closed them in August. The Bluebell was the third largest lead producer in Canada at the time of closing. Stoping here was carried on at about 200 ft. below the lake level. At Kaslo the matter of greatest interest in the latter part of the year was the consolidation of the Cork and Province mines by W. E. Zwicky and the resumption of operations after several years of idleness.

Yukon Placer Mining Regulations

By J. A. MacDonald*

The multiplicity of mining acts, rules and regulations in Yukon Territory has given rise to much litigation and dissatisfaction among the miners, while the difficulties met with by the surveyor of placer mining claims in disentangling the various intermixed regulations cause profound irritation on his part.

In 1884 there were about 250 placer claims surveyed in the Yukon in the vicinity of Forty-Mile River, 200 of which had been worked to some extent. In 1889 some changes were made in the Canadian Mining Act relating to placer mining in the Yukon, but they proved unsatisfactory. At the time of the great rush in 1897 the old act of 1889 was replaced by an act styled "Regulations Governing Placer Mining in the Yukon." This also proved unsatisfactory and a change was made in 1898; after three years' operation other changes were made in 1901. This 1901 act, while it pleased the big fellows, did not meet with favor from the miners, and consequently a radical change was made in the new act of 1906, entitled, "Yukon Placer Mining Act." Further amendments, however, have since been made.

The 1889 regulations governing quartz claims were made to apply to placer claims. There were to be erected on the end of the claim at high-water mark on both sides of the river eight posts to stake a claim, having the claimant's name with date of staking marked on each.

That these frequent and rapid changes in the mining regulations have caused endless litigation may be understood when it is considered that a bench claim of 1897, a plot 100 ft. square, has yielded $80,000; and it may be imagined that the demand on the surveyor for precise work is urgent. Some of the incongruities may be mentioned:

(1) Suppose that a creek forks; a base line is run up each fork of the creek, a miner stakes a claim on one fork a short distance up, and his claim being, as allowed, 1000 ft. on each side of the base line, may extend across the other fork, thus giving him two lengths of pay-streak, each the length of a claim, one on each creek.

(2) A small creek runs into a large one at right angles; the larger creek has a wide valley on the side upon which the smaller creek empties and its pay-streak lies on that side; a miner stakes a claim along the smaller creek in the valley of the larger one, so that his claim of 1000 ft. on each side of the base line along the smaller creek will include 2000 ft. of the pay-streak of the larger creek,

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*Box 83, Ottawa, Ont

whereas the instructions are that such pay-streak should be staked in claims of 500 ft. only.

(3) Angles in the base line and the treatment of claims in the vicinity of such angles give rise to much discussion and puzzle the surveyor.

At the 1914 session of Parliament in Ottawa an effort was made to improve the regulations by eliminating some of these incongruities, but difficulties were placed in the way and hence little was done.

As regards surveys of quartz or lode mineral-claims, the instructions of the department at Ottawa specify that "in making surveys of mineral claims and mill sites, it will not be necessary to take notice of placer claims or of the monuments making such claims."

F. H. Kitto, director of surveys in Yukon Territory, summarized at Ottawa the objectionable features of these placer-mining-claim regulations and offered suggestions for correcting their many incongruities and it is to be hoped the department, under whose jurisdiction these surveys are made, will act on them. The unsatisfactory conditions under which the miners labor, the endless confusion and litigation and the utter inability of the surveyor to work intelligently, all call for a drastic change.

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Bond Prices in 1914

The accompanying table shows the high, low, close and net change of the various bonds of the mining and metallurgical companies dealt in upon the New York Stock Exchange.

MINING AND METALLURGICAL BOND PRICES, 1914, ON THE NEW YORK EXCHANGE

1,059	American Smelting & Refining 6s	105	Feb. 4	101	Nov. 30	103	— ¼
1,913	Bethlehem Steel 1st ext 5s	100¼	July 23	93½	Jan. 5	98½	+ 5½
1,602	Bethlehem Steel ref. 5s	88⅛	Mar. 26	81⅜	Jan. 6	85¼	+ 4⅝
7	Chino Cop. 6s	166	April 3	150	Jan. 8	166	+23
1	Colorado Fuel & Ir. 6s	105	July 6	105	July 6	105	
78	Colorado Fuel & Ir. gen. 5s	99	Mar. 16	86	July 2	87	— 4½
2	Comstock Tunnel 4s	3	Feb. 26	3	Feb. 26	3	- 2
355	Granby Mining 6s	105½	April 2	95	Dec. 9	98½	— 4½
904	Illinois Steel deb. 4½s	89	Mar. 10	82¼	Dec. 31	82¼	— 1⅞
1,246	Indiana Steel 5s	102⅛	June 20	97	July 30	99½	+ ½
1,594	Inspiration Con Copper 6s	103	Feb. 5	94½	July 30	97	+ ½
699	Lackawanna Steel 5s 1915	99	Dec 30	93½	Jan. 5	99	+ 5
294	Lackawanna Steel 5s 1923	97	Feb 2	87		90	⅛
240	Lackawanna Steel 5s 1950	78½	Jan 23	69	Dec. 30	69	— 3
30	United States Red & Ref 6s	20	Jan 13	18	May 25	18	7
10,031	U. S. Steel 5s	103¼	Mar 24	99½	Nov 28	100	+ ⅛
1	Victor Fuel, 5s	73	April 29	73	April 29	73	7
130	Virginia Iron Coal & Coke 5s	94⅞	Jan 27	90	May 8	91	— 1½
1,035	National Tube 5s	100¼	May 18	96½	Jan. 5	97	+ 1¾
1,165	Ray Con. Cop 6s	95½	Feb. 7	92	Dec. 5	93¼	+ ⅝
14	Republic Iron & Steel 5s 1934	94⅝	June 16	90	Dec. 22	90¼	+ ¼
1,245	Republic Iron & Steel con. 5s 1940	101¼	June 1	100⅝	Jan. 9	100⅞	+ ¼

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La Grange "in Borrasca"

La Grange hydraulic mine, long known as the principal hydraulic operation in the United States, has fallen upon evil days, according to the report of the Consolidated Gold Fields of South Africa, which now controls La Grange. The mining season usually closes Sept. 30 with the shortage of water, and cleanups are made at most only three times a year. The preliminary figures for the season ended Sept. 30, 1914, indicated a loss in operating, complete returns for the season not being at hand at the date of the report. For the season ended Sept. 30, 1913, the profit above all expenses was only $9866 from the washing of 3,419,070 cu.yd. The cause of this regrettable condition is stated to be continued low gold content and cemented gravel, which reduced the duty per miner's inch of water. The report states that when working average gravel the profits should be about as previously estimated by engineers when the property was purchased.

The grade of gravel washed was extremely low, due to slides of top gravel, making it necessary to work most of the season in this low-grade material. The improvements in the water system are well along toward completion, and it is expected that this will be of much benefit to the operations of the present season.

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Revision of Mining Laws

The report of the committee on the revision of the mineral-land laws to the American Mining Congress, under date of Dec. 9, 1914, sets forth that the Congress has taken every opportunity to urge the creation of a Commission by act of the United States Congress which shall revise and codify the mineral-land laws now extant. Some progress has been made toward the accomplishment of this desire, since a bill providing for the appointment of such a commission was introduced in the Senate by Senator Smoot and was approved in a letter to Senator T. J. Walsh, Chairman of the Committee on Mines and Mining, by Secretary of the Interior Franklin K. Lane. The bill after some alterations was favorably reported by the Committee on Mines and Mining and was passed by the Senate on May 7, 1914. On Apr. 1, 1914, Mr. Taylor, of Colorado, introduced a similar measure in the House of Representatives, which was likewise approved by the Secretary of the Interior and reported back to the House by the Committee on Mines and Mining.

At this stage progress was stopped by the decision reached by Congress to restrict its legislative program for the remainder of the session to the Trust bills.

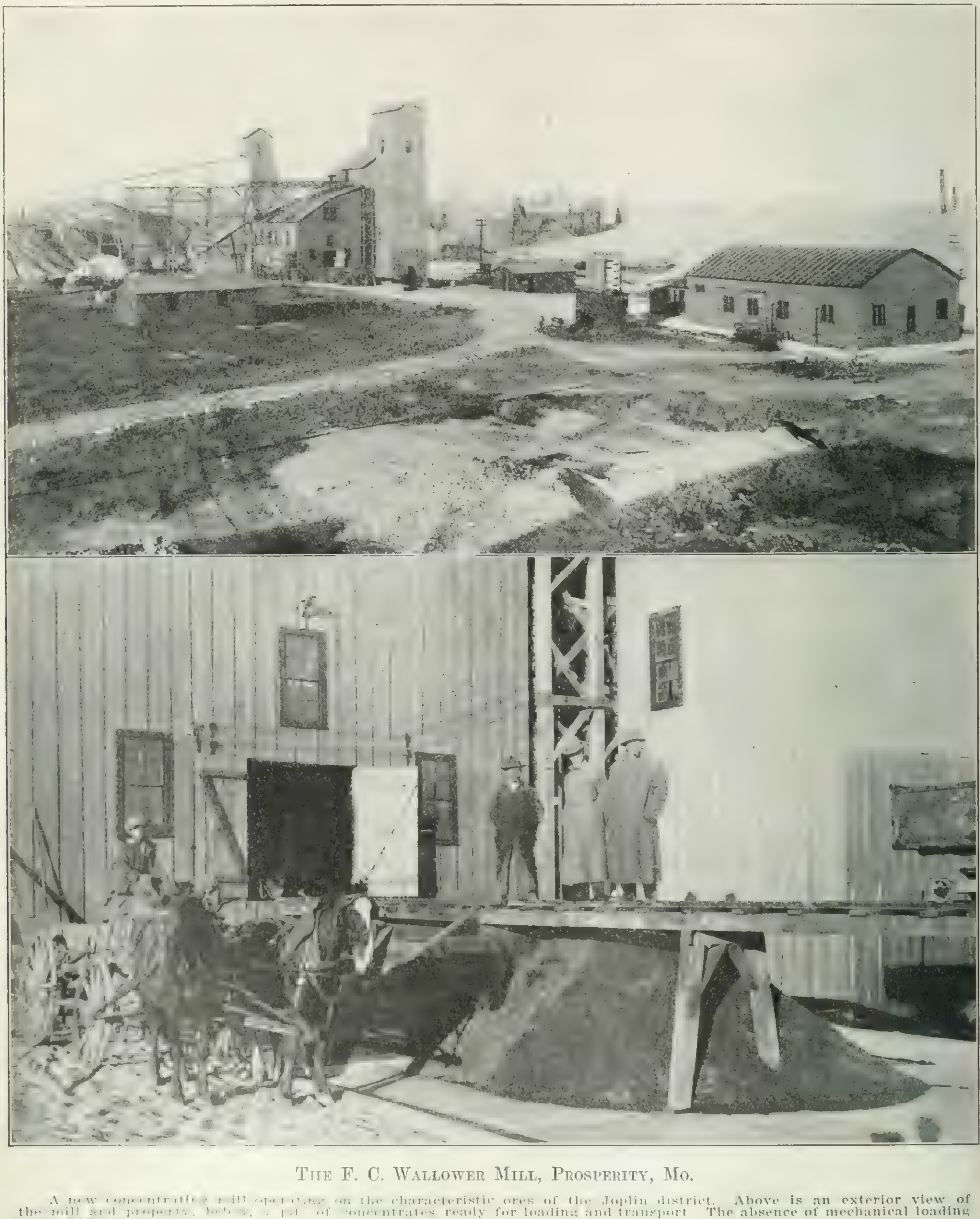
The recommendation of the American Mining Congress provided for a Commission of five members which should be selected by the President for their recognized knowledge and experience in the mining industry. In the Senate bill this was amended to create a commission of three members, two of whom should be lawyers and one a mining engineer. The House bill permitted the commission to consist of five members, but provided that they should serve without compensation. While these alterations are unsatisfactory, it is considered best to defer further efforts for their correction until after the passage of the House bill, and when it meets the Senate bill in conference.

The Committee of the American Mining Congress consists of E. B. Kirby, St. Louis, chairman, and L. V. Ray, Seward, Alaska; Will L. Clark, Jerome, Ariz.; E. H. Benjamin, San Francisco, Calif.; Victor C. Alderson, Denver, Colo.; Hennen Jennings, Washington, D. C.; J. H. Richards, Boise, Idaho; William Scallon, Helena, Mont.; Horace V. Winchell, Minneapolis, Minn.; D. C. McDonald, Ely, Nev.; C. P. Brown, Socorro, N. M.; H. H. Schwartz, Portland, Ore.; Isador Broman, Austin, Tex.; W. H. King, Salt Lake, Utah; L. K. Armstrong, Spokane, Wash., and Edwin Hall, Lusk, Wyo.

⁂

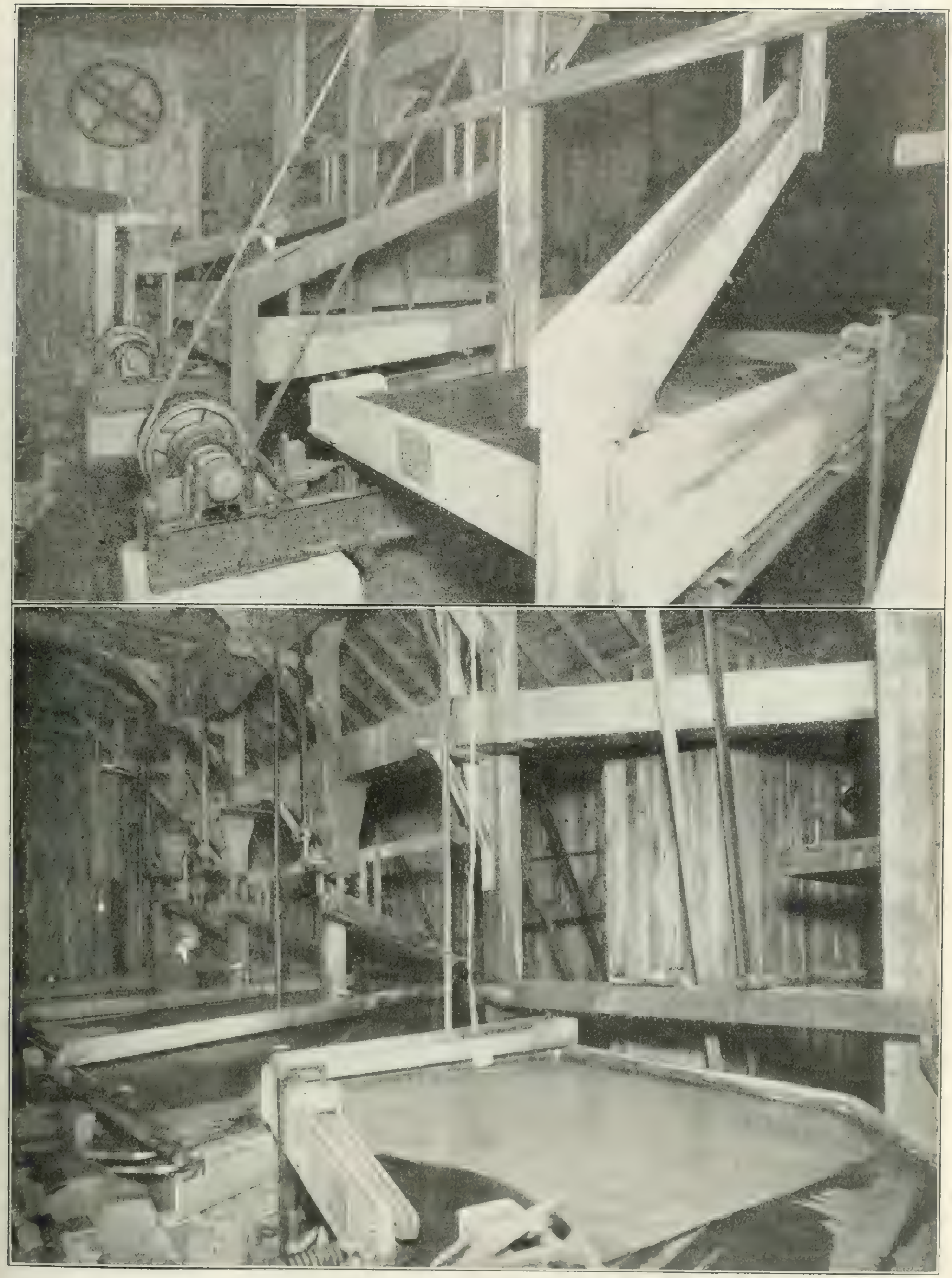
Italian Metal Production in 1913 was: Pig iron, 426,755 metric tons; copper, 24,625; lead, 21,674; mercury, 1004; aluminum, 874 metric tons.

Photographs from the Field



The F. C. Wallower Mill, Prosperity, Mo.

A new concentrating mill operating on the characteristic ores of the Joplin district. Above is an exterior view of the mill and property; below, a pile of concentrates ready for loading and transport The absence of mechanical loading devices is apparent.



Interior of the F. C. Wallower Mill

The new mill embraces all modern developments. The newer types of separators and sand- and slime-concentrating tables are used, showing a radical change from the practice of a few years ago

Annual Meeting, Mining and Metallurgical Society

At the annual meeting of the Mining and Metallurgical Society of America in New York on Jan. 12, the following officers for 1915 were elected: W. R. Ingalls, president; J. R. Finlay, vice-president; Frederick F. Sharpless, secretary-treasurer. Arthur S. Dwight, George C. Stone, Philip Argall and Mark L. Requa were elected members of the council. At the second session of the meeting, following the annual dinner of the Society, which was very well attended, the retiring president, Prof. James F. Kemp, delivered the presidential address. In behalf of the Society, J. Parke Channing presented to W. R. Ingalls, the retiring secretary-treasurer, a very beautiful and massive piece of bronze statuary representing two miners in action with hammer and drill.

The award of the gold medal of the Society to Prof. Robert Hallowell Richards of the Massachusetts Institute of Technology, in recognition of his services in the advancement of the art of ore dressing, was announced. The presentation of the medal will take place at a meeting about the middle of March, of which due notice will be given.

Other speakers of the evening were J. E. Johnson, Jr., who prophesied important developments in the metallurgy of iron; A. S. Dwight, who related reminiscences of the lead-smelting industry in the United States, tracing its development from Eureka, Nev., down to the present time, injecting a very interesting personal flavor into his remarks; H. W. Du Bois, discussing the nefarious practice of mine salting; and John B. Farish, who related a series of very interesting cases where salting of engineers' samples had been accomplished. The meeting was very successful and adjournment did not take place until a late hour.

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Canadian Mining Institute

The seventeenth annual meeting of the Institute will be held in Toronto, Mar. 3, 4 and 5. An interesting program is assured. In addition to the reading and discussion of papers on technical subjects, topical questions of general interest to the mining communities will be debated. These latter include a consideration of the influences of the war on the Canadian mining industry, with a view to ascertaining in what direction, if any, undeveloped resources heretofore not utilized may be turned to profitable account. It is expected that Dr. Eugene Haanel, director of the Mines Branch of the Dominion Department of Mines, will make an address on this subject. There will also be a general discussion on "How Can Prospecting Be Stimulated." This discussion will be opened by Prof. H. E. T. Haultain. Dr. Frank D. Adams, who represents the mining industry on the Commission of Conservation, has intimated that he will invite discussion on "The Conservaiton of our Mineral Resources." Other papers promised or tentatively promised include: "Safety Engineering at the Canadian Copper Co.'s Mines and Works," by E. T. Corkill; "The Oxygen Torch," by David H. Browne; "The Hall Desulphurizing Process," by H. F. Wierum; "The Smelting of Titaniferous Iron Ores in the Blast Furnace," by Bradley Stoughton; "Recent Metallurgical Developments," by Alfred Stansfield; "Operations at the Weedon Mine," by L. D. Adams; "The Ore Deposit at Copper Mountain, Similkameen, B. C.," by F. Keffer; "The Beaver Lake Gold District, Saskatchewan," by E. L. Bruce; "Electric Hoisting," by Dr. J. B. Porter; "Gold Dredging in the Yukon," by O. B. Perry; "The Economic Possibilities of the Yukon," by D. D. Cairnes; and "Western Oil Fields," by D. B. Dowling. Three or four papers, the titles of which have not yet been received, on subjects relating to mining and metallurgical problems and conditions in the Porcupine and Cobalt districts have also been promised.

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The Price of Lead in London

During August, September and October, the London Metal Exchange was closed and there was no official price there, except that fixed arbitrarily for August. For September and October, no official price was fixed, so far as we can find out. However, the following prices were quoted by some of the London dealers during that period:

September

8	£19			21	£19	2s	6d
9	19			22	19	5	
10	19	7s	6d	23	19	5	
11	19	5		24	19	7	6
14	19	5		25	19	7	6
15	19	5		28	19	5	
16	19	5		29	19		
17	19	5		30	18	5	
18	19	5					

October

1	£18	5s		16	£17	6s	9d
2	18	2	6d	19	17	8	9
5	18	2	6	20	17	10	
6	18	1	3	21	17	10	
7	17	18	9	22	17	10	
8	17	17	6	23	17	10	
9	17	16	3	26	17	12	6
12	17	12	6	27	17	11	10
13	17	12	6	28	17	12	6
14	17	10		29	17	12	6
15	17	5					

No quotations are available for the first seven days of September.

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World's Cyanamide Factories

The following table taken from *Engineering News* shows the name, situation and annual capacity of the world's cyanamide factories:

Name of Company	Place of Installation	Annual Output Metric Tons
Nitrogen Fertilizers, Ltd. (North Western Cyanamide Co.)	Odda, Norway	72,000
(North Western Cyanamide Co.)	Alby, Sweden	16,000
Societa Italiana di Prodotti Azotate	Piano d'Orta, Italy	6,000
Societa Italiana per il Carburo de Calcio	Terni, Italy	25,000
Societa Piemontese per il Carburo de Calcio	San Marcel, Italy	3,000
Societa Francaise pour les Produits Azotes	Martigny, Switzerland	12,000
	Notre Dame de Briancon, France	7,500
Bayerische Stickstoffwerke	Trostberg, Bavaria	25,000
Ostdeutsche Kalkstickstoffwerke u. Chemische Fabriken	Bromberg, Prussia	....
Mitteldeutsche Kalkstickstoffwerke	Gross-Kayne, Germany	6,000
A. G. fur Stickstoffdunger	Knapsack, Germany	20,000
Societa per l'Utillizzazzione delle Forze Idrauliche della Delmazia	Selencio, Dalmatia	6,000
	Durgriat near Almissa	15,000
Japanese Nitrogen Products Co	Kagami, Japan	16,000
American Cyanamid Co	Niagara Falls, Ont.	58,100
Societa Anonyme Lonza (Factory erected, but not yet in operation)	Lonaz, Switzerland	15,000
Total		302,600

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American Mining Congress

At the Phenix meeting, the American Mining Congress decided again to begin the publication of a monthly organ, to be known as the "Mining Congress Journal." It will be issued from the Washington office, and will be sent to all members without extra charge.

An associate membership will be created for men not eligible to full membership in the Mining Congress, this status including free membership in the State chapters.

Editorials

A Statistical Review

In preparing our annual review numbers in which we give statistics of the principal metals, based upon our own investigations, there are returns from a large number of producers coming in within two or three days, which have to be checked, computed and tabulated, involving a great deal of work and affording results while the presses are waiting and when there is insufficient time to study and interpret what they tell. We shall therefore devote considerable space this week to an analysis of the figures for 1914, especially those of copper, lead and zinc.

COPPER

There was perhaps a feeling of disappointment that the copper production of the United States did not show a larger decrease, there being the suggestion in this that some of the producers might not have stuck to the general scheme of curtailment, failure in which respect would be fraught with peril. Let it be said right away that the statistics show positively that the Anaconda and the porphyries curtailed their production by about 50%, as their managers said they were going to do. Several of the smaller companies, including the Balaklala, Mountain, Mason Valley, East Butte, British Columbia, Shannon and Shattuck-Arizona suspended completely. On the other hand, the Arizona companies, with the exception of Ray and Miami, did not reduce 50%, in fact never said they were going to, and consequently the total production of Arizona shows less decrease than some of the other principal states.

It is to be remarked that the curtailment which was ordered early in August could not and did not become fully effective until September, wherefore we had a year of normal operation for about two-thirds of the time and restricted operation for only about one-third. Also that the curtailment was based not on the average rates of production in 1913, but upon the rates at the middle of 1914, when certain important producers, e.g., the Utah, had greatly increased their production. And finally that the Michigan mines had to compare with a naturally curtailed production in 1913.

The total production of the mines of North America plus the copper brought here from elsewhere for refining, i.e., the total supply to our refiners, was about 1426 million pounds in 1914, compared with about 1650 in 1913. Now, assuming a production for eight months at the average rate of 1913, viz., 137½ million pounds per month, the production during the last four months must have been about 81½ million pounds, or a trifle less than 60% of the average for 1913. The monthly reports for the first semester of 1914 showed a crude-copper production of about 137½ million pounds per month, or just about the average rate of 1913. If we reckon the present supply of crude copper commanded by American refiners at 70 to 80 million pounds per month, we shall not be far out of the way.

Now, to examine first the statistics of the world's production: The United States showed a decrease of about 40,000 metric tons as compared with 1913. Mexico decreased about 23,000 tons, the political turmoil of that country having effected a forcible curtailment there. Canada made only a trifling decrease. A rich new mine in Cuba contributed to increasing the output of that island by about 3000 tons. Australasia shipped less than in 1913 by about 14,000 tons. In Peru, the Cerro de Pasco company made no material curtailment as compared with 1913, and the output of that country was off but a little. Even more surprising was the maintenance of the Chilean output. We must note, however, that our figures for Peru and Chile are based upon the receipt of their ore and blister copper in this country and in Europe, wherefore they are some weeks behind the mine figures, and it may be that the Chilean mines have actually curtailed more than appears; or it may be that Chile, which has suffered so keenly by the loss of its nitrate business, has had to realize on a commodity that is salable. Japan reports a smaller output by about 5000 tons. Africa increased about 3000 tons, the Katanga mines having made a considerably larger output. For all of these countries we had the actual returns for 10, 11 or 11½ months and the reported figures include estimates only for the small remaining portions of the year.

Correspondents informed us respecting the outputs of Spain-Portugal and Russia, both of which exhibited decreases. In Spain, the Rio Tinto company made a noteworthy curtailment. In Russia there was every incentive to enlarge the output, but before the outbreak of the war certain of the important Siberian mines were behind their figures of the previous year, and during November the producers of the Caucasus were obliged to suspend on account of military raids. The production of Germany and other countries, aggregating about 5% of the total, could only be guessed.

Figuring on the world's production in the same way that we have with respect to the supply to American refiners, it appears that the rate of production during the last four months of the year was probably about 75% of the average in 1913.

Such figuring is about all that can be done with the feeling that our feet are on safe ground. There have been published certain statements respecting stocks and consumption in the United States. They are wholly guesswork and in present circumstances are rather mischievous. Since the Copper Producers' Association suspended reports on this subject, there have been no data. A figure as to what stocks may have been at the end of 1914 can be arrived at by guessing what the consumption may have been. Among the refiners there is difference of opinion. Some say that the unsold stock of refined must be very large. Others, and they are the majority, say to the contrary and wonder where any very large stocks may be, averring that they have not been able to find them. However, at the present time all talk about stocks is idle unless stocks of crude copper as well as refined are taken into consideration.

Turning now to the production of the mines of the United States, it appears that Montana, Nevada and California returned noteworthy decreases. Michigan's output was about the same as in 1913, but in that year it was only about three-fourths of normal. Utah and New Mexico exhibited increases, but these were due to extension of operations by the Utah and Chino companies before the curtailment was ordered. Arizona reported a decrease, but it was proportionately less than that of Montana, which is ascribable partly to extensions of output by some of the companies before the war and partly to failure of some of the companies of that state to curtail at so large a rate as was done by the important companies in other states.

LEAD

It was clear at an early time in 1914 that there was something wrong with the lead industry and in view of the constant accumulation of unsold stocks, there was always a shrewd suspicion that production was being pushed, while consumption was diminishing. However, no one apparently appreciated how bad things were and it was therefore a shock to find that in spite of the curtailment in the autumn there was a production of 533,000 tons, an increase of over 100,000 tons over 1913. It looks, moreover, as if the revised statistics will show even a larger product than the preliminary report.

The distribution of the production, in tons of 2000 lb., by the principal districts was about as follows:

PRODUCTION OF LEAD BY THE PRINCIPAL DISTRICTS

	1913	1914
Southeastern Missouri	133,000	177,000
Coeur d'Alene	148,000	168,000
Utah	83,000	91,000
Joplin	22,000	25,000
Totals	386,000	461,000

That the lead producers of the United States should make such an enormous output in a year of bad business, with an average price of only 3⅞c. per lb. at New York, is nothing less than ghastly. The fact is that a good profit is realized on the Missouri and Idaho production even at 3½c., and for one reason and another the producers of those districts cut loose in 1914, the primary purpose being apparently just to produce as much lead as possible. The Joplin production is obtained in connection with zinc and is determined more by the position of the zinc market than of the lead market. An amazing feature is the increase from the districts adjacent to Salt Lake City, which have not had the reputation of being cheap producers. Yet Bingham, Tintic and the Cottonwoods appear to have increased, while only Park City decreased.

It is clear that only the phenomenal exports of lead — 20,000 tons — kept the lead industry from disaster in the first half of the year, but even that would manifestly have been insufficient, and in the second half it was only the renewal of exports following the outbreak of the war, the shipments abroad of 40,000 tons more, and the curtailment of production that saved things. If the curtailment had not come when it did we should probably have seen lead go under 3c. per lb.

The events of 1914 have forever dispelled some hoary myths. It can no longer be argued with any reason that the lead-mining industry in the United States is conducted under such unfavorable conditions that a tariff protection is necessary. There must also disappear any lingering belief in a malevolent lead trust in control of things, after the sight of that alleged trust imploring the miners to curtail their production in order to save its bacon and theirs; and being refused until the miners themselves were able to read the handwriting on the wall.

The conditions of the world's markets have been fundamentally less disturbed in the case of lead than in the case of copper, the lead production of Germany and Austria being not very far behind their consumption. The situation of the American producers was improved in the first place by the great reduction in the supply coming from Mexico, and in the second place by the interference with operations at Broken Hill, New South Wales. It must be contemplated that there will be a resumption of lead shipments from Mexico sooner or later, while the mining companies of Broken Hill are very active in taking steps that will permit them to realize on their lead even if they cannot on their zinc. War or no war, the world is not going to experience any shortage of lead. In so far as the American market is concerned, the outlook appears to be for lower prices during a period of years, though not necessarily right away. Up to a year or so ago, 4c., New York, was looked upon as a low price. It may be that we shall learn to look upon it as a high price.

ZINC

Two or three years ago the best opinion in the zinc industry was that ore supply was none too plentiful; that the trend of average spelter price would, therefore, be rising; that if 5¼c., St. Louis, were previously an average price reasonably to be expected, in the period immediately approaching it might be 5½c.; that anything under 5c. much prolonged would shut up so many mines as to be seriously restrictive of production.

During the latter part of 1913 we found it necessary to revise ideas, although we tried to find an excuse in the explanation that ore production had been greatly stimulated by the high prices of 1912 and the early months of 1913, and was not yet manifesting the full effect of the low prices. The results of 1914 show, however, that all excuses must be dismissed. Here we have a year with spelter averaging only 5.06c. and during much of the time materially below 5c., yet there was an increased production.

PRODUCTION OF ZINC ORE BY THE PRINCIPAL DISTRICTS
(In tons of 2000 lb.)

District	1913	1914
Joplin	254,000	228,000
Butte	91,000	125,000
Leadville	210,000	204,000
Wisconsin	90,000	98,000
Oklahoma	23,500	32,000

There was, to be sure, a decrease in the production of the Joplin district and Leadville, but in all of the other important zinc producing districts—Butte, Holston River, Wisconsin and Oklahoma, there were increases, although the principal producer at Butte was idle during the last two months of the year. Even Leadville, which produces a low grade of shipping ore, chiefly calamine, made but a slightly decreased output.

We have, in fact, witnessed lately a very great increase in the production of zinc ore, and to a large extent it is ore that costs but relatively little to produce. The fact that the zinc smelters of the United States in 1914 received nearly 100,000 tons of floated concentrates, is impressive in itself. The conclusion is unescapable that although the producers of zinc ore may not like a level of spelter price below 5c., no moderate reduction will reduce their production very greatly. As to zinc-smelting capacity, the statistics show that we now have a great surplus, although some of the capacity in the Kansas gas fields that is still reckoned as live probably will no longer be utilized except during brief periods that are favorable.

It is possible that the American zinc industry, which has supplied so much spelter to Europe during the last six months, will go permanently upon an international basis. It is a pity, even now, that our smelting works are so situated geographically that the surplus capacity may not be utilized for the smelting of Australian ore. Of course, the Australian producers are not going to remain deprived very long of means of marketing their product. Indeed, they are already moving heaven and earth to make new dispositions of it.

It is probable that we shall see relatively high prices for spelter at times during the war, when Europe finds herself obliged to draw largely upon our resources, but looking beyond the war we see great new supplies, not merely of ore but also of spelter, coming from Siberia, Burma and Japan, with the flotation process constantly increasing the supply of ore from all parts of the world. For those operators of lean mines who cannot make money unless spelter is higher than 5c., the war period is going to be a good time to make hay while the sun is shining.

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The Arizona Alien Law

The Federal District Court at San Francisco on Dec. 7 declared invalid and unconstitutional the Arizona law providing that at least 80% of the employees on the payrcll of a concern employing more than five persons must be American citizens. The court found this law to be contrary to the provisions of the fourteenth amendment to the Federal Constitution, which guarantees equal protection to all persons whether aliens or not, in this country. The court held that if the states were permitted to restrict the percentage of alien employees, they could with equal right forbid the employment of aliens altogether. The attorney-general of Arizona is reported to have announced that he will appeal to the Supreme Court of the United States.

We surmise that this decision is as good as the end of Arizona's pernicious law, which was enacted by popular vote last November. Of course, there was bound to be an appeal to the Supreme Court, but the decision of the district court was so certain and emphatic that few persons will be in doubt respecting the final decision. Indeed, the Arizona mining companies have at no time evinced any fear about the outcome of the foolish law that was intended to hamper them.

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In a note in the JOURNAL last year, we commented upon the differences in metallurgical practice existing between the plants of the Anaconda company at Anaconda and at Great Falls. These two plants, operated by the same company and smelting the same kind of ore, continued to exhibit radical differences in practice long after they passed under the same ownership and management. This is, however, soon to become a thing of the past, the present policy of the Anaconda company being to make these two works interchangeable. In pursuance of this policy, Frederick Laist, who has achieved remarkable distinction as a successful superintendent of the Washoe works, has been appointed chief metallurgist of the Anaconda company, and from the metallurgical viewpoint will look after things both at Anaconda and Great Falls. He will continue to direct things at Anaconda very much as he has done in the past. This is a well-earned promotion.

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It is a little remarkable that our columns should contain this week obituaries of three operating heads of important companies, all of whom came to their positions through the business side of those companies, none of them being originally men of technical education. Yet all three of them were successful administrators and under them the respective companies prospered and gained on the technical as well as on the business side. This is not altogether a new experience; the man with business and financial training often makes a very successful head, provided, as in the cases just mentioned, he understands his limitations and is willing to call in efficient technical assistance and advice. In fact, it more often happens that the man trained in business makes a successful manager than does the strictly technical operator, for reasons readily understood.

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The index for Vol. 98 of the ENGINEERING AND MINING JOURNAL will be mailed with this issue. Any subscriber not receiving a copy of same should notify the subscription department at once.

BY THE WAY

The Institution of Mining and Metallurgy has been discussing again that apparently insolvable puzzle, "What is the definition of ore?" Some members harked back to the old suggestion that ore be defined as minerals worked for metals at pecuniary profit. E. T. McCarthy offered a hard nut to be cracked by those definers when he inquired what they would do about metalliferous mines in Austria, Hungary and Germany that have been worked by the governments during many years, not at a profit, but at the least possible loss, in order to give employment to the workpeople.

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The Wall Street Paragrapher of the *Evening Post* related the following anecdote of the reopening of the stock market on Dec. 12: "Most impressive has become the inquiry from investors. At one end of the scale the character of the investment inquiry was typified by a fussy old man who one day this week entered the office of a bond firm with his list of requirements and the prices he chose to pay all prepared. He had been doing the same thing, in the same way, for more than a quarter of a century. On the other end of the scale the character was typified by a young Westerner, with tanned skin and a clear eye, who found his way into a brokerage house, seeking to buy 10 shares of a certain highly speculative mining stock, for investment solely. Its speculative qualities pointed out to him, he nevertheless persisted in buying the stock as an investment, for he was a mining engineer, and he knew that this particular company had a real hole in the ground out of which real ore was being extracted. What he could not be impressed with was that for every ton of ore there was also a generous supply of stock outstanding." There *may* be such reckless plungers among mining engineers.

The First Move*

Engineers have recently been hearing that something is wrong with the mining industry; that the mineral output does not keep pace with the demand; that the good mines are rapidly being worked out; that prospecting is a "lost art"; that engineers will not recommend prospects; that money for development is not to be had, and that only developed property can be marketed.

I am not going to say that these assertions are wholly false, because the statement which opens this discussion is true, there does seem to be something wrong with the mining industry, but I do not believe the other statements will bear the light of careful investigation. The mineral output does keep pace with the demand. Metal prices and statistics prove it directly beyond question, except in the case of gold, and since the price of gold must be measured indirectly we can only say that it seems also to be true of gold. It certainly is not true that all the good mines are worked out, neither is it true that prospecting is a "lost art," that engineers will not recommend prospects, that development money cannot be had, nor that only developed properties can be marketed. Any or all of these things may be true in individual cases, but in the aggregate the situation seems better than ever before. We are simply facing changed conditions and the old order is passing.

Prospecting Not Dead

The younger and more energetic men are the real modern prospectors, and both the increasing number of such men, and their influence on results, must be admitted. Some of these men are trained engineers, but many are not, and the statement that engineers will not recommend prospects almost answers itself; it makes little difference, so long as a body of active and intelligent young men is constantly discovering prospects and turning prospects into mines. It is also plain enough that someone is furnishing the money for this work. This leaves partially open only the statement that none but developed properties can be sold. Arizona again furnishes an answer. It is not necessary to go beyond her borders to show that some of the largest and best properties in the world have been bought, developed, equipped and put into operation within the last 10 years. Does anyone question the willingness of the men who did this to repeat their success, or the willingness of others to emulate them?

The real point to be noted and emphasized is that these are the large things, the spectacular things, the unusual things, the things requiring enormous capital. They are not the things requiring discussion here. We may take it as a firmly established fact that the really big things will continue to be handled by the really big men with their big resources.

It is a fact that nearly every successful mining operation of consequence, old or new, is today in the hands of experienced, technically trained men. These are the men who select, who reject, who discriminate, who decide on the place, time, direction and amount of expenditure, and who plan and execute the work. No man does these things for any considerable time successfully without becoming a business man of high order. Leadership is his by every right, but unfortunately he has not always chosen to accept it and turn it to best account, even when possible.

Let me illustrate what is possible. In one of the classes recently graduated from a certain mining school were four young men who resolved to pool their efforts and go to mining directly, instead of accepting salaried positions as assayers, surveyors, etc. At the end of five years they are in far better financial condition than the average of their classmates, they have had more real experience, and they understand what accepting responsibility means, but above all, they stand absolutely at the head of mining affairs in their community and are reaching out steadily for larger things. They have made good, and in making good they have secured an unhesitating local following in every mining enterprise they will take over.

Another illustration of results actually achieved: A company of 10 engineers was recently organized in Colorado with modest capital, and this company is already successfully operating selected property. When these men began systematically to put faith behind their works and money behind their judgment, they took the first necessary step. They have already secured the confidence and following of the communities in which they operate. No one believes either that 10 experienced men can be seriously misled or that they will ever adopt anything but a policy of absolute fairness and integrity. Everyone believed they would win, and they have.

While this is not the place for details, it may be well to point out briefly several interesting features of this first move. The proposal is not that the movement be restricted to mining engineers and operators, but simply that it must be organized and directed by them.

The movement probably cannot succeed without the confidence and coöperation of the business and professional men of the respective communities. Mining has usually been only a side issue, an incidental, a speculation, if you like, with most such men. Investing without proper guidance, their activity has been spasmodic and unsatisfactory.

How to Make the Move Successful

The movement must not only be started, but made systematic and continuous, otherwise it has no real future. The organizers must be prepared to make sacrifices of time and energy, to say nothing of money, and to sink any petty professional jealousies, but at the same time the idea must not be allowed to creep in that it is in any sense a philanthropic move. There can be just one underlying aim, and that is to make mining pay.

No such organization can hope to succeed permanently which does not propose to be fair and more than fair to its nontechnical associates and stockholders. The plan rests solely on confidence in the ability and fairness of technical men.

It is not expected nor necessary that every engineer and operator should take an active part in such an organization. Some are overburdened now; some are honorably bound to organizations already existing; some are more efficient working alone; but there is plenty of available material in every mining district, in every Western city.

It is a "get together" plan with indirect as well as direct benefits. It requires no large amount of capital. It is better to start modestly and well within the means of the primary associates. It is particularly necessary to assume no financial responsibilities beyond the actual capital in sight. Success in even the smallest way brings possibilities of growth far faster than they can be properly cared for. A good set of brakes is much more essential than the high gear.

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*Excerpts from an address delivered before the 17th annual convention of the American Mining Congress, Phoenix, Ariz., Dec. 7-11, 1914, by W. G. Swart, mining engineer, of Denver, Colo.

The mining men will have to start this themselves. No one is going to do it for them. No one ought to do it for them.

You will realize that this paper is not an inquiry into what is wrong with mining. It suggests that if something is wrong, here is one constructive remedy. It is a workable plan, the details of which will, of course, vary with location and conditions, and it is already in successful operation, but it is possible only to a body of trained men. Undoubtedly there are other good methods, but as I see the situation, the underlying idea must be the same. The qualified mining men ought to be in better control of the industry than they are, and they can be, but the first move is theirs.

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Barton Sewell

Barton Sewell died at his residence in New York Jan. 7, aged 67 years, after an illness of several months. He had been for nearly 45 years engaged in the smelting business and was one of the prominent figures in that business. Mr. Sewell was brought up in the West and served for several years during the Civil War. He enlisted as a drummer at the age of 15, and was in nearly all the campaigns along the Mississippi River. After the war, he engaged in business, and about 1870 he entered the dental supply business in Chicago. The use of silver and gold in dental work prompted him to engage in providing those metals and he began to buy jeweler's sweepings and to melt them and refine them. About 1873, he founded the Chicago Smelting Co. and built works on the Rock Island R.R. at 40th Street. Subsequently, he consolidated with the Aurora Smelting Co. under the name of the Chicago & Aurora Smelting & Refining Co., which owned smelting works at Leadville, Colo., and a refinery at Aurora, Ill. This company operated successfully for a number of years. About 1888, Mr. Sewell sold his interest in the Chicago & Aurora company and organized a new concern, known as the National Smelting & Refining Co., which obtained a contract to handle the bullion produced by the Helena & Livingston Smelting & Reduction Co., at Helena, Mont. The National Refining works were built in South Chicago, Mr. Sewell being president of the company. Shortly after 1890, control of the National company was purchased by the United Smelting & Refining Co., of which Abram S. Hewitt, of New York, was president, and Walter S. Gurnee, treasurer. About 1896, Mr. Sewell became general manager of that company.

The idea of a general consolidation of smelting works had been suggested and discussed a number of times, but for various reasons had not met with much favor and had not taken very definite form. In the latter part of 1898, the question was brought up again and F. L. Underwood obtained options on practically all of the smelting plants, except those of M. Guggenheim's Sons. Mr. Underwood then, with Barton Sewell, E. W. Nash, of Omaha, Leonard Lewisohn and H. H. Rogers, of New York, organized and brought out the American Smelting & Refining Co., E. W. Nash being president and Barton Sewell vice-president. Three years later, a further consolidation with the Guggenheim interests was effected, the name of the company remaining unchanged. Although the Guggenheims now control the company, Mr. Sewell remained vice-president and held that position until his death.

Incidentally, he had become an officer of several allied or subsidiary companies, being the first president of the United Lead Co. and also a director in the United States Zinc Co. He also took some interest in mining as well as in smelting, but was not connected with any prominent mining enterprise until, in connection with Messrs. Nash and Barton, of Omaha, and others, he organized and financed the Braden Copper Co., which is now developing important copper deposits in Chile. On the death of Mr. Nash, in 1895, Mr. Sewell became president of the Braden Copper Co., and held that position until his death. He was interested in a minor degree in several other enterprises.

Mr. Sewell had resided in New York for a number of years past. He was a member of the Manhattan and the Rocky Mountain clubs and of the Automobile Club of America. He was twice married and leaves two sons.

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The New Zealand Iron and Steel Industries Act

To further the development of iron and steel industries in New Zealand, the legislature has passed an act under which a bounty of 12s. per ton of pig iron, 12s. per ton of puddled bar iron, and 12s. a ton of steel produced from pig iron, is paid. There is also a bounty of 24s. for each ton of steel produced from molten metal direct from the furnace. Bounties are payable at these rates for the first three years after the date on which the production of material begins, and for each succeeding year the rate is reduced about 2s. per ton in the case of all except direct production of steel from blast furnace, upon which the reduction is 4s. per ton.

Total amount of bounties authorized by the act is not to exceed £150,000, of which not more than £75,000 shall be paid in respect to pig iron. The maximum bounty which may be paid in any one financial year must not exceed £30,000, but this may be averaged, so that if any part of that amount remains unpaid in one year, it may be paid in addition to the quota for the year following. No bounty is to be paid after Mar. 31, 1924.

Recipients of a bounty must give bonds in a sum to be fixed by the minister of mines, to be void if recipient transfers to the crown all lands, buildings, plants, machinery, and equipment of any kind used in or in connection with the manufacture of the goods, if so required by the governor at any time after Mar. 31, 1924; such transfer to be in consideration of fair compensation for the property transferred, to be assessed in case of dispute in the manner prescribed by the public works act, 1908, in the case of land taken for public works, but in no case shall good will enter as a factor when calculating such compensation.

Proper provisions are also made for the punishment of bounty recipients who show bad faith.

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One of the More Notable of the Older Iron Mines of the Marquette Range in Michigan will be finally abandoned in a month or so, when the pumps will be taken out and the mine allowed to fill with water. This is the Lake Angeline mine, which for over 30 years has been known a producer of high-grade hematite ore. It has passed through various hands, but for over 10 years past the Jones & Laughlin Steel Co. has owned and operated the property.

PERSONALS

Robert J. Kerr, of Los Angeles, Calif., is in New York.

R. S. Botsford is now in Petrograd, Russia, on special business.

Robert E. Palmer, chief engineer of the Rio Tinto Co., was in New York last week.

Harry J. Wolf, of Denver, Colo., recently inspected property in the Cripple Creek district.

W. D. Pearce has returned to Chihuahua, Mexico, where he expects to resume operations on several mining properties.

Kirby Thomas, of New York, has been making investigations of some manganese properties in Virginia and in the South.

C. W. Purington, recently returned from the Lenskoy mines in Siberi to London in December and is now visiting in this country.

John Ballot, chairman of the Minerals Separation, Ltd., has been in New York several weeks attending to interests of his company.

Walter B. Devereux, Jr., and Robert M. Raymond have been elected to membership in the Mining & Metallurgical Society of America.

Walter Harvey Weed, during the latter part of December, inspected the Cuyuna-Sultana property near Ironton, Minn., on the Cuyuna Range.

Howland Bancroft, of New York, has gone to British Columbia on professional business, returning probably about the middle of January.

E. G. Spilsbury has returned from Arizona where he was engaged in some professional work in the extreme southwestern corner of that state.

Frank McM. Stanton, of the Mohawk and the Wolverine copper companies, has been in Houghton, Mich., making an inspection of those properties.

A. H. Boyd, of Denver, Colo., formerly with the Denver Rock Drill Manufacturing Co., has associated himself with the C. H. Shaw Pneumatic Tool Co., of Denver.

David H. Ladd has returned to his home in Houghton, Mich., after some time spent abroad in the interest of the Wallaroo & Moonta copper interests in Australia.

Arthur G. McKee, with Robert E. Baker and Donald D. Herr, have joined in incorporating Arthur G. McKee & Co. to carry on the engineering and contracting business.

E. A. Wayne has resigned his position as general manager of the Ernestine Mining Co. at Mogollon, N. M., and will remove to El Paso, Texas. He remains a director of the company.

A. F. Kuehn, of London, has been visiting in the United States for several weeks. Mr. Kuehn was married in New York on Jan. 2 to Miss Muriel L. Carmody. They sailed on Jan. 9 for London.

S. C. Thomson, for the past 10 years consulting engineer for Neumann & Co., of London, New York, and Johannesburg, S. A., has returned to New York and opened offices at 14 Wall St., New York.

Frank H. Sistermans, of the Mines Management Co., of New York, sailed Dec. 31 to Nicaragua, where he will investigate several mining properties in different parts of the country. He expects to be gone about two months.

Cecil H. Cropper, engineer of the Tronoh Mines, Ltd., in the Federated Malay States, has returned to England and taken a commission in the 12th Battalion, Northumberland Fusiliers, which is composed chiefly of Northumberland miners.

Philip S. Morse, the well-known American metallurgist, who has been general manager of the mines, mills and smelting works of the Sulphide Corporation in New South Wales since 1902, recently resigned that position owing to poor health, and is back in the United States.

C. W. Newton, of Butte, Mont., formerly superintendent of the Butte-Balaklava and of the Butte & Zenith mines has been appointed superintendent of the Interstate-Callahan mine at Sunset, Idaho, succeeding N. C. Sheridan, who is going to Mexico.

Sir Ernest Rutherford, formerly professor of physics at McGill University, Montreal, and now professor in the University of Manchester, England, has been visiting Montreal accompanied by Prof. R. F. [illegible] of the University of Sidney, New South Wales.

A. L. Queneau, who was with the French artillery at Soissons up to the end of November, was detailed to serve as interpreter with the British forces, and according to advices received from him late in December he was acting in that capacity at the British base at Havre.

Irving J. Shields, who was mining engineer in charge of the Michigan Mineral Exhibits at St. Louis, and later mining engineer at the Cerro de Pasco mines in South America, has been appointed assistant district manager for the Standard Oil interests with headquarters at Duluth, Minnesota.

O. M. Kuchs has been promoted from assistant superintendent to superintendent of the International Smelting Works at Tooele, Utah. The ore purchasing department, formerly in charge of E. Scott Woodward, deceased, has been consolidated with the main purchasing department, under J. B. Whitehill.

A complimentary dinner to Frederick Gardner Cottrell was given at the Hotel Plaza, New York, Jan. 15, by members of the American Institute of Mining Engineers, the American Electrochemical Society and the Mining & Metallurgical Society of America. Dr. George F. Kunz was chairman of the committee in charge.

Albert Burch has resigned as general manager of the Goldfield Consolidated Mines Co., Goldfield, Nev., but continues with the company as a director and consulting engineer. He will also remain vice-president and general manager of the Aurora Consolidated Mines Co. J. W. Hutchinson succeeds Mr. Burch as general manager and K. M. Simpson is assistant general manager in place of Mr. Hutchinson.

Charles S. Witherill, formerly superintendent of the copper department of the Balbach Smelting & Refining Co., of Newark, N. J., sailed from New York on Jan. 9, for Chuquicamata to assume his new duties as general superintendent of reduction at the plant of the Chile Exploration Co. His assistants will be Leonard M. Green, in charge of leaching; Maurice R. Thompson, in charge of electrolytic tank house; Otto Koch, in charge of smelting and melting plant.

OBITUARY

John Peterman, who died at Rockland, Ontonagon County., Mich., recently, age 83 years, was well known as one of the pioneers of the Lake Superior country.

Felix N. Humes died at his home at Tarentum, Penn., Dec. 21, aged 90 years. He claimed to have drilled the first oil well in Pennsylvania in 1847, having discovered oil when he was drilling for salt, near Tarentum. Later, he was engaged in the oil business for a number of years.

H. E. O'Driscoll died in Denver, Dec. 30, from the result of bullet wounds which he received at Durango, Mexico, in an encounter with bandits. He was born in Port Huron, Mich., in 1862, but had been engaged in Colorado, Arizona and Mexico for a number of years as a mining engineer.

Cayetano Alvarez, who was a member of the H. E. Lee party, which is contending for the ownership of the Searles Lake potash lands in southern California, is reported to have perished in a blizzard on the desert in the Slate Mountain region. Search parties were driven back by the storm, which was the severest known on the desert in many years, compelling miners in the Panamint Valley to take refuge from the north winds.

Charles S. Price died at his residence near Johnstown, Penn., Jan. 10. He had been in failing health for some time, but his death was rather unexpected. He was 62 years old and had been, for 18 years, general manager of the Cambria Steel Co., and later its president. He was born at West Chester, Penn., and when a young man went to Johnstown as a draftsman. He rose gradually through various grades to be the head of the company with which he was connected for nearly 40 years.

Thomas Lynch died, Dec. 29, at his home in Greensburg, Penn. He was president of the H. C. Frick Coke Co., of the U. S. Coal & Coke Co. of West Virginia and a number of subsidiary companies, and a director of the U. S. Steel Corporation. He was born at Uniontown, Penn., in 1854, and educated in the public schools. He commenced work as a clerk in the store of H. C. Frick & Co. at Broad Ford, Penn., and worked so successfully that in 1877, when the company purchased the Valley Coke Works in Fayette County, he was appointed superintendent of the plant. In 1890, he was made general superintendent of the H. C. Frick Coke Co., which had been organized to succeed the former concern, and when

Mr. Frick resigned as president of the company Mr. Lynch was chosen his successor and had ever since had charge of the operations of the company. Mr. Lynch was one of the pioneers in the safety movement and commenced organization for safeguarding the lives of his employees over 15 years ago. It was said that it was largely through Mr. Lynch's influence that President Gary of the U. S. Steel Corporation undertook the safety movement in which the corporation has since largely engaged.

Thomas Coltrin Keefer, who died at Ottawa, Jan. 7, aged 93 years, was the father of Canadian engineers and had been associated with many of the important public enterprises of Canada during the ninteenth century. He was born at Thorold, Ont., and his first work as a young man was in connection with the building of the Welland Canal. Subsequently he was engaged in engineering work at Montreal, Hamilton and Ottawa and later on the preliminary surveys for the Grand Trunk Railway. He was a strong advocate of transcontinental railroad building and had much influence in the promotion of the Canadian Pacific. His reputation as an engineer and as an authority on international trade caused him to be employed in much government work. His report on trade relations with the United States resulted in the negotiation of the Reciprocity Treaty of 1854. He served on many important government commissions, was president of the Canadian Society of Engineers in 1878 and of the American Society of Civil Engineers in 1888. The British Government conferred on him the title of commander of the Legion of St. Michael and St. George and the French government made him an officer of the Legion of Honor a number of years ago.

Theodore Armstrong died, Jan. 5, at his residence in Philadelphia, aged 71 years. He had been in failing health for some time. He was born in New York and served in the army during the Civil War. After the close of the war, he obtained a position to audit the accounts of internal revenue collectors in Philadelphia and neighborhood. Soon after he became connected with the Pennsylvania Salt Manufacturing Co., and later was appointed chief accountant of the company's works at Natrona, Penn. Seven years later he was made chief auditor at the Philadelphia offices of the company and later became successively secretary, treasurer, vice-president and president. He was chosen president in 1888, and had since held that office. Under him, the management of the company was practically reorganized and many improvements made in its operation and general business, constituting it one of the foremost concerns of its class in the country. Mr. Armstrong was also president of the Wedge Mechanical Furnace Co. and a director in several other companies. He had been, for several months, too sick to attend to business and Joseph Moore, Jr., was chosen president pro tem. to perform his duties. He was a member of the Society of Chemical Industry, the American Chemical Society, the National Geographical Society and of many clubs and societies in Philadelphia.

Andrew K. Beatson, discoverer of the famous Big Bonanza copper mine on Latouche Island, in Prince William Sound, a pioneer in the development of mining in Alaska, and an associate with the Guggeheims in the development of the property he discovered, died, Dec. 16, at Los Angeles. Mr. Beatson, though a native of New York City, where he was born in 1854, removed to California with his parents when a child. He engaged in the mining business as a young man and the early years of his career were the usual ones of a mining man. He was appointed superintendent of the Big Bend Tunnel & Mining Co. in 1881, remaining with that concern for more than 10 years, directing the construction of the 12,000-ft. tunnel which now drains the Feather River. In 1896 he went to Alaska and less than a year later was associated in the location of the Big Bonanza group. The discovery composed the second group of copper locations made in southwestern Alaska. The claims developed with the financial aid of the Guggenheims into an important copper property. The Alaska syndicate became identified with Beatson and his associate Andrew Robertson in 1910, and since that time development at the Bonanza mine has progressed rapidly. The operations on Latouche Island have been carried on under the corporate name of the Beatson Copper Co. with main offices in New York. The first ore shipment from the Bonanza mine was made through Seattle in 1899. The discovery of the Bonanza was purely an accident, as Beatson who brought down samples of copper ore to the Selby smelter from the Ellamar district was told to go back into that country and stake claims. While making the trip his party was notified of the even richer property on Latouche Island and later returned there and staked their claims. Before the Guggenheims became interested in the proposition Beatson and his cousin had blocked out a large quantity of ore. Stephen Birch was instrumental in aquiring the property for the Alaska syndicate. In 1908 he married Miss Flora MacDonald, who survives him.

SOCIETIES

University of Wisconsin—On Dec. 12 Bradley Stoughton, secretary of the American Institute of Mining Engineers, lectured before the College of Engineering on "Steel" and attended a meeting of the Mining Club, taking part in the program. His visit has stimulated greater interest in the Institute on the part of the mining students.

Washington State College—The winter school of this college at Pullman, Wash., lasts from Jan. 4 to Mar. 29, and six different courses for mining men are offered during the 12 weeks. The courses are planned to appeal to the practical miner and prospector and include surveying, mining, metallurgy, geology, ore deposits, assaying and chemistry. The school is in charge of Prof. Francis A. Thompson, head of the Department of Mining Engineering.

American Institute of Mining Engineers—The members of the Puget Sound Section, with headquarters at Seattle, recently decided to increase their activities by holding open meetings to which the public are invited. At the first of these meetings there was presented an illustrated paper on "Oil Fields in Washington," by Dr. Charles E. Weaver, professor of geology at the State University of Washington. This address took place Dec. 14 and was attended by an audience of over 600 persons. I. F. Laucks, chairman of the section, made the introductory address, which was followed by Dr. Weaver's illustrated paper, which gave a comprehensive analysis of the subject. The Puget Sound Section expects to give two more such public meetings during the winter, on subjects of a technical nature that are of public interest.

INDUSTRIAL NEWS

The Webb City & Carterville Foundry & Machine Works has begun the manufacture of a 36x14-in. heavy crushing rolls.

A. Milne & Co. has opened a branch warehouse at 550 Washington Blvd., Chicago, Ill., where a complete stock of tool steel and hollow and solid drill steel of the F J A B brand will be carried.

Manufacturers and dealers in excavating machinery and machinery and supplies for gravel-mining are requested to send catalogs to the Lenskoi Gold Mining Co., 20 Galernaya, Petrograd, and to Nadezhdinsky Mine, Bodaibo, Siberia.

A new composition disk for steam service has been perfected by Jenkins Bros., 80 White St., New York, and will hereafter be used in all of their standard pattern globe, angle, cross and radiator valves. The composition is hard but becomes tough and flexible in service when under steam pressure. It shows remarkable freedom from cracking and flaking and is durable with steam pressures up to 150 pounds.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

PEAT DEWATERING PROCESS. Thomas Rigby, Dumfries, Scotland, assignor to Wetcarbonizing Ltd., London, England. (U. S. Nos. 1,121,203 and 1,121,204; Dec. 15, 1914.)

PHOSPHATES. Method of Producing Soluble Phosphates. John Woods Beckman, Niagara Falls, N. Y. (U. S. No. 1,121,160, Dec. 15, 1914.)

PIGMENT FURNACE. Clifford D. Holley, Detroit, Mich., assignor to Acme White Lead & Color Works, Detroit, Mich. (U. S. No. 1,116,703; Nov. 10, 1914.)

PRECIOUS METALS. Apparatus and Process for Recovering Precious Metals. Frederick A. Wiswell, Oakland, Calif. (U. S. Nos. 1,120,175 and 1,120,637; Dec. 8, 1914.)

RARE METALS—Process for Securing the Precipitation of the Rare Metal Oxides. Royal S. Davis, Newmire, Colo., assignor to Primos Chemical Co., Primos, Penn. (U. S. No. 1,119,929; Dec. 8, 1914.)

REGENERATOR FURNACE. William E. Moore, Peru, Ill.; Harriet L. Moore executrix of said William E. Moore, deceased. (U. S. No. 1,117,219; Nov. 17, 1914.)

ROASTING. Combined Roasting and Smelting Furnace. William R. Heslewood, Oakland, Calif., assignor to Hydro Vacuum Smelting Co., Oakland, Calif. (U. S. No. 1,121,559; Dec. 15, 1914.)

SALT—Method and Apparatus for Mining Salt. Charles S. Bradley, New York, N. Y. (U. S. No. 1,121,325; Dec. 15, 1914.)

SEPARATION—Process of Electrical Separation. Henry M. Sutton, Walter L. Steele, and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,116,951; Nov. 10, 1914.)

Editorial Correspondence

SAN FRANCISCO—Jan. 6

The Smelting Fume investigating commission has reported to Governor Johnson. The investigation covered the Mammoth plant at Kennett and the Penn at Campo Seco, and in both cases the commission finds that damage has been done. Examination of the Selby plant was postponed because of the coming on of wet weather "which destroys some of the evidences of damages from fumes"; but it is recommended that the Selby investigation be undertaken next spring. Evidently the commission does not consider the report and findings of the Selby commission to be a settlement of the controversy in that region. The report of the state commission was submitted to the governor on Dec. 26 and on Dec. 31 two suits were begun in the U. S. district court at San Francisco against the Penn Mining Co. The complaints allege damage to trees, vines and wire fencing and injury to animals in the vicinity of Campo Seco, the damages aggregating $38,395. There is a suit pending in the same court against the Mammoth, which is set for hearing on application for injunction in February. The state commission recommends no remedy and offers no suggestion as to further legislation. The measure creating and empowering the commission provides that the attorney general may bring action against such metallurgical plants as are found by the commission to be doing damage to the farmer and his crops and his animals, etc. About the only legal action the attorney general can bring would be to put the plants out of commission. In that case there would be no need for further legislation. The commission, which was appointed during the last session of the legislature, is composed of the following state officials, who hold their state offices at the pleasure of the governor: Dr. Charles Keane, state veterinarian; Dr. W. F. Snow, secretary of the state board of health, and Dr. A. J. Cook, state horticultural commissioner. The commission was assisted by professors of the University of California and Stanford University.

Improvements in metallurgical plant and taking over of additional mining ground near Kennett are significant features of the Mammoth Copper Co. operations, indicating that the company does not seriously consider the injunction suit pending nor anticipate disaster from the state investigation. The Mammoth has taken over the Friday-Lowden group of gold-copper claims on which there is an aggregate of 1000 ft. of diamond drilling and other development. The property was located 27 years ago and worked for several years in a small way. It adjoins the Mammoth on the south near the original development tunnels of the copper mine. The situation is shown on a map published in the "Journal" of June 27, 1914. The Stowell group of copper claims will also be taken over under an agreement recently made to extend the time of payment to June 28, 1916. This property is also shown on the map referred to. Recent improvement of the Mammoth baghouse and the present intention of the company to install a zinc sorting room adjoining the convertor building are additional evidence not only of the prospect of settlement of the fume trouble but of relief from the depression following the declaration of war in Europe in August. The fact that the Mammoth is taking over new ground and improving the metallurgical plant is a hopeful sign.

The Pacific Gold Dredging Co. operating on the middle fork of American River, dividing line between Placer and Eldorado counties, contemplates constructing a settling basin. This basin will also be used by the Eldorado Dredging Co. The work will cost approximately $3000, of which the latter company, it is understood, will pay $1000. The Pacific dredge operates from Mammoth Bar north and the Eldorado dredge operates at Poverty Bar and northward. The placer claims of the two companies adjoin. There has been much complaint recently that these dredges were polluting the water furnished to the people of Orangevale and Fair Oaks by the North Fork Ditch Co. The two towns are situated in Sacramento County about 30 miles southwest of the dredging operations. The dredge companies do not admit the charge of polluting the waters but are willing to expend the money necessary to settle the water, allowing it to flow again into the stream, rather than contest an injunction suit. At present they ask only that the dredges be allowed to continue operation pending the time of completion of the settling basin. It appears that this is the only method of handling the water so as to satisfy the complainants, and it is not absolutely certain that even this preventive will be accepted.

DENVER—Jan. 7

The Colorado Metal Mining Association holds its next meeting on Jan. 11, 1915, at the State Capitol in Denver. John M. O'Connell is secretary. At the meeting legislation needed by the mining industry will be discussed and arranged in form for introduction during the first 30 days of the General Assembly. The object of the association is to promote the welfare of the mining industry in the State of Colorado by securing more uniform and favorable legislation, especially in connection with mine taxation.

State Bureau of Mines control by the Colorado School of Mines was proposed by Dr. Russell D. George, state geologist and professor of geology in the University of Colorado, in a recent address at Boulder. He also urged a legislative appropriation of considerably greater amount for development of the state's mining industry, pointing out the fact that twenty times as much money is spent by the state in encouraging and aiding agriculture as is used in furthering mining and metallurgy, despite the prime importance of the latter industries which furnish the railroads with 90% of their freight tonnage.

The Water Famine on Breece and Iron Hills, in the Leadville district, has been noted in the "Journal." Snowfall has been unusually light thus far this winter, whereas the temperature average has been low, with the consequence that streams heading well up in the Mosquito Range are running dry or are frozen tight. The Ibex company has laid a temporary pipe line that will carry water from abandoned shafts. The Wolftone company has installed a pump within the city limits to force water from the city mains through a line up to the mine east of town.

BUTTE—Jan. 7

Sanitary Conditions in the Butte Mines have been reported upon by Doctor Lanza, of the Public Health Service, who last summer inspected mines in the neighborhood of Butte and three out of the 30 mines in the Butte district. The sanitary conditions in the mines are stated to be good insofar as they depend on factors under the control of the operators. Certain work is performed under unhygienic conditions for which no satisfactory remedy has so far been devised, work, for instance, in the presence of moist heat or in an atmosphere laden with hard rock dust. Promiscuous spitting is a menace to health, especially in dry and dusty levels. Exposure to cold air on leaving work is deemed responsible for many pneumonia cases. As to miner's asthma, local physicians agree that it is uncommon in the Butte mines.

Labor Unions—The injunction case brought Dec. 17 in the district court, by President Moyer and members of the executive board of the Western Federation, against officers of the local union, to restrain the latter from controlling or disposing of the funds of the local, came to an abrupt conclusion in Judge Lynch's court on the morning of Dec. 29, being dismissed upon the pleadings. An appeal may be taken in which, under the court's ruling, plaintiffs will have to file a new petition containing all of the names of members of the Federation, probably 3000. Members of the local union are confident that the action of the district court concludes the case, arguing that it will be next to impossible for Moyer and his colleagues to secure the names of all the Federation members in a complaint against the local officials. At an animated meeting of the Butte Mine Workers' Union. Jan. 4, R. McGrew was elected president for the ensuing year Owen Smith, a miner, was tried in the district court at Bozeman recently and was found guilty of kidnapping Martin Harkins during the riots in Butte on June 13; he was sentenced to 18 months in the penitentiary. Thomas Retallick, in the same court, was found guilty of grand larceny of funds from the safe of the old union in Butte, on June 13, which during the riots was taken from the wrecked miners' union hall and dynamited. He was sentenced to a year in the penitentiary.

SEATTLE—Jan. 6

The Tolovana region in Alaska is drawing prospectors from Fairbanks, Rampart, Fort Yukon and Circle. Rampart is practically deserted as a result of the exodus. The Fairbanks Commercial Club has appropriated funds to blaze a trail to the new camp. Recently 9 ft. of pay gravel was opened by a shaft on No. 5 Below, Livengood Creek, carrying 3c. pans throughout.

A New Gold Strike was made in December. The first arrival over the ice from Chisana brought word of a new placer strike on Central Creek, in the Upper White River Valley, 25 miles below the international boundary line and 75 miles above Donjek. Central Creek is a tributary of Lake Creek, which flows into the White River from the south. Twenty-five men are said to have staked on the new find and applications of several were brought out from the mining recorder's agent. The creek is said to have been discovered by William James, the discoverer of Chisana about a year ago, who went back quietly this fall to prospect further. A few have already left Dawson for the new strike. There are many prospectors in the Chisana this winter, some of them trying the high benches.

The Mayo silver discovery in the upper Stewart River Basin, Yukon Territory, may prove important. Mushers returning to Dawson over the winter trail from Mayo say that a rich ledge 5 ft. thick was located, and much loose material found. They also report silver found in shafts of claims over several miles in several directions. About 1000 tons of the silver ore is to be hauled to Mayo Landing this winter for shipment to the smelter as soon as the river opens. Ruby silver and silver oxide, as well as galena, have been found on the McWhorter property. George Cressfield and David Robinson struck a ledge 12 in. wide eight miles north of the McWhorter claim, showing silver and lead. Five miles south of the discovery another outfit struck silver and lead running several hundred dollars to the ton. Prospectors are erecting cabins along the belt, and there will be a good deal of work in the district this winter.

Tin Mining in Alaska should witness increased activity as a result of the war. In preparation for greater production next summer, contracts have just been let by the American Tin Can Co., of Portland, Ore., to the American Dredge Building & Construction Co., of Seattle, for a new $50,000 dredge, and to a company in San Francisco for two similar dredges, all these to be placed on the American company's property of 37 claims in the York district. The owners of the tin mines at Hot Springs, the American Gold & Tin Dredging Co. and the York Tin Mining Co., which for several years shipped to Germany, are reported to have agreed to back a proposition for erecting tin smelting works in the Puget Sound country. Last fall, the American Tin Plate Co. sent a crew of engineers to Nome to see what could be done toward developing the quartz tin of Alaska, and the results of their investigations led to the construction of three additional dredges. These will be equipped with double flumes so that no time will be lost in cleaning up; a special device to separate the fine particles of gold from the tin nuggets will be installed. The construction company has already installed two dredges of a type similar to this in the Nome district, the latest one being completed last summer, operating on the American Tin Mining Co.'s property.

WALLACE—Jan. 7

The Idaho Mining Association has made application to the Interior Department for a reclassification of land in the Pine Creeek district. This action has been taken in conjunction with mineral claimants whose claims had been held invalid by the local land office at Coeur d'Alene because the land had been classified as agricultural.

The Interstate-Callahan has just cut the vein in the crosscut run from the winze at 450 ft below No. 4 tunnel. The vein at that point carries 8 ft. of high-grade zinc ore Drifting will show up the extent of the orebody. On the main tunnel level the orebody is 1200 ft long and 20 to 50 ft wide; its development is of interest and importance because it is one of the few mines of the Coeur d'Alene district which is primarily a zinc mine, producing more zinc than lead and silver, and also because it is developing into one of the largest deposits of zinc ore in the United States Operations are confined mostly to development, with the mill running chiefly on ore taken out by development work

SANTA FE—Jan. 7

A Mining Law more liberal in its provisions is recommended by State Land Commissioner R. P Ervien in his biennial report, just made public. The present law, he declares, is too stringent, particularly in the matter of prospecting. He points out that more liberal provisions will encourage prospecting and mining development, resulting in great benefit to the state. He recommends, as well, a law to encourage oil development, stating that "the development of oil in New Mexico would materially increase the state revenue and incidentally reduce taxes." The report also shows that a total of approximately 1,000,000 acres of land, selected by the state under congressional acts granting New Mexico more than 12,000,000 acres, is tied up, due to the allegation of the Federal Government that the lands are mineral in character, and therefore not open to selection by the state. The state contends that neither the U. S. Land Office nor the Interior Department has the right to pass on the characer of lands, and that the question must be settled by court procedure. A suit to test the right of the state to take such controversies into court for adjudication will be brought soon in the District of Columbia. In the meantime the Federal Government will not give the state title to the million acres of alleged mineral land.

JOPLIN—Jan. 9

Workmen's Compensation is advocated in the report of the legislative committee appointed by Gov. Elliott W. Major, to investigate industrial conditions in the state and to recommend legislation. The act newly proposed in the report takes away the old defenses of contributory negligence and assumption of risk from employers and specifies $6000 maximum compensation for the death of an employee or his total disability, caused by an accident incurred while working at his occupation for the employer. Other features of the bill are equally drastic and the mine operators are thoroughly aroused over the prospect of a large increase in their liability rates. The mine operators' organization is coöperating with other employers' associations over the state in protesting against the present draft of the bill. The mine operators' organization has gone on record, judging by the public discussions held, as favoring the principles involved in the proposed law but is desirous of less drastic compensations being exacted. It is stated that the law proposed has a higher maximum by $2500 than that of either Illinois or Kansas, two neighboring states. One feature of the law that has apparently appealed to the mine operators is the plan for a mutual state liability company in an effort to reduce the rates of insurance which have always been high. The legislative committee reported that it estimated an increase of the rates of liability insurance from 4% to 6 and 7% under the working of the proposed law.

DULUTH—Jan. 9

A Division of St. Louis County is contemplated. Residents of the county, in which the larger part of the Mesabi range lies, are preparing to ask the legislature to divide the county into two. The extreme length of the county is about 130 miles, and its extreme width about 60 miles. Due to the vast iron ore deposits, its valuation for taxation purposes is larger than that of several individual states. Duluth, the county seat, is 50 to 75 miles from the Mesabi range, and the latter district, inasmuch as it pays the major part of the taxes, feels that it is entitled to a more satisfactory arrangement. The proposed division, however, would leave part of the range in the present county of St. Louis.

CHICAGO—Jan. 9

The Minnesota Steel Co., it is reported, will resume work on its steel plant at West Duluth, Minn., in February. This is good news and substantiates what certain officials of the Steel Corporation have said recently regarding the prospects for the steel business in 1915.

In the Platteville district, Wisconsin, the Vinegar Hill Zinc Co. recently began construction on its Kitto mill, where shaft sinking has been in progress for some time. The Cleveland Mining Co. is expected to commence operations soon at its Lawrence mine where a shaft is in operation, and where a mill was constructed in 1914; up to date this has not been put in operation because of the low ore market during the latter part of the summer.

The Low Prices of machinery, it was noted some time ago, were leading many mining companies to take advantage of the slack time to make repairs and generally overhaul their plants. In this connection, it is also an interesting fact that some of the machinery makers, themselves, are not losing the opportunity to do the same thing at their manufacturing plants. One such firm, at least, has undertaken to fill its line of machines in stock, and it has almost certainly been able to do this at unusually low costs for iron, steel, and other supplies. The line it manufactures is a large one and the shipping floor is now filled with all sizes of machines, crated and ready for shipment, except for whatever changes in the way of accessories may be necessary to meet the needs of individual orders. Such preparedness means that when business becomes normal or even rushing, it will be possible for this concern to take advantage of the improvement, right from the start.

The Isle Royale reconstruction decision indicates the underlying spirit of optimism and confidence that prevails in the Copper Country. It also illustrates some of the advantages of having a strong parent company the controlling factor in a number of subsidiary companies. From an engineering standpoint, the new mill will undoubtedly offer some interesting comparisons with the old one. The latter was built about 18 years ago, at which time it embodied the best practice of the day and the district. As well as possible it has been kept up to date by the addition of new machinery and by changes in the flow sheet. There have been, however, notable changes in the design of mill machinery as regards crushing and concentrating, and it is not unreasonable to expect that the new mill will depart considerably from the old one as it originally stood. The Worden-Allen Co., of Milwaukee, will probably erect the steel work and assist in the design.

Concerning the Cuyuna range, an interesting report has gained credence, to the effect that the Cleveland-Cliffs Iron Co. is considering the leasing of some properties there. In this connection, it is worth recalling that in the summer of 1910, it was also known that some officials from this company were doing more or less investigating on that range. The Cleveland-Cliffs has been in the business of mining and selling iron ore in the Lake Superior region for over 50 years, and during that time has been consistently indentified with the best practices and methods of the business. There is no question that its entrance on the Cuyuna would add much to the reputation and standing of that range in the eyes of outside operators. It has also been suggested that it would give additional stability to the range and help to give the Cuyuna ores an established place in the iron-ore market. Most of the real mines of the Cuyuna are operated by furnace companies or their near connections, and a great deal of the ore is sold to the furnaces of the mine operators. It is probable that few sales have been made which could really be considered as establishing the market price for these ores. In view of this, it is not at all unlikely that, should the Cleveland-Cliffs Iron Co. become a shipper and seller of Cuyuna ores, its action would fix beyond question the old-range price for those ores. And in the estimation of some Mesabi operators, that is the price they deserve.

HOUGHTON, MICH.—Jan. 10

A Silver-Bullion Shipment, the first of any considerable amount to be sent to the United States mint from the district, went out from Hubbell last week. The shipment amounted to 100,000 oz., and was made by the Calumet & Hecla smelting plant. The new electrolytic plant at Hubbell is doing efficient work. It serves the twofold purpose of eliminating arsenic and recovering silver. It is doing all the work of the Calumet & Hecla, replacing the Buffalo plant. The two large furnaces are economical operators and there is capacity to spare. The electrolytic plant does not replace the old furnaces—an erroneous idea that is prevalent. It is rather, for additional treatment, as explained.

In the Hyams Suit, the reversal of Judge Sessions's refusal to grant an injunction against Calumet & Hecla's election of directors in the Isle Royale and against the parent company's [illegible] of this subsidiary means that the case will [illegible] be reopened and further consideration taken by the Federal district court. There was at first some fear that this legal technicality might make it impossible for Isle Royale to continue to [illegible] its rock to the Point Mills subsidiary stamp mill and that the Isle Royale mine might be shut down until [illegible] leased stamp mill could be replaced. Happily the Calumet & Hecla interests are satisfied that not even the [illegible] stretching of the decision could mean such [illegible].

ROANOKE, VA.—Jan. 10

The Manganese Deposits of Virginia [illegible] of the South have [illegible] revival of interest which began early in [illegible] accelerated by the conditions in the [illegible] the last month of the year it continues [illegible] with the [illegible] of several [illegible] for the [illegible] properties. The investigations and development [illegible] in the control of parties not directly connected with the iron and steel companies [illegible] [illegible] replace the [illegible] [illegible] found [illegible] the local owners [illegible] have done some development [illegible] to make small shipments as soon as the season is favorable. The most important negotiation has been in connection with the famous Crimora deposit in Augusta County, Va. This has been sold to a New York company called the Crimora Manganese Corporation and it is proposed to open it for a large operation using new methods for the separation of the manganese ore from the clay gangue. This was formerly one of the best producers in the state and supplied the Carnegie Steel Co. with a large part of its requirements for many years. It has been closed for several years since the expiration of the steel company lease. The Piedmont deposit in Campbell County, near Lynchburg, is being reopened and it is reported to have a large development of good ore made available by a former company which failed because of financial entanglements. Lynchburg interests associated with Col. Meyers, the former owner, are now in control. Recently a syndicate of Philadelphia men took a contract on an abandoned iron mine near Sugar Grove, in southwestern Virginia, and uncovered a large body of manganese ore from which shipments of manganiferous iron ore to the Pulaski, Va., furnace are now being made. Plans for the more extensive operation of this deposit are considered. Richmond, Va., interests have been investigating the old mines near Warminster in Nelson County. These have been abandoned for more than 30 years. They were at one time actively operated by English companies.

DAHLONEGA, GA.—Jan. 9

In the Georgia Gold Field, there is no great activity, but numerous projects are aiming to open up properties. Last summer, Charles H. Breymann, of Toledo, Ohio, owner of a large group of mining properties in the Dahlonega district, at the suggestion of a Mr. Crafton, had erected a 20-stamp mill to treat material from his Free Jim property within the town limits of Dahlonega. The features of this installation are an extremely long, steep sluice leading from opencuts in a saprolite belt down a long hillside and over a high trestle across a stream to the new mill; a trommel, which delivers oversize to the stamp bins and the ⅜-in. and finer to a settling tank from which excess of water overflows to waste while the pulp goes directly to a tube mill. The stamps are fed automatically and are followed by a set of amalgamation plates arranged on the Homestake plan. The product from the tube-mill goes to a similar set of plates. It is understood that the tube mill was installed to test the theory that polishing of the gold particles therein will cause them to amalgamate better. An generally known, the Georgia gold does not amalgamate easily, although it is fine and bright. The results of the first cleanup cannot now be stated. A placer tract along Cane Creek in the same district forming a portion of the Barlow mining property, has been equipped with hydraulic lift and was being worked not long ago below the creek level with satisfactory cleanups of coarse gold. The Pine Mountain mine, near Villa Rica, it is stated, is held under option by a Mr. Aldrich who has been trying to operate a mine at Hog Mountain, Ala.; he is now engaged in erecting a small cyanide plant to treat the saprolites which occur here in tremendous quantity. The owners are in Birmingham, Ala. R. L. Herrick, of Lebanon, O., has secured options to several tracts of alluvial ground that appear to be dredgeable, and churn-drill prospecting is to be started.

TORONTO—Jan. 9

The Discovery of gold, silver, platinum and other minerals reported at Rutherglen, some 40 miles east of North Bay, Ont., has created some excitement. Assays of a highly favorable character have been reported from the claims of two prospectors, H. C. Clark and J. H. Diehl, and a rush to the neighborhood has resulted in about 1000 claims being staked. Clark reported to the Ontario Department of Mines that he had found platinum and was an applicant for the $[illegible],000 reward offered for its discovery in commercial quantities. He was told to forward samples and other data, which have not so far been received.

A Cyanide Supply for all mining companies in northern Ontario, sufficient for their requirements until the close of the war, has been [illegible] by the action of the Imperial government. The Cassel Cyanide Co. of England having announced that there was more than enough cyanide being manufactured in Britain to meet legitimate demands within the Empire, the company was [illegible] by the government to restrict the output to mines within the Empire so long as they had need of it. Cassel's representative has made contracts with every company using cyanide in northern Ontario, with two exceptions, to keep them supplied at the rate of 18c. per lb during 1915, and 16c. per lb in 1916. The mills using zinc dust, formerly procured from Belgium and Silesia, have experienced a rise in price from [illegible] to 11c. per lb f.o.b. Cobalt.

The Mining News

ARIZONA

Cochise County

WOLVERINE & ARIZONA (Bisbee)—After paying recent dividend company has in treasury $0.50 a share and ore blocked out which will net another $0.50 if sold in 13c. market. Considering limited operations and small territory owned, record is good. Exploration operations only going forward now and ore shipments will not be resumed until betterment in general metal conditions.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Understood management will expedite building of new mill and other improvements, with litigation finally settled. Not believed probable case will go to Supreme Court.

ORIGINAL AMADOR (Amador City)—Reported friendly suit will be instituted in superior court for perfecting of title to Eclipse quartz-claim, one of group composing this mine. Possessory rights of about 50 defendants will be observed and no effort made to eject occupants.

MOUNTAIN KING (Pine Grove)—Recent formation of company, with B. W. Pitts, former owner of mine, as member insures development by shaft to depth of 1000 ft. before crushing of ore begins. Hoisting machinery and supplies being hauled in. This is one of good prospects of East belt of Mother Lode, produced enough gold from surface workings to warrant undertaking development on scale that will prove whether East belt veins in Pine Grove district will make producing mines.

KENNEDY EXTENSION (Jackson)—Cost bill in suit against Argonaut filed in superior court, $2710. While plaintiff lost decision regarding trespass upon orebodies it was admitted there was trespass upon unproductive ground within the plaintiff's lines, and cost of suit was awarded. Amount does not represent actual cost of expert examinations and evidence, as engineers employed were allowed by the court only the regular fee of $2 per day as witnesses. Five-sixths of total was stenographers' fees.

Butte County

INDIAN SPRING CHANNEL GOLD MINING CO. (De Sabla)—Motor on large centrifugal pump burned out, causing temporary closing of mine. Unwatering drifts will not require much time and regular operations should soon resume.

LAVINIA CRABBE VS. MAMMOTH CHANNEL (Magalia)—Supreme court sustains superior court of Butte County in verdict for $20,000 damages. Husband of plaintiff killed in performance of duties, being struck by rock falling from roof of tunnel. Supreme court holds there was no evidence of carelessness or negligence on part of deceased.

Calaveras County

ECONOMIC (Esmeralda)—Material on hand for relining chutes after ore is withdrawn. Chutes will be widened. Electric power line has been put in good condition. Outside line being put in commission. Complete installation and operation of electric system only awaits receipt of transformers and motors. General Electric Co. installing the plant.

Eldorado County

HOOK & LADDER (Placerville)—This placer claim at Smiths Flat bonded by Bert L. Bryan and E. F. Hand.

LUKENS GOLD MINING CO. (Auburn)—Property at Pilot Hill leased to J. H. Cooper, Paul Savoy and James Collins, of Aurora, Nev. Mine being pumped out, is well equipped with machinery for operation.

Kern County

BIG BLUE (Kernville)—Fire which originated in August, 1914, and caused loss of three lives reported to be still burning or to have started fresh. Efforts made to close up draft without success.

Nevada County

DELHI MINE (Columbia Hill)—Change house burned Dec. 8, without loss of life.

PHOENIX (Nevada City)—Reported property to be reopened, 500-ft. shaft repaired and hoisting and pumping machinery put in order. Mine was large producer in early days when operated by Smith & Clay.

THOMAS KNUCKY VS KENOSHA MINING CO. (Grass Valley)—Suit to establish that claim of company was void decided in superior court in favor of defendant. Held that improvements by the mining company represented assessment work.

YOU BET MINING CO. (You Bet)—Reported controversy with Jerry Goodwin estate settled out of court; probably hydraulic mining will resume unless other litigation follows. Recently mine operated chiefly by lessees who [illegible] temporarily. Owners have [illegible] possession mining company that may permit resumption of [illegible].

Placer County

GARDELLA (Ophir)—Four-mile electric power line being constructed by Lawrence Gardella, of Oroville, for operation of his dredge at Gold Hill. Line will carry 11,000 volts and will tap main high-tension line at Ophir.

San Bernardino County

AMERICAN TRONA CO. (Trona)—Judge Dewhurst, of the superior court at San Bernardino, denied injunction [illegible] R. Waymire and others to prevent forfeiture of rights of Thomas Peck to potash lands in holdings of company. Action to establish ownership will proceed as soon as trial date is set by court.

Shasta County

SUMMIT (French Gulch)—E. J. Barnes and associates of Redding have reopened this mine, former producer, situated between Brunswick and Niagara mines.

L. O. JILLSON VS CENTRAL PACIFIC R.R. CO. (French Gulch)—General Land Office in decision dated Nov. 23, 1914, affirms rulings of Sacramento register and receiver holding land involved to be of mineral character. Land adjoins Blue Gravel mine, said to be valuable.

Tuolumne County

J. D. CURTIN VS CHARLES E. KNOX (Sonora)—Suit brought demanding 50,000 shares in the Black Oak Mines Co. as compensation for services under contract of December, 1907. Cash value of legal services placed at $10,000, but Curtin avers he agreed to take stock. Curtin was Democratic candidate for governor at recent election.

COLORADO

Boulder County

BLACK CLOUD MILL (Salina)—Additional equipment, including battery of Monnell slimers, will be installed under direction of Ira Monnell.

Lake County

YAK MINING CO. (Leadville)—Employees to number of more than 125, received Christmas surprises in shape of U. S. postal savings bank deposit-books, each showing amount on deposit equal to 2% of recipient's annual earnings.

San Juan County

SILVER LAKE (Silverton)—Lessees have opened important body of copper-lead ore in workings above Unity tunnel. Additional raises and ore passes will be made above tunnel during winter. Thought regular shipments can now be maintained. Silver Lake company may repair tramway from Unity tunnel as soon as lessee's operations justify expenditure.

San Miguel County

TOMBOY (Telluride)—New cyanide plant in operation.

LAKE SUPERIOR-OPHIR MINING CO. (Telluride)—Wire rope tramway will be installed between mine and mill.

Teller County

PORTLAND (Victor)—New change room, accommodating [illegible] men, opened for use just before Christmas. No. 2 shaft being sunk below 1700-ft. level.

QUEEN GOLD MINING CO. (Cripple Creek)—Company acquired holdings of El Oro Mining & Milling, plans development work. El Oro shaft retimbered for entire depth of 600 ft. and ready for operation.

UNITED GOLD MINES CO. (Cripple Creek)—Company has taken over Wild Horse mill. Many improvements made in plant; recovery now equal to that of any mill in district. Arthur Finn will be retained as superintendent.

GOLD COIN (Victor)—New oreshoot opened in 11th level of this property operated by Granite Mining Co., varies in width from 4 to 12 ft., assays from $20 to $[illegible], exposed in drift for 100 ft. with breast still in ore. Shoot is new one and strike therefore regarded as important. Granite company crosscutting on 12th level to determine downward extension and main shaft being sunk additional 100 ft. below 1200 ft. level.

BLUE BIRD (Victor)—This property on Bull Hill leased by E. S. Johnson, president of Blue Bird Gold Mining & Milling Co., to Nelson Franklin, general manager of Eagle Ore Co., of Victor, for five years. Active campaign of development was to be inaugurated Jan. 1; probable that mine will be blocked out and subleased. Development under direction of John Price, appointed general manager. Property known to contain large reserves of low and medium-grade ore.

IDAHO

FEDERAL (Wallace)—Access given to all books and accounts of Washington Water Power Co. by order of Public Utilities Commission, in action to lower electric-power rates.

MARSH (Burke)—By decision of district court company allowed to condemn 3[illegible] acres of surface ground of [illegible] Mining Co.'s property, to be used for railroad to [illegible] sorting plant, ore bins, shops and timber sheds. Stipulation made with Washington Water Power Co. to postpone indefinitely hearing on power rate discrimination before Public Utilities Commission.

STEWART (Kellogg)—Company bought old Sweet group of [illegible] claims, [illegible] District, [illegible] from W. [illegible] Cullen, of Spokane, and M. W. [illegible], of Butte. Group comprises 27 patented claims, was recently bonded by Cullen and [illegible] for [illegible], of which [illegible] had been paid. [illegible] to property from Kellogg and 20 more will follow soon.

HUNTER (Mullan)—Operations resumed after short shutdown [illegible] plant. New plant consists of two pebble mills [illegible] Capacity of plant [illegible]

MARYLAND

TOWNSEND gold mine being developed by J. H. Eckersley; near Great Falls of Potomac River 14 miles from Washington. Vertical shaft being sunk, now 150 ft. deep, will go 200 ft. and crosscut will be made to vein. Property advantageously situated near Chesapeake & Ohio canal and receives coal in barges. Adit level connects with shaft at 70 ft. depth and near portal of adit are compressor plant and small mill, consisting of Marathon mill, plates and concentrator.

MICHIGAN

VANADIUM DEPOSIT reported from near L'Anse in Baraga County visited by Mr. Hopper, assistant state geologist, recently. Operations to date include shaft with depth of 20 ft. and some surface exploration. Samples of fissure material show low-grade ore of questionable commercial value. Chicago capitalists own property. Work in charge of Mr. Thompson.

Copper

TAMARACK (Calumet)—Regrinding structural work completed. Plant 100 ft. wide by 186 ft. long. Steel used in construction totaled 307 tons. Operations probable next summer, following installation of machinery.

CALUMET & HECLA (Calumet)—Stamp mill now operating five days a week instead of four, due to increased efficiency in mining. Change in schedule gives men but two shifts a week off, Saturdays and Sundays.

ISLE ROYALE (Houghton)—Framework for new stamp mill to replace that destroyed by fire Christmas Eve now up. Construction will be rushed. New mill will be especially suited to treat Isle Royale rock. Insurance on old plant $137,000, about three-quarters of loss. Foundations intact and 50% salvage on milling machinery. Fire did not interrupt production of copper, rock going to Calumet & Hecla subsidiary mill at Point Mills.

MOHAWK (Mohawk)—Mine maintains best rock tonnage in history and best grade of rock ever sent to stamp mill. Rock shipments averaging better than 3600 tons daily and grade of rock showing 20 lb. refined copper. General expectation of slight betterment in grade when product from No. 5 became factor in output and still better showing when No. 6, nearer Ahmeek, contributed tonnage, but fact is that bulk of tonnage comes from older shafts and is better than before. January production likely to reach 825 tons of mineral, breaking all records for property if remainder of January maintains record made so far.

FRANKLIN (Demmon)—Not producing but employing 80 men both in exploratory operations concerning which there is so much interest and to keep general underground workings in condition. Franklin's operation would be unprofitable under existing metal conditions. Expenses down to minimum compatible with best results in interesting geological work now under way. Company has on hand 30,000 lb. of mineral and mass yet to be smelted. Treasury in such condition that operations at present rate can be carried forward without calling on shareholders for assessment. Franklin cutting over 100 amygdaloids in long crosscut now being run. Among other known and unknown lodes has already cut two formations of rather sensational value. Crosscut ought soon to encounter Calumet conglomerate and it will be interesting to observe characteristics as well as mineral content at this depth and this distance from Calumet property. Houghton conglomerate already cut and work progressed in trap for some distance beyond point of contact. Better than 250 ft. a month made in this long crosscut, now in over a quarter of a mile from 32nd level, Allouez conglomerate. New Arcadian's showing has important bearing on future of Franklin since its metal dips to north.

Iron

VOLUNTEER (Palmer)—New headframe erected here at shaft recently put down. Most of ore will continue to come from old shaft, new outlet being designed to give better ventilation.

ISABELLA (Palmer)—First ore was hoisted from this new mine a few weeks ago. Several drifts now in ore. Force being added to as the mine opens up. Property will be an active shipper the coming season.

CLIFFS SHAFT (Ishpeming)—Small quantity of bornite, chalcopyrite and azurite found in drift on one of lower levels of this mine last week. One of few instances of copper minerals found in iron mines of the Marquette range.

MINNESOTA

ZENITH FURNACE CO. of Duluth received orders to resume work. Plant closed in fall. Considerable pig iron in stock has been sold. Furnace relined and other repairs made during time plant was out of blast. Crew will be increased to 375 men within few days. Large force employed during the time repairs were in progress.

Cuyuna Range

ARMOUR NO. 1 (Crosby)—After being idle since early in 1913 mine now being unwatered; purpose not stated.

CUYUNA-SULTANA (Ironton)—Company has corps of engineers making preliminary surveys for stripping operations planned for early spring.

Mesabi Range

IROQUOIS (Mountain Iron)—After idleness of 18 months, crew put to work clearing up mine ready for early operation.

RUDDY (Biwabik)—After shutdown of six weeks, mine started with 60 men. Full crew will be put on soon.

MOHAWK (Aurora)—Pickands-Mather making extensive improvements including new steel shafthouse. Desired to obtain heavy production from mine next season.

HELMER (Kinney)—Swallow & Hopkins has brought suit against Iroquois Iron Co. for $70,000 damages, alleging contract for 100,000 tons of ore from Helmer mine in 1913 at $2.82 per ton, and that company took and paid for but 11,000 tons, refusing to accept remainder.

QUINN-HARRISON (Nashwauk)—Steel for concentrating plant expected by Feb. 15. [illegible] development work all completed and construction work will be rushed upon receipt of structural material; plant will be in operation next season. Site being cleared and leveled for machine shops. Butler Bros. will hereafter make headquarters at Nashwauk.

MISSOURI-KANSAS-OKLAHOMA

MINE LA MOTTE (Mine Lamotte, Mo.)—Plant was completely shut down and pumps pulled as result of walk-out of about 350 men when 7% cut was made in wages. Most of men were willing to accept reduction, but agitators persuaded them to remain out for some time. Later they returned to work under the reduced scale.

MONTANA

Cascade County

BOSTON & MONTANA (Great Falls)—On Jan. 2 copper refinery resumed operations with small force of men to be increased to about 100 men by Jan. 12. As none of other departments of plant will be reopened at present, anodes will be obtained from Washoe, and will not represent any increase of output at latter plant, merely diverting of shipments hitherto sent to other refineries. Copper will be refined to wire bars for shipment to wire mills, final market for product being provided by Milwaukee electrification. Expected that output of refinery will amount to about 5,000,000 lb. per month.

Missoula County

AMAZON DIXIE (Sildix)—Six-foot vein of lead-silver-zinc ore cut in lower tunnel, on south side of fault about 3000 ft. from portal. Drift on vein 75 ft. long encountered fault. Crosscut 160 ft. found vein beyond fault, 8 ft. wide with 6 ft. of good ore. Company will drift. Depth below surface about 2000 ft.

Silver Bow County

CLARK-MONTANA REALTY CO.—On Dec. 31, Judge Bourquin rendered decision in suit against Ferguson and others, finding for plaintiff. Held that defendants, who had located Zeta lode over plaintiff's placer ground, failed to establish that lode was "known to exist" when placer patent was applied for. Also held plaintiff's placer patent conveyed title to premises involved and plaintiff therefore entitled to recover accordingly.

ANACONDA (Butte)—Owing to an accident in No. 2 shaft of Leonard mine Dec. 31 property was closed and will probably remain so for three weeks or month. As skip, with five tons of ore, was about to dump, pin connecting it with cage gave way, allowing loaded skip to fall to bulkhead at 2000-ft. level, bulkhead preventing it from going to sump, 400 ft. deeper. No damage done until 1100-ft. level was reached, but from there down skip tore guides out and cut partly through most of wall plates as cleanly as though with chisel. Because of Leonard shutdown company changed plans somewhat with regard to Badger State and Original mines. Badger State began operations Jan. 1 as planned, but force from Leonard was transferred there and will remain until latter opens. At Original, which was to have closed as soon as Badger State began, orders were given to continue work until Leonard is in commission again. Badger State will be operated on five-day schedule, like other mines of company will be closed Sundays and Mondays.

NEVADA

Douglas County

GOLDEN GATE (Gardnerville) — Milling plant put into operation recently. Ore free milling, assaying $7.50 per ton. Mine and mill connected by tramway.

Elko County

BLUSTER (Jarbridge)—Ten-stamp mill, stamps 950 lb. each, Allis-Chalmers type, will be built; also 1500-ft. tramway from mine to mill.

Esmeralda County

COLUMBIA SAMPLING PLANT of Western Ore Purchasing Co., Goldfield, will be reopened. Plant being remodeled and 50-ton ore bin being built.

YELLOW TIGER (Goldfield)—Plant damaged by fire completely repaired and operations resumed on 700-ft. level.

MILLTOWN MINING CO. (Goldfield)—Property recently purchased, will be developed from 700-ft. level of Yellow Tiger or by sinking 300-ft. shaft to deeper levels.

JUMBO EXTENSION (Goldfield)—Development work on deeper levels continues to open ore of good grade. Rich seams found in prospecting to west toward Clermont ground. Rich oreshoot above 921-ft. level of Velvet claim increasing in size as work progresses. December production estimated $100,000.

Humboldt County

CODD LEASE (Rochester)—Aërial tramway will be built from tunnel level to Nevada Short Line.

MILL FOR LEONARD CREEK DISTRICT may be built; company organized for purpose. Large placer deposits may be worked by dredges.

Lyon County

NEVADA PROGRESSIVE CO. (Yerington) — Headframe built and 25-hp. hoist installed at this property in Smith Valley. Shaft 100 ft. deep and station cut; shaft will be sunk 100 ft. deeper.

KNIERIAM (Yerington)—Shaft sunk to 180-ft. level and drifting under way. Stated 2-ft. oreshoot assaying $20 in gold and silver opened for length of 50 ft. Property 13 miles south of Yerington near Nevada Copper Belt R.R. Power line to Pine Grove crosses claims and abundant water supply can be developed from springs. Will be worked by lessee; mill may be built if results of future development work justify.

Nye County

PIONEER CONSOLIDATED (Pioneer) — Cave occurred in mine Dec. 24, in which W. J. Tobin, president and general manager, suffered broken leg

Ormsby County

PRAIRIE FLOWER MINING CO.—Articles of incorporation filed with secretary of state. Capital stock, 1,000,000 shares; par value, $1.

COMSTOCK MILLING & MINING CO. (Empire)—Morgan mill property of 800 acres on Carson River, 40-stamp mill and tailing dumps, sold to San Francisco men for $20,000; last installment paid.

White Pine County

NEVADA CONSOLIDATED (Ely)—Production from Copper Flat pits now 140,000 tons per month, less than half capacity of McGill smelting plant; 180 men employed. Present rate of production to be continued indefinitely.

NEW MEXICO

Grant County

HOSPITAL to be erected at Tyrone. Twenty-five thousand dollars donated by Thomas Parker, former mine owner; Phelps, Dodge & Co. to furnish balance of $50,000. Hospital to be one of most modern in Southwest.

STAUBER & WRIGHT (Pinos Altos)—Contemplating erection of mill on Pacific No. 2 claim. Electrostatic process to be employed.

85 MINING CO. (Lordsburg) — Operations again resumed after temporary shut-down necessitated by condition of roads. Night shift added to working forces.

CLINE STAMP MILL (Gold Hill)—Plant opened near Gold Hill. Treating ore from Roosevelt mine. Two stamps in use with gasoline engine power. Operator plans to put in cyanide plant soon.

EMPIRE ZINC (Silver City)—Company has completed development of water supply for Cleveland and Utter mines at foot of Gomez Peak; will necessitate constructing pipe line three miles long. Work progresses rapidly on tramway to Silver City.

Socorro County

MOGOLLON FLOODS disastrous. Mail and supplies delayed for days. Cableways washed out.

SOCORRO MINING & MILLING CO. (Mogollon)—Company given until Jan. 25, 1917, to complete work on power project in Mogollon Mountains; $90,000 already expended according to report made to state engineer and similar amount to be spent before 1917.

NORTH CAROLINA

TALC OR PYROPHYLLITE DEPOSITS in Moore County arousing interest. New company, Talc Products Co., has taken over two properties of Glendon Mining & Mfg. Co. and Deep River Talc Co. New company has been operating mill formerly used by Glendon company, while getting steam-driven mill at Deep River property in shape for grinding. Latter mill near mines and use cuts out long haul of crude material over poor road.

GARDEN HILL (Greensboro)—Ten-stamp mill lately built and in operation. Equipment consists of amalgamating plates and Wilfley table. Ore contains both copper and gold. At present milling old dump estimated to contain 25,000 tons. Addition of jigs contemplated, and hand sorting prior to milling. Unwatering of mine expected to begin shortly.

OREGON

OREGON PLACER CO. (Galice)—Company purchased Old Channel mine, preparing to operate on large scale.

GOLD LEAF (Bohemia)—Five-stamp mill will soon be in operation driven by 12-hp. gasoline engine. Considerable freemilling ore already blocked out in mine.

INDEPENDENCE—Putting of mill in shape for resumption of milling operations at this mine in Granite district, Grant County, about completed. Tanks in cyanide portion of mill being rebuilt and other improvements made.

GRANITE HILL MINE (Grants Pass)—Manager O'Grady has gone to Chicago for consultation with other owners and will arrange for installation of cyanide plant at mine to work sulphide ores. Mill operating on free milling ore with success, it is said, but management wishes to make greater saving. G. A. Baker superintendent.

UTAH

Beaver County

WASATCH EXTENSION (Beaver City)—New shaft being sunk on this property adjoining Utah United Copper fissure carrying gold and copper. Now down 70 feet.

BEAVER BUTTE (Beaver City)—This property two miles south of Sheep Rock thought to be on Sheep Rock vein. Work resumed, and car of ore will be run through Sheep Rock mill for test. Sherman McGarry in charge.

ROB ROY (Beaver City)—Work resumed and contract let to drive tunnel from Indian Creek side. Lost vein, rich in specimen ore, being sought. Old workings 300 ft. deep, and considerable drifting done. Small stamp mill operated short time in past.

Juab County

BULLION BECK (Eureka)—Operations suspended for repairs, which will be completed soon. Eureka Hill also not operating at present, as it is worked through Bullion Beck.

GEMINI (Eureka)—During 1914 property paid $175,000 to lessees, and dividends amounted to $125,000. Expected that soon after first of year there would be resumption of shipments, curtailed in November, and discontinued in December.

Salt Lake County

CARDIFF (Salt Lake)—Thirty mine cars of ore being broken daily. Raise up 60 ft. in ore, which second crosscut shows to be 35 ft. wide or more. Body opened 180 ft. on strike.

COLUMBUS EXTENSION (Alta)—A. O. Jacobson and associates recently secured control. Work will be done from main tunnel for Cardiff contact of quartzite and limestone.

MAXFIELD (Salt Lake)—Machinery on ground and being installed by F. M. Vahrenkamp, who recently took bond and lease on this mine in Big Cottonwood. Workings below tunnel level to be unwatered.

UTAH COPPER (Bingham)—Mine and Magna mill resumed operations Jan. 2, after short shutdown during holidays. Operations to be continued on 50% basis as heretofore, output amounting to about 6,600,000 lb. copper a month.

WASATCH MINES (Alta)—Strike on Blake lease above Howland tunnel continues to improve. Ore occurs on quartzite-limestone contact, followed 25 ft. by raising. In No. 2 stope good ore being broken on company account; opened 20 ft. on strike, and averages 2 ft. in thickness. Property formerly Columbus Consolidated.

Summit County

SILVER KING COALITION (Park City)—New electrically driven equipment put in operation on 1300 level and at Silver Hill station, on Alliance tunnel level.

DALY WEST (Park City)—New electric hoist in operation and development being done after year's closedown following burning of mill and equipment. New mill being tested out on tailings. No ore yet treated. Shipments of crude ore started.

THOMPSON-QUINCY (Park City)—At special meeting decided to reorganize. Property well situated. Annual report in November showed indebtedness of $44,381. Plans for refinancing being considered.

Tooele County

INTERNATIONAL (Tooele)—Second reverberatory blown in on copper, making two copper furnaces now in blast. This furnace will replace another now being used, which will be shut down in 30 or 40 days. At present more copper ore accumulated than one furnace can handle. All five lead furnaces in blast.

CANADA

British Columbia

ST. PAUL group of seven claims belonging to Rembler Paul, of Kelowna, located on Porcupine Creek in Fire Valley district has entered producing stage, having yielded $18 a ton in gold from 175 tons of ore put through two-stamp mill in continuous run of 28 days. Seven men employed mining ore from 2-ft. vein and rawhiding it 1¾ miles from mine to mill. Mill driven by water power obtained from Porcupine Creek.

ARGO MINING & TUNNEL CO (Greenwood)—An 8-ft. vein opened, said to assay $40, at a depth of 800 ft. Strike important as showing gold content continues in depth.

NICKEL PLATE (Hedley)—Construction of power plant on Similkameen River begun about a year ago, fast nearing completion. About 25 men engaged on work and power should be available early in 1915.

NOVA SCOTIA

DOMINION STEEL CORPORATION—Three blast furnaces in operation and fourth will be blown in soon. New structural mill will be erected for manufacture of small material; 12 new wire-making machines being installed to fill large orders for wire received from England.

NOVA SCOTIA STEEL & COAL CO. (Sydney Mines)—Having received heavy orders from abroad company preparing to resume full operations. Open-hearth furnaces, after being closed for about four months, were started several weeks ago; preparations being made to start blast furnaces and other departments.

ONTARIO

CONIAGAS (Cobalt)—Employees paid Christmas bonus of $4015.

CROWN RESERVE (Cobalt)—Company paid customary Christmas bonus to employees, $16,675.

PORCUPINE RESERVE—Property and assets will be sold by tender pursuant to winding-up order.

DOME (South Porcupine)—Large crusher to be installed on bottom level; will probably be 40x48 in.

CASEY-COBALT (Cobalt)—On Jan. 3 end of air receiver blew out damaging side of compressor and breaking pole on power line.

YORK ONTARIO (Cobalt)—Understood company has raised sufficient funds to enable it to resume work on lease of King Edward property.

SILVER LEAF (Cobalt)—Recently discovered vein on 75-ft. level developing satisfactorily. In winze, down 15 ft., vein strengthening with several feet of good mill rock on both sides.

TRETHEWEY (Cobalt)—Company has taken options on two claims adjoining Huronian Mining Co.'s property in Gauthier Township, half way between Tough Oakes and Larder Lake.

PORCUPINE CROWN (Timmins)—Vein at 500-ft. level is 4 ft. wide yielding ore running $15 to $20 per ton. On this level ore contains larger proportion of schist than on upper levels, which will necessitate some difference in treatment to secure good extraction.

HURONIAN—Property now being operated again, having obtained power from Goldfields' Ltd. Mining Co. Some rich stringers of quartz-bearing gold on surface, running parallel within distance of 10 or 12 ft. Ore at present being treated by amalgamation with extraction not more than 50%.

NORTH THOMPSON ASSOCIATED GOLD MINES, LTD. (Schumacher)—Company which purchased North Thompson claims has been registered in London with capital of £200,000 in £1 shares. Company will make agreement with Associated Gold Mines of Western Australia, parent company, regarding property in Porcupine district. Directors receive £100 a year salary and 5% of profits up to maximum of £1000 a year.

The Market Report

Metal Markets

NEW YORK—Jan. 13

Copper and spelter have been very strong. Tin has been about stationary. Lead has been distinctly weak.

Copper, Tin, Lead and Zinc

Copper—The remarkable improvement that developed during the afternoon of Jan. 6 proved to be substantial and well maintained. A fairly large business was done at 13½c., regular terms, and on Saturday 13⅝c. began to be realized. On Jan. 11 the market was very firmly on the basis of 13⅝c., and large sales having been made at or near that figure, the producers began to ask 13¾c., which price was apparently put out as a basis to trade from. At the close the actual market was between 134⅝c. and 13¾c., regular terms.

The volume of business transacted during the week was moderately large. Domestic buying seems to have predominated, but a good deal that was sold to buyers here was destined for export, either as wirebars, cakes and ingots, or as rods, brass, and more highly manufactured forms. The demand during the last week is indeed considered to have a military basis rather than an industrial one. The buying orders have been both for prompt and later shipments, the latter extending through March.

Copper sheets, base price is now 18½c. per lb. for hot rolled and 19½c. for cold rolled. Usual extras charged and higher prices for small quantities.

The Department of Commerce reports the exports of copper from Atlantic ports for the week ended Jan. 2 at 12,051,892 lb. The larger shipments were 6,209,377 lb. to France, 5,050,732 lb. to Great Britain and 682,372 lb. to Russia.

Imports of copper for the week ended Jan. 2 were 635,750 lb. metal and 2,743,395 lb. in ore and matte, 3,379,145 lb. in all. Of the imports 2,429,765 lb. were from Chile.

Tin—After a considerable decline in the London market on Jan. 7, prices became firmer again and quotations were advanced practically from day to day. Consumers in this country however, showed no interest even at the low prices which were quoted here on Jan. 7 in sympathy with the decline in London. However, the close is firm.

Lead—The lead market began to be distinctly weak on Jan. 7, when certain interests, scenting a substantial decline in price, began to sell freely at concessions, undercutting other sellers who found that their offerings at previous prices failed to command more than a relatively trifling business. Outside sellers [illegible] as low as the basis of 3.70c., New York, before the A. S. & R. Co. cut its price to that figure. The reduction by the A. S. & R. Co. was made on Jan. 12.

The statistics showing an increase in the domestic production in [illegible] 1914 were a great shock to the trade, but it is to be remarked that since October production has been curtailed by 10,000 to 12,000 tons, and whatever may be the future of the lead market taking a long view ahead, the present situation appears to be fairly comfortable.

Spelter—[illegible]

[illegible]

such sorts of Prime Western spelter as can be guaranteed a trifle better than the official limits respecting lead and iron contents.

Base price of zinc sheets was advanced ¼c. per lb. on Jan. 12, and is now $9 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

The Belgo-German Zinc Smelters' Union at a meeting in Germany on Dec. 8, 1914, was extended to Mar. 31, 1916, the conditions of the renewal being but slightly modified from those of the present union, which will soon expire. It is reported from Germany that since the outbreak of the war the spelter production has been at the rate of 55c. of normal, but whether this refers to the German production alone, or to the Belgian-German, is uncertain.

Iron Ore Imports in Great Britain 11 months ended Nov. 30, were 6,905,026 long tons in 1913, and 5,340,348 tons in 1914, decrease 1,564,678 tons. Imports of manganese ore were 530,251 tons in 1913, and 446,205 tons in 1914.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
7	4.8388	48¾	13.30 @13.35	32¼	3.75 @3.80	3.55 @3.60	5.87½ @5.92½	5.70 @5.75
8	4.8544	49	13.30 @13.35	33½	3.70 @3.80	3.55 @3.60	5.90 @5.95	5.72½ @5.77½
9	4.8558	48¾	13.35 @13.45	33½	3.70 @3.80	3.55 @3.60	5.92½ @5.97½	5.75 5.80
11	4.8270	49⅛	13.40 @13.50	33¾	3.70 @3.80	3.55 @3.60	6.00 @6.05	5.82½ @5.87½
12	4.8375	49¾	13.50 @13.55	33½	3.70	3.50 @3.55	6.02½ @6.07½	5.85 @5.90
13	4.8363	49¼	13.50 @13.55	33¼	3.70	3.50 @3.55	6.02½ @6.07½	5.85 @5.90

The quotations herein given are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Jan.	Silver	Copper				Tin		Lead		Zinc	
		Standard									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
7	[illegible]	[illegible]	12.7[illegible]	[illegible]		148¼	143½	19	4.13	28[illegible]	6.16
8	[illegible]	[illegible]	12.[illegible]	[illegible]	64[illegible]	150	145	18¾	4.07	28½	6.19
9	[illegible]										
11	[illegible]	[illegible]	12.[illegible]	[illegible]		152	147½	18¾	4.07	28¾	6.25
12	[illegible]	[illegible]	[illegible]	60	[illegible]	[illegible]	[illegible]	18[illegible]	4.05	29	6.30
13	[illegible]	[illegible]	13.01	[illegible]		[illegible]	[illegible]	18	4.05	29	6.30

*No quotations.

The above table gives the closing quotations on London Metal Exchange. [illegible] 2240 lb., except silver which is in pence [illegible] 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being [illegible] London prices [illegible] £10 = 2.17¼c.; £15 = 3.26c.; £20 = 4.35c.; [illegible] Variations, £1 = 0.21¾c.

Other Metals

Aluminum remains quiet, but with more inquiry for metal. Quotations are rather firm, at 19@19¾c. per lb. for No. 1 ingots, New York.—**Antimony** is quiet so far as jobbing business is concerned, but there is some talk of exports. Prices are firmer as supplies are working down, and futures uncertain. Ordinary brands are higher, 14½@15½c. per lb. being paid, New York delivery. For Cookson's 16½@17c. is asked.—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher.—**Quicksilver** is quiet and unchanged, $50 per flask of 75 lb. being the New York price for large lots. San Francisco, $49 for domestic orders, special terms for export. London price is £11@11 5s. per flask.

Minor Metals—Current sales of **Bismuth** have been at $2.75 per lb., New York.—**Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.

Gold, Silver and Platinum

Gold production in the Transvaal in December is reported by cable at 695,000 oz. This makes the total for 1914 in value $172,273,280, which is a decrease of $9,615,732, or 5.3% as compared with the 1913 total.

An unusual incident is the receipt of $3,000,000 gold direct from China; $1,700,000 having already arrived, while the remainder is in transit. This is an unprecedented shipment, as American accounts with China have heretofore been settled through London. The direct shipment is the result of war conditions.

Platinum—The market remains quiet and demand small. Sales are made at $40@43 per oz. for refined platinum, and $45@49 per oz. for hard metal, according to quality.

Our Russian correspondent writes that little change in the situation is apparent. From Ekaterinburg it is reported that the State and private banks are now making advances to the small producers at the rate of 18,000 to 20,000 rubles per pood. This has relieved the pressure to sell, but some small lots have changed hands at 7,30[illegible] rubles per pood—$27.4[illegible] per oz.—for crude metal, 83% platinum. There are no regular quotations for large quantities either at Ekaterinburg or Petrograd.

Silver—The tone of the market continues fairly good. Inquiries other than the English Mint, probably on Oriental account, have slightly advanced price of silver to 22[illegible]d. in London.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 9

Blende, high price $55; assay base 60% zinc, $48@52.50; metal base, 60% zinc, $46@48; calamine, base 40% zinc, $23.50@27; average all grades of zinc, $47.52 per ton. Lead, high price, $48; base, $47 per ton of 80% metal contents; average all grades of lead, $47.12 per ton.

January weather conditions have been ideal all week, with but light freezing at night, and land operations are again well under way.

SHIPMENTS, WEEK ENDED JAN. 9

	Blende	Calamine	Lead	Values
Total this week	10,[illegible]	711,660	1,523,650	[illegible]
Total this year	20,0[illegible]	1,883,[illegible]	2,[illegible]	[illegible]

Blende value, the week, $2[illegible]; two weeks, $486,280.

Calamine value, the week, $9600; two weeks, $25,130.

Lead value, the week, $3[illegible]; two weeks, $59,[illegible].

For week ended Jan. 2 high price of blende was $[illegible]; assay base, $48.50@52.50; metal base, $46.50@48.50 per ton of ore; calamine base, 40% ore, $23.50@27.50; average all zinc ore, $48.[illegible]. Lead high price $48; base, $47 per ton of 80% lead; average all grades, $46.60. Shipments and value, [illegible] lb. blende, $23[illegible]; 1,1[illegible] lb. calamine, $1[illegible]; 1,0[illegible] lb. lead, $23,4[illegible]; total value $[illegible] for the week.

PLATTEVILLE, WIS.—Jan. 9

The base price paid this week for 60% zinc was $[illegible] per ton. No sales of lead ore were reported.

SHIPMENTS WEEK ENDED JAN. 9

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	[illegible]	[illegible],000	[illegible]
Year	6,[illegible],010	[illegible],000	[illegible]

Shipped during week to separating plants, [illegible] lb. zinc ore.

For week ended Jan. 2 base price 60% zinc ore, $[illegible]; base price 80% lead ore, $45@46. Shipments 3,016,[illegible] lb. zinc ore and 256,[illegible] lb. sulphur ore. Delivered to concentrating plants, 2,830,100 lb. zinc ore.

Iron Trade Review

NEW YORK—Jan. 13

The United States Steel Corporation reports unfilled orders on its book, Dec. 31, 1914, at 3,836,643 tons of all kinds of material which is 512,051 tons more than on Nov. 30.

Pig Iron Production in January remains at about the same rate as in December. On Jan. 1, according to the reports from the furnaces collected and published by the "Iron Age," there were 147 coke and anthracite stacks in blast, having a total daily capacity 48,8[illegible]0 tons of iron, an increase of 350 tons over the Dec. 1 report.

PITTSBURGH—Jan. 12

The steel situation continues to show gradual improvement. Prices show a firmer tendency, except in sheets, while qoutations on wire products have been definitely advanced $1 a ton, effective Jan. 11.

The steel mills are still operating intermittently, as specifications are received, but show an average of better than 40%, while in November and December the average was under 35.

The Steel Corporation's unfilled obligations increased 512,000 tons during December, whereas in the three preceding months there had been decreases. The December increase would have been larger had not the corporation subsidiaries canceled several hundred thousand tons that had remained on books and did not seem likely to result in actual shipping orders. January promises to show a further increase in unfilled obligations, as there is a fair volume of contracting for second quarter in bars, plates and shapes.

A few wage reductions are being made in the smaller iron and steel plants, despite the decisoin of the Steel Corporation, followed by the large independents, not to make any general reduction.

Pig Iron—The Westinghouse Machine Co. and Westinghouse Electric & Manufacturing Co. have been in the market for 15,000 to 20,000 tons of foundry pig iron for extended delivery but are understood not to have closed yet. In general the market is quiet though the tone is somewhat firmer. We quote: Bessemer, $13.75; basic, $12.50; No. 2 foundry and malleable, $12.75@13; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market continues quiet with prompt and forward still quoted at $68, Baltimore. Consumers are well stocked for the present.

Steel—Steel mills in the Pittsburgh district are much firmer in their price views, as they have lately closed a large tonnage of billets and sheet bars for forward delivery, though at exceptionally low prices, and the market delivered Pittsburgh is now regarded as $20 for billets and $20.50 for sheet bars. A sale of 3000 tons of billets is reported at $20. With yesterday's advance in wire products rods are firm at $25, Pittsburgh, and may shortly advance.

COKE

Connellsville Coke—The market is now very quiet, practically all the contract tonnage being closed and there being very little demand for prompt. Quotations are largely nominal at $1.60 for spot furnace, $1.75 for contract furnace, $2@2.15 for spot foundry and $2.10@2.25 for contract foundry, per net ton at ovens.

Anthracite Shipments in December were 5,702,2[illegible] long tons, being 39,610 tons more than in 1913. For the year ended Dec. 31 shipments were 69,0[illegible],62[illegible] tons in 1913 and 68,342,601 in 1914, a decrease of 727,027 tons or 1.1%. Making the usual allowance for coal used and sold at mines, the total mined in 1914 was 75,860,300 long tons, equivalent to 84,963,536 short tons.

Chemicals

NEW YORK—Jan. 13

The general markets show rather more activity than for some weeks past, and there are signs of improvement on several lines.

Arsenic—The market is quiet but there seems to be more interest in the article. Quotations are $4 per 100 lb. for both spot and futures.

Copper Sulphate—On a moderate but rather steady business there has been no change in quotations, which are $[illegible] per 100 lb. for carload lots, and $5.60 per 100 lb. for smaller parcels.

Nitrate of Soda—Business has been quite active. Demand is broadening and prices are firmer. The present quotation is [illegible] per lb. for spot and January, and [illegible] per lb. for later deliveries.

Assessments

Company	Delinq	Sale	Amt
Andes, Nev	Jan. 5	Jan. 27	$0 03
Belcher Silver, Nev	Feb. 8	Mar 1	0.10
Bingham Lead, Utah.	Dec. 23	Jan. 12	0 0025
Blue Bull, Nev	Jan. 4	Feb. 8	0.01
Booth, Nev	Jan. 25	Mar. 1	0.02
Cash Boy, Nev	Jan. 15	Feb. 15	0.005
Century, Utah	Jan 2	Feb 2	0 01
Clear Grit, Ida	Jan. 12	Jan. 29	0.0015
Clearwater Con., Ida		Feb. 15	0 001
Con. Imperial, Nev	Dec 23	Jan 15	0.01
Darby, Ida	Dec. 14	Jan 14	0.001
East Hercules, Ida. (post.)	Jan. 1	Feb. 1	0 001
Emerald, Utah (three instal.)		June 9	0.01
Exchequer, Nev	Dec. 21	Jan. 11	0.03
Grt. Copp King, Utah	Dec. 21	Jan. 21	0.001
Gypsy Qn., Nev	Jan. 12	Feb. 16	0.01
Happy Day, Ida	Dec 24	Jan. 25	0 0025
Hope, Calif	Dec. 15	Jan. 11	0.05
Hypotheek, Ida.	Dec. 17	Jan. 29	0.006
Idaho-Nev., Ida	Jan. 7	Feb. 1	0.001
Id.-Mont, Ida (post.)	Nov. 2	Jan. 8	0.001
Keystone, Utah	Dec. 21	Jan. 21	0.02
Laclede, Ida	Jan. 12	Feb. 3	0.003
Lehi Tintic, Utah	Dec. 17	Jan. 16	0.0025
Lucky Friday, Ida	Dec. 14	Feb. 11	0.003
MacNamara, Nev	Jan 12	Feb 3	0.03
Majestic-Idol, Nev.	Dec. 15	Jul. 20	0.005
Moonlight, Ida	Dec 30	Jan. 28	0 005
Nabob, Ida	Dec. 31	Jan. 25	0.005
New Yerington, Nev.	Dec. 23	Jan. 13	0.01
O. K. Ex., Utah	Dec. 26	Jan. 12	0 0025
Oreano, Ida.	Dec. 26	Jan 25	0.00075
Overman, Nev	Dec. 22	Jan. 11	0.05
Phoenix, Ida (post.)	Dec. 26	Jan 26	0.005
Potosi, Nev	Jan. 12	Feb. 4	0.02
Raven, Ida.	Dec 30	Jan. 30	0 0003
Riverside, Ida	Dec. 20	Jan. 20	0.001
Scranton Ex., Utah	Jan. 4	Feb. 5	0 00025
Seg. Belcher, Nev	Dec. 16	Jan. 11	0.02
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev	Feb. 8	Mar. 2	0 05
Silver Star, Ida	Jan. 5	Feb. 5	0 002
Sonora, Ida. post	Nov. 30	Jan. 15	0.002
Sunset Dev., Ida	Jan. 18	Feb. 18	0.0025
Ton Gip Qn., Nev	Jan. 12	Feb. 16	0.01
Umatilla, Nev	Jan. 4	Feb. 8	0 01
Union Con., Nev	Jan. 14	Feb. 4	0 05
Utah-Yerington, Nev	Jan. 2	Jan. 23	0.0006
Wheeler, Utah	Dec. 21	Jan. 11	0.01
Zuma, Utah.	Dec. 21	Jan. 12	0 0025

Stock Quotations

COLO. SPRINGS Jan 12		SALT LAKE Jan 7	
Name of Comp.	Bid.	Name of Comp	Bid.
Acacia	04¼	Beck Tunnel	04½
Cripple Cr'k Con.	01¼	Black Jack	06½
C K & N	06¼	Colorado Mining	10
Doctor Jack Pot	09¾	Crown Point	01¼
Elkton Con.	47	Daly-Judge	4 87½
El Paso	1 40	Gold Chain	09½
Findlay	03½	Grand Central	66
Gold Dollar	04	Iron Blossom	1 05
Gold Sovereign.	06¾	Little Bell	10
Isabella	17¼	Lower Mammoth	04
Jack Pot	07	Mason Valley	‡1 37½
Jennie Sample	02	May Day	13½
Jerry Johnson	03¾	Opohongo	01
Lexington	008	Prince Con	24
Old Gold	01	Seven Troughs	03
Mary McKinney	32	Silver King Coal'n	2 27½
Pharmacist	02	Silver King Con	1 90
Portland	1 11	Sioux Con	02½
Raven B H	03½	Uncle Sam	06
Vindicator	1 24	Yankee	06

TORONTO Jan 12

Bailey	01¼	Foley O'Brien	15
City of Cobalt	‡ 30	Hollinger	22 00
Coniagas	5 00	Imperial	02
Peterson Lake	26	Jupiter	09½
Right of Way	02	McIntyre	19½
T & Hudson Bay	30 00	Pearl Lake	03¾
Timiskaming	12	Porcu Gold	50
Wettlaufer-Lor	04	Preston E. D	01
Big Dome	6 00	Rea	22
Dome Exten	07	Seneca Superior	1 00

SAN FRANCISCO Jan 12

Comstock Stocks		Misc. Nev. & Cal	
Alta	04	Belmont	4 35
Belcher	30	Jim Butler	67
Best & Belcher	04	Lone Star	09
Caledonia	30	MacNamara	03
Challenge Con	03	Midway	07
Confidence	10	Mont.-Tonopah	33
Con. Virginia	12	North Star	15
Crown Point (Nev)	29	Rescue Eula	06
Gould & Curry	02	West End Con	55
Hale & Norcross	03	Atlanta	40
Julia	01	Booth	23
Mexican	58	C. O. D. Con	08
Occidental	85	Comb. Frac	09
Ophir	05	Jumbo Extension	85
Overman	11	Pitts.-Silver Peak	14
Potosi	02	Round Mountain	36
Savage	04	Sandstorm Kendall	11
Sierra Nevada	04	Silver Pick	11
Union Con	13	Central Eureka	24
Yellow Jacket	31	So. Eureka	2 35

N. Y. EXCH. Jan. 12	
Name of Comp.	Clg.
Amalgamated	54⅜
Am.Sm.&Ref.,com	60⅛
Am. Sm. & Ref., pf.	100
Am. Sm. Sec., pf. B.	80
Anaconda	26⅜
Batopilas Min.	⅞
Bethlehem Steel, pf.	97¼
Chino	34⅜
Colo. Fuel & Iron	25½
Federal M. & S., pf.	29¾
Great Nor., ore., ctf.	28¼
Guggen. Exp	47¼
Homestake	115
Inspiration Con.	18¼
Mex. Petroleum	51½
Miami Copper	17¾
Nat'l Lead, com	46
National Lead, pf	107⅜
Nev. Consol	13
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf	1⅞
Ray Con	16⅝
Republic I&S, com	20½
Republic I&S, pf	75½
SlossSheffl'd, com	27
Sloss Sheffield, pf	‡82
Tennessee Copper	32⅜
Utah Copper	51⅞
U. S. Steel, com	51⅜
U. S. Steel, pf.	108⅛

N. Y. CURB Jan 12	
Name of Comp.	Clg.
Beaver Con.	21
Big Four	08
Blue Bell	06
Braden Copper.	6¼
B. C. Copper	‡ 50
Buffalo Mines.	1
Can. Cop. Corpn.	1⅛
Can. G. & S.	03
Caribou	.58
Chambers Ferland.	13
Con. Ariz. Sm	31¼
Coppermines Cons	1
Davis-Daly	1 1/16
Diam'field-Daisy	09
Dia. Black B.	05½
Ely Con	‡ 01
Florence	62
Goldfield Con.	1⅜
Goldfield Merger	33
Greene Cananea.	24
Kerr Lake	4½
La Rose	.75
McKinley-Dar-Sa	57
Mines of Am	2 5/16
Mutual Min., pf	‡2½
Nevada Hills	31
New Utah Bingham	‡ 7/16
Nipissing Mines	5⅝
Ohio Copper.	10
Oro.	12½
Pacific Smelt	1/16
Stand'd Oil of N.J.	400
Standard S. L.	1⅜
Stewart	1 11/16
Tonopah	7 7/16
Tonopah Ex.	2⅜
Tonopah Merger	30
Tularosa	25
West End Ex	03
Yukon Gold	2⅜

LONDON Dec 31	
Name of Comp	Clg
Alaska Tre'dwell	£8 08 0d
Camp Bird	0 6 0
El Oro	0 10 6
Esperanza	0 8 9
Mexico Mines	4 0 0
Oroville.	0 10 0
Santa Gert'dis	0 10 0
Tomboy	1 1 3

BOSTON EXCH Jan. 12	
Name of Comp.	Clg.
Adventure	‡1¼
Ahmeek	‡255
Alaska Gold M	27½
Algomah	‡.80
Allouez	37
Am. Zinc	18½
Ariz. Com., ctfs.	4 3/16
Bonanza	41
Butte-Ballaklava	2¼
Butte & Superior	39⅜
Calumet & Ariz.	54½
Calumet & Hecla.	360
Centennial	15
Cliff	‡1
Copper Range	31
Daly West	2
East Butte	9
Franklin	5
Granby	62¾
Hancock	12
Helvetia	‡.30
Indiana	3⅜
Island Cr'k, com	46¼
Island Cr'k, pfd	‡86½
Isle Royale	18½
Keweenaw	‡3
Lake	6
La Salle	‡3¼
Mass	3
Mayflower	5½
Michigan	‡ 75
Mohawk	47½
New Arcadian.	6¼
New Idria Quick	‡3½
North Butte	23
North Lake	‡1½
Ojibway	‡.75
Old Colony	4⅞
Old Dominion	‡44
Osceola	67
Quincy	50
Santa Fe	1¼
Shannon	4¼
Shattuck-Ariz.	20½
Superior	24¾
Superior & Bost.	1½
Tamarack	28
Trinity	3
Tuolumne.	‡ 23
U. S. Smelting	25
U. S. Smelt'g, pf.	42¼
Utah Apex	2
Utah Con.	10
Victoria	1 3/16
Winona	2
Wolverine.	35
Wyandot	.75

BOSTON CURB Jan 12	
Name of Comp.	Bid.
Alvarado	60
Bingham Mines	3¾
Boston Ely.	13
Butte & Lon'n Dev	23
Calaveras	97
Calumet-Corbin	13
Chief Con	81
Corbin	‡1
Cortez	17
Crown Reserve.	65
Eagle & Blue Bell	90
First Nat. Cop.	1 3/16
Houghton Copper	1⅞
Iron Cap Cop., pf.	‡5
Majestic	15
Mexican Metals.	15
Nevada-Douglas	17
New Baltic	1½
Oneco	75
Raven Copper.	‡ 10
Smokey Dev	10
So. Lake	04⅜
Tonopah Victor.	.17
Trethewey	14
United Verde Ext	1⅞

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56 260	62 938	57 572	25 887	28 983	26 553
February	59 043	61 642	57 506	27 190	28 357	26 573
March	58 375	57 870	58 067	26 875	26 669	26 788
April	59 207	59 490	58 519	28 284	27 416	26 958
May	60 880	60 361	58 175	28 038	27 825	26 704
June	61 290	58 990	56 471	28 215	27 199	25 948
July	60 654	58 721	54 678	27 919	27 074	25 219
August	61 606	59 293	54 344	28 375	27 335	25 979
September	63 078	60 640	53 290	29 088	27 986	24 260
October	63 471	60 793	50 654	29 299	28 083	23 199
November	62 792	58 995	49 082	29 012	27 263	22 703
December	63 365	57 760	49 375	29 320	26 720	22 900
Year	60 835	59 791	54 811	28 042	27 576	25 314

New York quotations cents per ounce troy, fine silver, London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16 488	14.223	71 .741	64.304	77.750	69 488
February	14 971	14 491	65 519	65.259	71.575	70.188
March	14 713	14.131	65. 329	64.276	70 658	69.170
April	15 291	14.211	68. 111	64.747	74.273	69 313
May	15 436	13.996	68. 807	63 182	74 774	67.786
June	14 672	13.603	67 140	61.336	70 821	66 274
July	14 190	13.223	64 166	60.540	69 446	64 955
August	15 400	*	69 200	‡	74.313	‡
September	16 328	*	73. 125	‡	78 614	‡
October	16.337	*	73 383	‡	79 250	‡
November	15.182	11.739	68. 275	53.227	73.825	*
December	14.224	12.801	65. 223	56.841	69.583	*
Year	15 269	13.602	68 .335	61 524	73 740	68 168

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50 298	37.779	238.273	171.905
February	48.766	39.830	220.140	181 556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150 702
June	44 820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41 582	*	188.731	‡
September	42.410	32.675	193.074	‡
October	40 462	30.284	184.837	‡
November	39.810	33.304	180.869	139.391
December	37.635	33.601	171.786	147.102
Av. year	44.252	34 301	206.279	156 564

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4 048	4.175	3.937	16.550	19 606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3 688	17 597	18.225
May	4.342	3 900	4.226	3 808	18.923	18.503
June	4.325	3.900	4.190	3 810	20.226	19.411
July	4.353	3 891	4 223	3.738	20 038	19 051
August	4.624	3.875	4.550	3.715	20.406	‡
September	4.698	3.828	4.579	3 658	20.648	‡
October	4.402	3.528	4 253	3.384	20.302	‡
November	4 293	3.683	4.146	3.585	19.334	18.500
December	4.047	3.800	3.929	3.662	17.798	19 097
Year	4.370	3.862	4 238	3.737	18.743	19 079

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5 262	6 854	5.112	26.114	21.533
February	6.239	5 377	6 089	5 228	25.338	21.413
March	6.078	5 250	5.926	5 100	24.605	21.460
April	5.641	5.113	5 491	4.963	25.313	21 569
May	5.406	5 074	5.256	4.924	24.583	21.393
June	5 124	5 000	4.974	4.850	22.143	21.345
July	5 278	4 920	5.128	4.770	20.592	21 568
August	5 658	5 568	5.508	5.418	20.706	‡
September	5.694	5 380	5.544	5.230	21 148	‡
October	5 340	4 909	5.188	4.750	20.614	‡
November	5 229	5.112	5 083	4.962	20.581	25.016
December	5.156	5.592	5.004	5.430	21.214	27.369
Year	5 648	5.213	5.504	5.061	22.746	22.544

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18 15	$14 94	$17.35	$13.23	$18.59	$13.99
February	18 15	15.06	17.22	14.12	18.13	14.08
March	18 15	15 07	16.96	13.94	17.53	14 10
April	17 90	14 90	16.71	13 90	16.40	14.13
May	17 68	14 90	15.80	13 90	15.40	14 27
June	17 14	14.90	15 40	13 90	15.10	13.96
July	16 31	14 90	15 13	13.90	14.74	13.90
August	16 63	14 90	15 00	13 90	14.88	14 08
September	16 65	14 90	15 04	13 90	14 93	14 03
October	16 60	14 84	14 61	13.75	14.80	13.97
November	16 03	14.59	13 91	13.43	14.40	13.83
December	15.71	14.70	13.71	13 45	14.28	13 83
Year	$17 09	$14 88	$15 57	$13 78	$15 77	$14 01

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton * Not reported ‡ London Exchange closed

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Bawdwin Mines of the Burma Corporation

SYNOPSIS—In northern Burma, development work of the last few years has disclosed one of the world's great zinc-lead-silver deposits in the Bawdwin mines, long worked by the Chinese for silver. The modern exploitation of these deposits was undertaken in 1907 by Burma Mines, Ltd., which first began smelting the old slags for lead, and after many delays, undertook the active exploration of the sulphide orebodies. The development of these extraordinary orebodies and equipment of the property is now in the hands of a technical committee of the Burma Corporation, Ltd., which took over the property about a year ago.

THE STATION AT NAMTU ON THE BURMA MINES RY.

Namtu is 13 miles from the Bawdwin mines; the company's lead smelting plant, which was erected in Mandalay in 1907, has since been moved to Namtu

The accompanying engravings present some views of the Bawdwin mines in upper Burma at the time Burma Mines, Ltd., undertook the smelting of the old slag dumps left by the Chinese. Later the company began exploring the sulphide orebodies of these old mines. The development work of the last year or two has shown this property to contain one of the great zinc-lead-silver deposits of the world.

The exploitation and management of the Bawdwin mines was taken over in April, 1914, by the Burma Corporation, Ltd., and fortunately the development and equipment of this property are in the hands of a technical committee consisting of Dr. E. Heberlein, Theodore J. Hoover, A. F. Kuehn and R. Gilman Brown. Having the technical direction of the corporation in the hands of such a committee augurs well for the future of the enterprise. Some idea of the extraordinary metalliferous content of the ores, the width of the orebodies and the metallurgical problems involved may be obtained from the recent report of the corporation, from which most of the accompanying data were obtained. The stockholders are to be congratulated on the frank and full information given in the summary of the assay maps in the company's report.

Bawdwin mines are in Tawnpeng State, one of the Northern Shan States in upper Burma. The mines are connected with the Mandalay-Lashio branch of the Burma Rys. by a narrow-gage (2 ft.) line, 51 miles long, which meets the Burma Rys. at Manpwe, 544 miles from Rangoon.

Bawdwin Mines Antiguas

The Bawdwin mines were worked for many centuries by the Chinese for silver, possibly dating as far back as 2000 years ago. The present undertaking was started for the purpose of recovering the lead from old slag, estimated at 125,000 to 160,000 tons, left by the Chinese, and to prove and work the virgin ground below a vast open cut, locally called "the amphitheater." The smelting plant for the treatment of the slags, on account of flux supply, was originally erected at Mandalay, but in 1912 was transferred to Namtu on the company's own railroad, 38 miles from Manpwe and 13 miles below the mine.

An Early View of Bawdwin, Showing Station, Offices, Ore Bins and Siding Shortly after the Modern Exploitation Was Begun

The company's concession embraces an area of 2496 acres, beside various smelting and railway sites. The Sterne River in passing through the leases drops about 1000 ft. The average elevation of the mine area above sea level is 3200 ft. The ore channel is from 350 to 500 ft. wide, and has been definitely traced for a length of at least 8000 ft. The active work by ancients and by the present company has been concentrated on the northern 1000 ft., where the ore outcrops at the surface. The ore occurrence of present greatest interest is in nearly vertical shoots in feldspathic grit, locally classified as the Bawdwin series. The hanging wall in all cases, and the foot wall in some cases, is feldspathic grit, but the foot wall is generally rhyolite. The ore channel is capped by sedimentaries locally classified as the Banyan series, which dip at a flat angle to the south. The upper, or northern, 4000 ft. has been largely eroded. In this upper series, flat ore occurrences have been noted but from available data seem to be of minor importance.

The ancients devoted themselves largely to the exploitation of the high-grade silver-lead ore, while the work of the present company has been directed to the exploitation of the deposit as a whole. The principal orebody, the Chinaman, has been opened at the Chinaman tunnel level for a distance of 1300 ft. and an average width of 49 ft. The sulphide ore is of complex character and falls into four general classes, the predominating and most valuable metals being mentioned in the order of their importance: (1) Zinc-silver-lead ore; (2) lead-silver-zinc ore; (3) silver-lead-zinc ore; (4) copper-silver ore. The approximate assays of these four classes of ore are given in the accompanying table.

TYPE ASSAYS OF BAWDWIN ORES

Class of Ore	Silver, Oz.	Lead, %	Zinc, %	Copper, %
Zinc-silver-lead ore	24	26	30	..
Lead-silver-zinc ore	17	24	14	..
Silver-lead-zinc ore	40	30	26	..
Copper-silver ore	8	..	..	15

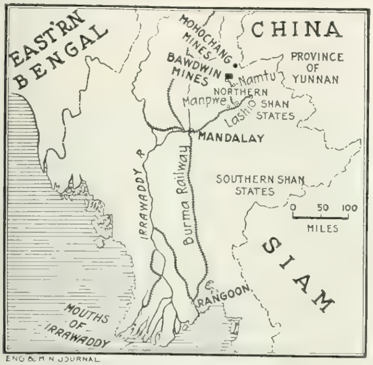
All major effort is today being devoted to the opening of the Chinaman orebody and the fulfillment of the program to extract and market 1000 tons of ore per day. Bawdwin is one of the few development operations that have not been stopped by the European war. This is partly due to the fact that this property is producing from

650 to 850 tons of lead per month, although only considered as yet in the development stage.

Development Work

The principal development at Bawdwin mines is through (1) the Chinaman tunnel, (2) internal shaft from the 171-ft. (Chinaman tunnel) level, (3) a 437-ft. vertical shaft, (4) the Tiger tunnel.

The Chinaman tunnel, the portal of which is 3650 ft. south and 100 ft. west of the vertical shaft, enters the ore channel at a point 1887 ft. south of the shaft and at a horizon about the same as the 171-ft. level of the shaft. For the present, it is the outlet for the 0, the 102-ft. and the 171-ft. levels in the Chinaman orebody, which is the principal development at the Bawdwin mine. The Chinaman orebody, as will be noted from the accompanying plan, contains a core of zinc-lead ore about 500 ft. long, with an average width of about 44 ft.; over the maximum width, 100 ft., the average assay was Ag 22.7 oz., Pb 25%, Zn 29.8%. Lead-zinc ore envelops the zinc-lead core and extends over the whole length of the zinc-lead ore with various widths averaging about 29 ft.; over a width of 63 ft. it assayed Ag 23.3 oz., Pb 27.9%, Zn 16%. The two orebodies were 113 ft. at the point of maximum width; at this point the average assay for the total width was Ag 20.6 oz, Pb 25.6%, Zn 19.2%. Low-grade ore of possible value for concentration, but not at present considered in the ore reserve, partly envelops the other orebodies and runs from nothing up to 65 ft. in width; the latter width is at the point of maximum width for the other two orebodies and the average assay of the low-grade extension at this place was Ag 7.7 oz., Pb 8.7%, Zn 4.2 per cent.

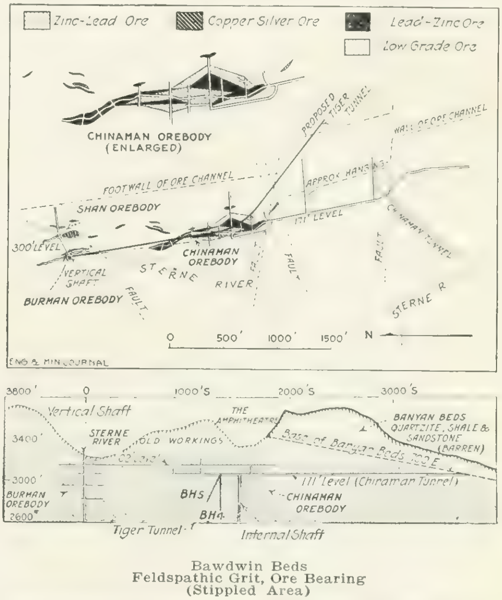


Sketch Map Showing Bawdwin Mines

From the 171-ft. (Chinaman tunnel) level, the internal shaft and bore hole No. 4 have encountered higher grade silver-lead-zinc ore than is today found in the upper workings of the Chinaman orebody, the presumption being that the high-grade silver ore in the upper part of the deposit was mined by the Chinese. The internal shaft was 168 ft. deep on Dec. 13; crosscuts driven at 67 and 124 ft. showed an average value over a width of 90 ft. of Ag 18.4 oz., Pb 21.3%, Zn 21%. Bore hole No. 4, between vertical depths of 136 to 254 ft., showed Ag 42 to 49 oz., Pb 32 to 39%, Zn 26 to 30 per cent.

Burman and Shan Lodes Narrower

The vertical shaft, from which the Burman and Shan lodes have been opened, is situated about 1100 ft. south of the north end of the Chinaman orebody and is now 437 ft. deep. Crosscuts driven at the 102-ft. and the 171-ft. levels intersected old workings, while the 300-ft. level and a crosscut at the 430-ft. level were driven in virgin ground. The Burman orebody on the 300-ft. level had an average width of 31 in. over a length of 190 ft., assaying Ag 37 oz., Pb 33%, Zn 16%, and a trace of copper. The Shan lode parallels the Burman lode about 150 ft. to the east; no attempt was made to cut the lode at the 171-ft. level, but at the 300-ft. level, chiefly south from the crosscut, a copper orebody was encountered, averaging about 15% Cu and 6 oz. Ag; on the 430-ft. level, the average value of the ore over a width of 23 ft. was Ag 21.7 oz., Pb. 24.4%, Zn 16.5%, Cu 2%. The pumps have been pulled in the vertical shaft and exploitation of the Burman and Shan lodes discontinued, while the development on the larger Chinaman orebody is being pushed.



Plan and Section through the Bawdwin Mines of the Burma Corporation

Tiger Tunnel 500 Ft. Below the Chinaman

The Tiger tunnel is being driven as a complete working entry to the mine. Its portal lies in the Sterne River valley at a convenient point of access to the Namtu smelting works. This adit will be 6000 ft. long, entering the ore channel a short distance south of the internal shaft. It will enter the workings about 500 ft. below the Chinaman tunnel and 660 ft. below the collar of the vertical shaft. The Tiger tunnel on Dec. 13, 1914, was in 673 ft., an average advance of about 85 ft. per month having been made by hand work; recently a power plant and rock drills were installed, and this speed should shortly be increased.

The technical committee of the corporation in November, 1914, estimated that on the 171-ft. level, an area of 63,500 sq.ft. had been opened on the orebody, equivalent to approximately 670,000 tons per 100 ft. of depth; and on the 102-ft. level, an area of 43,000 sq.ft., equivalent to approximately 453,000 tons per 100 ft. of depth. The ore reserves are officially stated as: Proven ore, 440,000 tons, averaging Ag 16.3 oz., Pb 20.4% and Zn 20.5%; ore reasonably assured, 870,000 tons, averaging Ag 21.6 oz., Pb 24.6%, Zn 22.1%. The ore classed as "reasonably assured" is that in the wedge-shaped block connecting the extremities of the fully developed portion on the 171-ft. level with the developments of the internal shaft and diamond-drill hole No. 4, taking a vertical depth of 200 ft. below the 171-ft. level. Commenting upon the ore reserve, the technical committee states that the bottom of the mine is in the highest grade ore and the greatest widths yet encountered.

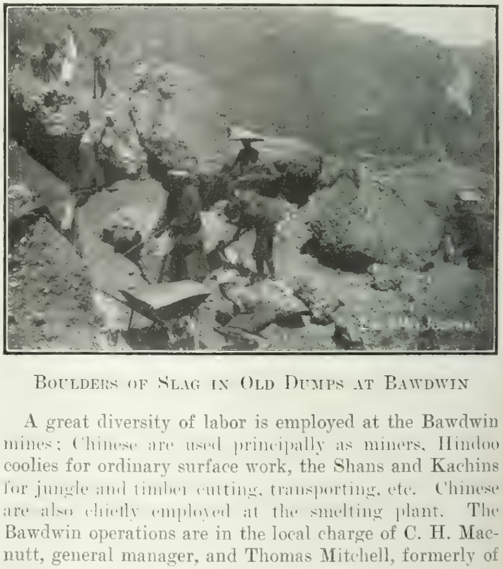
The present equipment at the property consists of a lead-smelting plant, a lead refinery, an experimental mill, various mining equipment and 51 miles of railway of 2-ft. gage. The company's smelting works comprise three blast furnaces, two roasting furnaces, and H-H sintering pots having a capacity of 3000 tons per month. The output of the smelting plant is about 750 tons of lead bullion per month. The company sells soft, refined lead and also silver-lead bullion. At the beginning of the European war, the company was selling at a profit to Continental smelters about 2000 tons of zinc-lead ore per month, derived partly from development. The company is now stockpiling from 1500 to 2500 tons of this ore monthly, but has found a market in the East for much of its lead, owing to other supplies having been cut off.

ANNUAL PRODUCTION OF 300,000 TONS

It is proposed to place the Bawdwin mines in a position to produce 300,000 tons of average ore annually, and in order to get on this basis the technical committee reported in April that it was necessary: (1) To complete the Tiger tunnel, carrying on internal development concurrently; (2) to widen and realign the route of the railway; (3) to install a hydro-electric power plant; (4) to erect a concentration mill. The capital outlay involved in this program is roughly estimated at £250,000, not including the cost of reconstructing the railway. It was estimated that about two years would be required for the consummation of these improvements and during this period the production at the mines would not only cover administration expenses, but contribute materially to the capital outlay. Some of the improvements have already been made and others started. Surveys have been completed for the hydro-electric-power development at Mansam Falls and the plant will be ordered in the near future.

The high metal content of the Bawdwin ores is partially offset by their complexity, and the profit value does not follow from the gross value, but rather from metallurgical considerations. The working costs under the new program were estimated by the technical committee, in April, 1914, as follows: Development, mining and handpicking, 12s.; transport to Europe, 41s. 6d., or a total of 53s. 6d. In case of concentrating the ores, there would be an increased cost due to this operation but a decreased cost for transport charges, and the costs in this case are estimated to be under 40s. per ton. In view of the extraordinary gross value of the ores, there is a great opportunity for the expansion of profits by the development of metallurgical methods for the recovery of the various metals; but it is too early to make any definite statement as to what can ultimately be done in this direction. Shipments of average grade zinc-lead ore, without any attempt at hand-picking, namely, of a grade of 30% Zn, 26% Pb and 23 oz. Ag, showed a profit of from £2 to £2 10s. per ton of ore, when the combined metals had a value of £39, the average prices of the preceding four years.

The lead-zinc ore will require concentration prior to shipment. This ore is of higher average grade than that of Broken Hill, and of much the same general metallurgical character. Considering that the working conditions will be more economical than at Broken Hill, the technical committee estimates that the profit per ton on the lead-zinc ore should be about £2 per ton. The copper-silver ores can be smelted locally, at a profit of approximately £3 per ton under average copper markets, but as yet no consideration has been given to the question of equipment, etc., on account of other development connected with the larger zinc-lead and lead-zinc orebodies. The above were pre-war estimates, but Chairman H. C. Hoover at a recent meeting stated that the cost of placing either crude ore or concentrates into metallurgical establishments in Europe would not exceed £3, whereas the value of the ore was from £11 to £18, thus leaving a comfortable margin.



BOULDERS OF SLAG IN OLD DUMPS AT BAWDWIN

A great diversity of labor is employed at the Bawdwin mines; Chinese are used principally as miners, Hindoo coolies for ordinary surface work, the Shans and Kachins for jungle and timber cutting, transporting, etc. Chinese are also chiefly employed at the smelting plant. The Bawdwin operations are in the local charge of C. H. Macnutt, general manager, and Thomas Mitchell, formerly of Butte, is assistant manager.

MOHOCHANG MINES AND OTHER PROSPECTS

Besides the Bawdwin mines, the Burma Corporation has acquired a 90% interest in the Mohochang mines, situated about 20 miles north of the Bawdwin mines. There are also extensive ancient workings in this property, and a considerable amount of slags from ancient smelting operations. The ore seen on old dumps is similar to the Bawdwin. A small furnace has been erected and produced lead from the slags; smelting has been stopped, but exploration work is in progress. The company has also acquired a large interest in a promising copper prospect. The work on the prospects in the immediate future will probably be purely exploratory and not of magnitude until general conditions are more favorable.

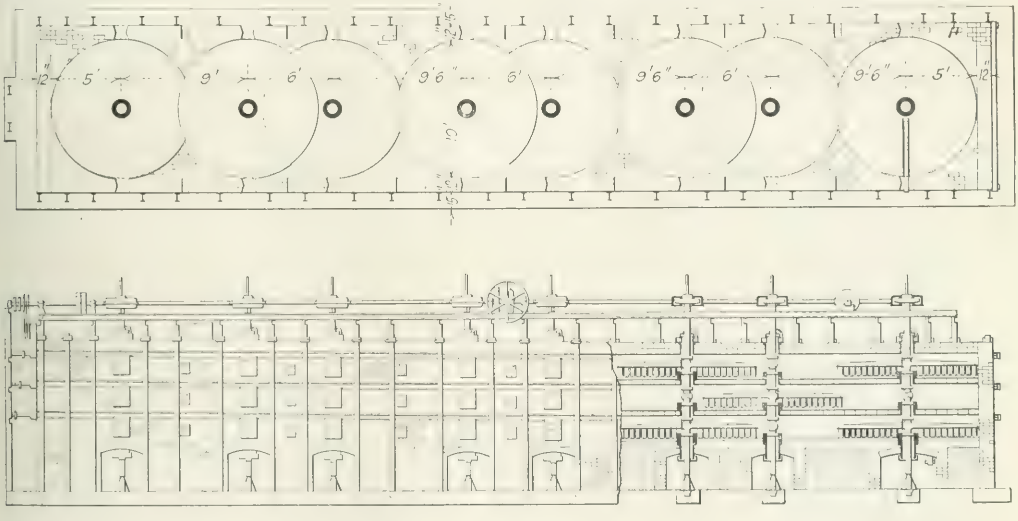
Rectangular Mechanical Furnaces

By Godfrey Vivian*

SYNOPSIS—Some of the salient characteristics of the Edwards and Merton types of rectangular, mechanically rabbled furnaces.

The development of mechanical furnaces has advanced considerably more in Europe than in either America or Australia, the cause being that more complex ores are worked and that a mechanical furnace capable of producing sulphuric acid from complicated blende ores and at the same time leaving the blende with very low sulphur, calls for a calciner designed on very scientific lines.

It is at once apparent to the metallurgist that the multiple hearth, with its capacity for passing the heat through the brickwork to the bottom of the charge above, must be productive of a saving in coal over the long straight hearth; but the difficulty to be overcome of keeping up the hearths from falling in has led to a fact being discovered in practice that to have a safe arch the rise should never be under ½ in. to the foot.



Merton Ore-Roasting Furnace for Sulphuric-Acid Production

Here again in Europe this has led to the duplex furnaces being designed in two separate units with a division wall, as against the duplex with no division wall and intersecting rabbles as in the Edwards of Australian gold-telluride roasting practice. On the question of capacity, this led Edwards to adopt his variably inclined hearth, but in Europe the means of augmenting the speed of ore fed through the furnaces has proceeded on other lines.

Means of Accelerating Speed of Ore through Furnace

It is perfectly evident that where a hearth has an inclination and all the rabbles intersect at about their middle path, the progress of the ore through the furnace is in no way dependent on the length of the furnace, progression being produced by the talus or heap at the end of the rabble being less when the rabble is at its highest point from the level than when it is at its lowest; that is, there is more ore falling away from the rabble when it is near the fire end than when at the feed end of the furnace.

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*Mining and metallurgical engineer, Camborne, Cornwall, Eng.

In an Edwards duplex furnace the backwardation[1] is tremendous. In an ore that has to stay in the furnace a very long time, this type of furnace is advantageous, but supposing that capacity is necessary, then we have to resort to other means of preventing backwardation. In the Edwards duplex, the rabbles do not intersect each other even approximately to the middle of their paths in certain blocks. These particular rabble-arms, where the paths of the rabbles only slightly intersect, are fitted with an involuting rabble, so that backwardation is impossible beyond the obviously designed or intended limit.

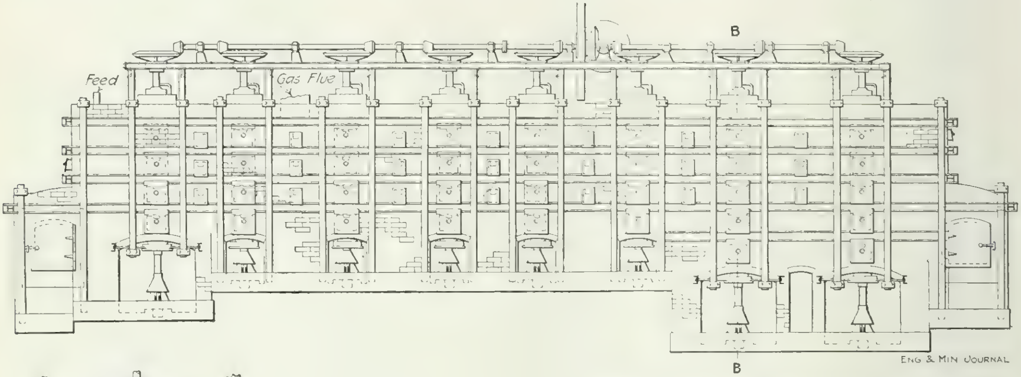
Backwardation may also be prevented by stepping the hearth, and setting the lower rabble to cut under the other, or it may be obtained in the Edwards duplex furnace by setting the rabble-arms perpendicular instead of inclined, which really amounts to the same thing as stepping. If further backwardation in the Edwards duplex furnace has to be prevented, all the rabbles on one side of the furnace must revolve the same way, in such a manner that when the rabble goes up the incline, it shall do so by going up against the wall of the furnace and down in the middle, since no talus can form against the wall but can in the middle of the calciner.

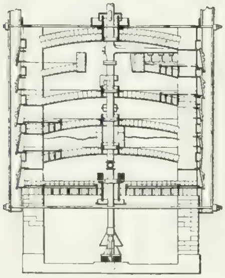
The advantages of putting all involuting rabbles on one set of arms and devoluting rabbles in the following set can also be seen from a consideration of the Edwards furnace. The speed of rabble arms may be from 1½ up to 8 r.p.m. Where dusting is at all pronounced, the long multiple hearth stirs up obviously less than does the circular calciner.

Characteristics of Good Calciner Brick

The whole question of bricks in a calciner is one of degree of heat, but the expansion or contracting under heat must also be tried practically, before the bricks are put into a furnace. Care should always be taken to have a chemical analysis made of the bricks as high lime and heat are incompatible, because the bricks disintegrate. The effects of sulphur on the brick should also be tried and in no case should old bricks be used, because if any compounds of alumina and sulphur are formed in the brick, these in the presence of water will so swell that the bricks will not only disintegrate, but heave all the brickwork and arches out of level. Firebricks should never be too siliceous or contain too much alumina, as too much silica swells, and so causes the arches to rise to an extent that may interfere with the rabbles, while too much alumina will drop the arches so that often bricks will drop out and cause breakage in the calciner.

A good brick should have the alumina and silica balanced with the lime somewhere about 3%. In texture, a fine brick should of preference have the silica in small angular 2- or 3-mm. grains as quartz; this keeps the brick from splitting under heat, which is most important.




SECTION B-B

Merton Muffle Furnace for Blende and Copper Matte

Most European multiple-hearth calciners have a jack at the bottom of the shaft, so that the rabbles may be lifted or lowered as the furnace changes in temperature.

Rabbling a furnace in an excess of hot air, in a muffle, is peculiar to the Merton calciner, and is particularly advantageous in blende ores that contain lime, magnesia, baryta, etc.

Firebox Construction

In regard to firebox construction, the semiproducer type seems to be replacing all other forms. Whether hollow firebars are used for the production of hot air for calcination or combustion purposes depends entirely on the coal and the labor. When the Welsh firebox is used with clinker-grate, the air is best taken from below the firebars. All iron work used in the furnace has resolved itself into cast iron for shafts and rabbles. All shafts are being made hollow with either an internal tube for water circulation or with a division, but the internal water tube easily takes first place when there is much heat required. Where the furnace is water cooled, there are a number of heat units lost in the process, so that practically wherever water or air is used for cooling process it becomes more economical to cover the rabbles and shaft, more particularly those in front of the fireplaces, with clay, so that the coal may be saved. A simple calculation on any water-cooled furnace as to the amount of heat lost in heating the water for the rabbles will make this point assume its proper proportions. These coverings may be made either in tile or a mixture of fireclay and long-fiber asbestos mixed into a clay with silicate of soda solution (12½%). All bricks in the arches should be dipped in a mud of fireclay mixed with silicate of soda (12½ to 15%) solution. The proper proportion is found by making the mud and trying it on the bricks to be used in the firebox of any working furnace.

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[1] Backwardation is the term applied by the author to the tendency of ore in the mechanically rabbled furnaces to go round in a circle with the rabble, instead of proceeding through the furnace.—EDITOR.

Feed is a most important point in mechanical-furnace construction. Usually a calciner fed from the side to the top rabble, and the flues taken off between the first two shafts, will give good results. Sticky or wet ores are best fed by means of a worm such as is used on a pugmill and the amount of ore regulated by a measurer with pockets. The speed of the measurer is regulated by a ratchet wheel placed on the outside, with the rachet on a variable arm worked by an eccentric from the main shaft of the calciner, which by varying on a slide will move the measuring wheel either one or two teeth.

Another good feeder is a hopper made so that it can e lowered onto a revolving plate placed in the center of he hopper. The method of forming muffles so that the ases may be taken off resolves itself into building three mall walls along the back of the arches and covering hem with large firebrick tiles that dovetail the one into he other. The passing of the ore from one hearth to the ther is done by cast-iron or fireclay pipes.

As to gearing, all tendencies seem to be toward the orm gear in oil. Mechanically, the worm may be inefficient, but it is dust-proof, and its great advantage is hat the internal tube for water circulation (for flushing ut the rabble arms) may be placed at any height and the ear got near to the furnace.

The Merton calciners are in use both in Great Britin and on the Continent. The calciner for roasting tin oncentrates containing carbonate of iron, arsenic, sulhides, etc., dries the concentrates on the top of the furace, which does away with the expense connected with rying concentrates and the labor connected with it. he main arch is constructed of solid interlocking firericks so that it is never possible for the arch to collapse r for firebricks to drop out into the calciner, thus causg serious breakages.

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Kerr Lake

The report of the Kerr Lake Mining Co., Cobalt, Ont., r year ended Aug. 31, 1914, states that 1,828,424 oz. silver were produced on which a profit of $620,785 was ade; $614,000 of this was paid in dividends. Total dividends to date amount to $5,220,000. The cost of production is given as follows: Mining and development, 2.49c. per oz. of silver; shipment and treatment charges, 1.61c.; administration and general, 0.76c.; total, 21.86c. er oz. of silver. The smelters' settlements show a proction of 1,670,933 oz., indicating a deduction of 174,-22 oz. of silver in the way of treatment charges and sses. Ore reserves were estimated to contain 5,698,700 of silver. Development work for the year amounted 5399 ft.; stoping, 37,100 sq.ft.; and trenching, 2513 ft. evelopment work to date amounts to 40,062 ft. Altother, there were 44,794 tons of rock hoisted; of this, 33,955 tons were ore and 10,839 tons waste. Of the ore, 321 tons were sacked, 16,130 tons milled and 17,504 tons discarded as waste from the bumping tables. The mining cost was $5.09 per ton of rock hoisted.

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Mining Prospectuses

By T. M. C.

Many a peevish wail has been blatted forth from between the gnashing teeth of unphilosophical losers in the mining game; and a very common grievance is that the prospectus of the mining company was deceptive. Such, unfortunately, is often the case. But perhaps the average mining prospectus would assay fairly high in frank honesty as compared with some of the "documentos ineditos" of the ordinary business world. Consider, for instance, that fruit vulgarly known as the "cackle berry." Down in Mexico, when Juan brought in a basket of eggs from the ranch, he would offer them "as is" at a flat rate of 3 centavos each. But if we insisted upon putting them through the inquisition "trial by water," the innocent eggs which sank commanded a rate of 4c. each, or "tres reales y media la docena si toma Ud. todo." But in New York City you may be offered eggs which are neatly labeled with a rubber stamp; in some cases even dated. The shell of such an egg is literature. It is a mining prospectus. If we see a duck egg labeled "Fancy White Leghorn" we are shy of investing. The egg may be perfectly fresh and wholesome, but we instinctively know that there is something wrong, although the primary or the ultimate vendor may be entirely innocent. Some benevolent duck with perverted maternal instincts may have "put one over" on a perfectly respectable hen. A zealous employee of the vendor, working overtime, stamps the egg with the official label. A slave to routine, he dares not intrude his personal convictions, lest he be haughtily reminded that his task is simply to label each egg to correspond with the hen in whose nest the egg is found.

Mining engineers are frequently employed by individuals and companies interested in the preparation of mining prospectuses and reports which are simply revised editions of prospectuses. And in rare cases a genuine engineer is permitted to arrange the final proof sheets of such publications. It is customary for the employer to outline the class of report desired; and an engineer may be asked to report upon certain definite features of a mining property or proposed undertaking, being requested to pay no attention to other features, the consideration of which might involve the unnecessary expenditure of time or money or both. And there have been cases where there existed other motives for restricting the activities of the engineer. In the preparation of a prospectus the name of the engineer is often omitted, especially in the cases where much of the subject matter of his report has been eliminated. Such action on the part of prospectus editors does not necessarily imply dishonesty. Those who publish mining prospectuses have something to sell, as a rule.

It is natural that they should desire to present their proposition in the most favorable light. The reader is privileged to investigate all statements before purchasing stock. If he buys, he can have no just grievance on the ground that the literature was deceptive, unless he can prove that the prospectus contained false or deliberately misleading statements concerning supposed facts. For example, let us imagine that you have organized the "Peg Leg Imperial Gold Mining Co.," incorporated under the laws of the state of Arizona, with a capitalization of 1,000,000 shares at a nominal par value of $1 each. Then suppose you issue a prospectus, offering 250,000 shares of treasury stock at 10c. per share. An invitation to get rich could be concocted by first quoting verbatim one or two newspaper accounts of the marvelous gold discovery said to have been made by "Peg Leg Smith" in the early part of the past century. Then note that when Melchior Diaz reached the Colorado River it was called the Tizon. Casually remark upon the resemblance of this name to the Pison, listed in the opening chapters of the book of Genesis as a river abounding with gold. It is unnecessary to state that historians say Diaz named the river "Tizon" because of the habit the Indians of that region had of carrying firebrands to keep warm. Some historians are malicious or idiotic liars; and anyhow, too much of the wrong brand of history will interfere with your business. Repeat a little of what aids your purpose, and let the other fellow have plenty of bucking space for the hobby of his imagination. All you have to do is cinch the saddle tight.

Briefly outline the purpose of Coronado's expedition and show what quitters they were to give a black eye to regions which now abound with prosperous mining camps. Mention that Cardenas (sent by Don Pedro del Tovar to investigate the lake on whose shores much gold was said to be found) was headed straight for the Peg Leg zone in the Salton Basin near the lower Tizon (Pison?), and would no doubt have reached that section if he had continued on the schedule as planned by the Moquis of Tusayan. Casually note that the Spaniards were looking for seven cities as per the original dream of their pre-Columbian ancestors, and that the Indians of the Southwest almost without exception had met the overtures of Alvar Nuñez Cabeza de la Vaca with the mystic word of "Cibola," following this up with the cheerful pastime of killing until but few remained alive to reach the viceroy with the tales which inspired the expeditions of Fray Marcos de Niza and Coronado.

Then note the resemblance of "Cibola" (pronounced by some Spaniards as "Sibola" and by others as "Thibola") to the mysterious test-word "Shibboleth—Sibboleth," which the Bible mentions as being propounded by the guardians of a river to determine the credentials of those who desired to pass. If you can work it in tactfully, render the name of the city Tusayan as "Tuz-Ayan," and fake up some clever English equivalents for the words "Tuz" and "Ayan," which seem to be favorite geographical appellations for that portion of Turkey where some theologians have assigned the river Pison. To clinch the error of such location, show that the source of the river which waters Ethiopia is quite remote from that of the Euphrates, thus exploding the theory that the four rivers which sprang from the Garden of Eden had any connection with the vicinity of Mount Ararat. Scrupulously avoid quoting Mr. Dominian ("Trans. A. I. M. E." XLII, p. 586), lest you damage your case.

Continue reference to the Bible by quoting the text about King Hiram and the ships of Tarshish bringing gold to King Solomon, and show by a calculation from data in I Kings, x, 14, that some $20,000,000 in gold was conveyed in one year; and show by verse 22 that the ships returned every three years. Call attention to th fact that the original Mr. Tarshish was a grandson o Japheth, first mate of the ark. Also note J. P Jehosophat's experience in attempting to reorganize th Tarshish Navigation Co. and the location of his shipyard. Mention the date palms found in the Salto Basin, touching upon the mystery of their origin. A the author George Wharton James expresses it, "Whenc came these date palms?" They yield a very inferio fruit, but dates. Trees propagated from date seeds als yield inferior fruit. Now call attention to the fact tha the principal date region in the world is that from whenc sailed the mysterious ships of Tarshish.

Quote an article published in the National Geographi Magazine, about five years ago, which speaks of the reported finding of an ancient sailing vessel imbedded i the shifting sands near the Imperial Valley; showin how it was surmised to have been Spanish, but that n precise investigation was ever made. Here again it i quite unnecessary to state that of a fleet of four vessel which followed up Alarcon's explorations of 1540, thre disappeared and were never heard of again. In a mining prospectus you must not tell too much.

Give a moderate dose of figures and calculations base upon the writings of Major Powell and others, showin the approximate tonnage of rock which was yielded b the immense watershed of the Colorado or Tizon (don' forget to put in "Pison?" once in a while) River. Enumerate several of the rich gold mines now operating within that territory, milling the residual roots of veins lon since eroded. Give an approximate total of production o all gold mines within the limits as aforesaid. Show th grinding power of the rocks in the cañon rapids, besid which the puny efforts of a man-made pebble-mill slime shrink to insignificance. Estimate an infinitesimal valu per ton of rock, and then cast up the figures showin what must have been the value of all the gold in th millions upon millions of tons of rock which crumble and passed beneath the waters. Call attention to th golden sands on the beach at Nome and other points and then blandly ask where is the gold of the Tizon Where?

Then summarize your random quotations and weav a plausible theory in the hypnotic form of making th reader believe that it is his own clear, logical mind whic has deduced the inevitable conclusion—namely, that th gold is where it is. Practically, it is where you find it and in several other places. Be careful not to jolt th mental processes. A few adroit questions will start train of thought in the reader's mind, and you have him going till the whistle blows. That is, a certain class o investor. Cap the climax with the description of plausible scheme of operation and a list of good, hones directors and perhaps (mind you, we say *perhaps*) w might take a few white chips ourselves, just for the fu of the thing. You see, the drills might show no appr ciable values in gold; but if water in sufficient quantit for irrigation is found, the result would be of everlastin benefit to humanity. However damfoolic such a minin prospectus might appear to a mining engineer, it woul be hardly less rational and logical than some real one we have read. And they got the money. If you do no believe that even the wisest of bankers relish a bit o nonsensical finance now and then, just glance over th unexpurgated lists of the appraisals of their estates.

The Opportunity in Placer Mining

By Carney Hartley*

SYNOPSIS—Placer mining outside of dredging little developed. Expert handling neglected. Opportunity exists in semiarid regions. Failures largely attributable to lack of mechanical-engineering experience. Ore-concentrating methods available in general way. Round sum must be spent for plant just as in case of dredge. Full-circle-swing steam shovel offers attractive possibilities. Treatment involves roughing process and final concentration. Typical plant shows characteristic failures but offers suggestions. Little skilled labor needed.

In a letter recently received from the editor of one of the American mining journals, placer mining is referred to as being largely a prehistoric art. In the minds of a great many people, it has unquestionably about this position, and when we consider what has been done for it, we should almost feel justified in going back to the hieroglyphics of Egypt with the reasonable expectation of finding some valuable matter on methods employed.

Causes of Slow Development in Placer-Mining

Within the history of placer mining, there has practically been one advance, the development of dredging. This has put in the minds of a great many people the idea that placer mining can be conducted only in one of two ways; either by hydraulic operations with the sluices which usually accompany that form of mining or by dredges. This impression is altogether wrong and has unfortunately been the cause of a great deal of useless investment, besides stopping the growth of the placer-mining industry in directions which at this time, because of neglect in the past, offer more opportunities than any other.

In the ordinary lines of endeavor, it is hardly considered as showing either knowledge or good judgment to hire a plumber to put on a shingle roof. In carrying on mining operations, such incongruous combinations are not infrequent, and it is the rule rather than the exception that the man who is put in charge of mechanical plants for doing placer mining, other than dredging, has no more to recommend him for the position than the fact that he has done placer mining. There are numerous instances, even more extreme, of men put in charge who had never done placer mining but could run machinery.

There are a great many placer properties which have to the eye of the ordinary observer all the requisites for financial success. This is true, not only of properties which seem suitable for hydraulic work, but even more so of those which might be considered for dredging. Just why they eventually prove unsuccessful is not always understood by the stockholders and frequently not understood by even the management, except that they can figure easily that there is no more money available and can reason, therefore, that they must be spending it faster than they are taking it out—not an indication of profit. The outside specialist sometimes called in at this stage often refrains, through politeness, let us say, from expressing the feelings aroused by what he finds.

I have spent a good many years in following the development of placer mining, dating from the time the first practical dredge of the American type was built. The conditions shown therein have been, if anything, worse than those shown in lode mining, due, no doubt, to the greater attractiveness of mining gold and to the generally accepted idea that placer mining is a much simpler undertaking than the other. In the earlier days of mining this was undoubtedly so. And the impression reasonably follows from the stories told by early prospectors in the Rocky Mountain region. To hear an old-timer in California Gulch say that when he could not clean up $100 a day with a pick and shovel and a long tom, he would move to a new location, is impressive; while to hear of a man cleaning up $800 in one day is sure to make a live man think of the possibilities which might result from more modern methods of doing the work. He is thoroughly surprised on investigation to find that "there ain't no such animal," the modern methods of doing the work being the methods of 1860, of 860 and, we might pretty nearly say, of 60 B.C.

All of this may sound somewhat facetious and a good deal like the wail of the disappointed office-seeker in speaking of his successful opponent, but, as a matter of fact, the premises is easy to prove, while at the same time, the proof is worth while, since there are actually great possibilities along legitimate lines, possibilities worth many times the effort being put on them today or for a number of years past.

Failure to Handle Semidry Placer Properties Successfully

Between the placer-mining property which can be successfully worked by pick and shovel and that which can possibly be worked by dredging, there is a vast amount of ground which carries a good gold content. This is particularly true in the arid countries where little or no water is available, but it is not by any means limited to such regions. Some of these properties have been equipped for operation, but lack of knowledge of methods has made them altogether unsuccessful and has unjustifiably laid the curse of failure on them. Many of them are in the hands of people who have neither the means nor the connections to develop them, and who fail to understand the increase of value which proper development would give, holding them at a figure entirely beyond their legitimate value. For these reasons also, there have been numerous failures in attempting to equip these properties and this has discouraged many people who might otherwise be interested and who could be interested provided one real success could be shown them.

In considering all these causes of failure, the one most evident can be classed under the general head of ignorance. This is no disparagement of the men who tried, since they unquestionably did the best they knew how, but the difficulty is that they did not know how. The mechanical equipment for any mining property is expensive and in most cases its success or failure cannot be determined until it is fully installed and ready for operation, which practically means that the initial investment is complete. In a great many instances, this entire work has been placed in the hands of men who were thoroughly competent in mining operations, so far as their experience had gone, but who were infants in matters relating to mechanical equipment. It is one thing to know what is to be done, but it is an entirely different thing to know how to do it. The majority of mining engineers know what is to be done, but there is no large percentage of them with the experience needed to devise the means for doing it. A great many of them will claim that this statement is not correct, in which they are highly inconsistent, since it is only the rare genius who can be successful in two lines of endeavor so widely different as mining engineering and mechanical engineering.

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*Placer mining engineer, 316 Colorado Bldg., Denver, Colo.

In further argument on this point, a little consideration will show that the ultimate man in any mining work is the mechanical engineer. It makes little difference how successful a given method of treatment may be metallurgically or theoretically; to make it a commercial success the machinery involved must be adequate from every standpoint. Nothing affects commercial success more strongly than lack of capacity and the real basis on which to buy machinery is its capacity and ability to keep at the work with a high average efficiency. Obviously, to provide these requisites is an essential function of the mechanical engineer and it certainly would seem to be a most decided mistake to leave their determination to a mining engineer, whether he has obtained his education in a school or in practical work.

General Methods to Be Followed

There are two principal sources of loss in placer mining, fine gold and black sand. In the early operations the average recovery probably never exceeded 50% of the value of the gravel, certainly not more than this if there is any fine gold or black sand carrying gold. In this present day the losses are likewise from these sources, either one or both, depending on the region, and one of the curious features of the methods which have usually been tried is that, generally speaking, they do not seem to have learned anything from the development in lode mining, which has been so great in the last 25 years. To compare placer gravel and ore might seem to some people as rather far-fetched, and yet, the object of crushing and grinding ore is to bring it to the state in which nature has left the placer ground. It would seem reasonable, therefore, to treat gravel in about the same way that crushed ore is treated. As a matter of fact, this is being done, but only within the last few years and apparently following my efforts to make people who are interested in placer mining think along these lines. Success, however, is uncertain in such work, one reason being that the machinery developed for handling crushed ore is not successful when applied to the round particles of placer gravel, neither is it entirely successful in making marketable concentrates from the black sand; in fact, while ultimate success will be obtained, there is not now, so far as generally known, at least, any commercially successful installation.

Money Must Be Spent for Equipment

The most promising field for the development of machinery is that in which water is available only in small quantities, as when pumped from a well or derived from springs. Equipment for use in these regions must be such as to permit the water to be settled and used over or as to require no more water than that easily available. There are large areas in the southwestern portion of the United States which come under this general class. Some regions have exceptionally rich material, and many show material which it would seem might easily be worked with profit. It has never, however, seemed possible to take up the development of these properties except in a few instances, since the general investing public seems to be so filled with the idea that placer mining, unless done by means of dredges, should require a comparatively small investment in machinery. This is a wrong impression and inconsistent, as is proved by experience in practically every line of business. It makes little difference what the business may be, there is always a definite relation between the cost of equipment and its efficiency. If, then, we are to put in equipment for handling this class of ground on an economical basis, we may expect that the investment will be in about the same ratio as for dredging. It does not work out, however, that costs can be brought to the low figure which has been found possible in dredging work, the principal reason being that machinery of this class cannot handle the enormous quantities of gravel, while the total labor cost is practically the same in each case. There is some advantage obtainable from the fact that the work is always in plain sight and is easily prospected ahead so that there need be no waste of effort, while the dredge is always working under water and must handle enormous quantities in order to overcome the lowering of efficiency when handling gravel which does not pay its own expenses. There is also the further economy of not having to go into the bedrock in order to insure a cleanup.

Excavating

This statement applies more directly to the excavator required, preferably a steam shovel, and in view of former experience with the disadvantages of the A-frame type there would appear to be a great many advantages and possibilities in the more recently developed full-circle-swing shovel. The older type could not swing more than 90° from its direction of movement, which made it out of the question to have the washing plant follow the shovel on the same track unless there were used what generally proved to be a cumbersome and elaborate conveyor. With the full-circle swing, however, a second car, carrying the entire washing plant, can immediately follow the shovel. At the same time, the shovel has a better radius of action, one which is as economical in time and certainly much better suited for the work. With a combination of this kind the work can be conducted on the same general lines as dredging, the whole mechanical plant moving along as a unit, digging its way at the front and filling in behind.

Roughing Treatment

The process of recovering the gold in a plant of this kind has been just as much of a problem as the excavating. In many places it is absolutely out of the question even to consider screening, since the gravel must be washed through the screen; it is seldom dry enough under the surface to be successfully dry-screened. A screen, furthermore, to handle the gravel as it is dug, must be a heavy and cumbersome affair and, worst of all, it must be set at a considerable height in order to give the fall needed in every gravity method of concentration. A number of machines have been devised to do this work, the later and most promising ones using some sort of a conveying device to get rid of the oversize and at the same time to effect a preliminary concentration. This seems to be working along proper lines and particularly so when the machinery is of ample size so that the material is handled at slow speed. Too much agitation is not permissible; there should never be enough movement to cause a current which would carry with it any of the gold.

The product from this device would be frequently in condition to be treated on a suitable concentrator. It would probably be necessary to provide a gravity screen to take out the small percentage of oversize which is certain to be present, but this is not a complication that need worry anyone.

The concentrator, as stated, must be one particularly adapted to the work. There are a few instances where some of the standard shaking tables have worked, but there are a great many more where they have been commercial failures and some where they have been mechanical failures, all going to prove that placer gravel is subject to local variations just as ore is. Quite recently this matter has been taken up by some of the concentrator manufacturers with the assurance that they were going ahead until they have worked out the problem, and there are one or two machines on the market which have already achieved some success along somewhat different lines from the ordinary.

A Case in Point

To illustrate the matter, the case was brought to my attention a short time ago of an installation, all of which showed how little has been the development in this direction. The property concerned which is the Cunningham Mesa Placer of the Ortiz Mine Grant in New Mexico, is extensive, but has only a limited supply of water, while other conditions make dredging impracticable. Effective prospecting has shown a gold content which is attractive and the plant which was installed handled about 10,000 yd. of gravel, enough to show the possibilities of an installation which might be used. The gravel was dug by means of one of the full-circle-swing shovels and loaded into cars which carried it to a fixed washing and screening plant, an ultimate distance of ¾ mile, dumped without wash water onto a bar grizzle, having ¾-in. spaces, the oversize going to dump cars for conveyance to the tailings pile, the undersize falling into a large bin. Gates in the bin bottom fed a 10-in. sluice 150 ft. long fitted with block riffles. No quicksilver was used and the bulk of the saving was in the first 50 ft. of the sluice as in the usual case.

The water supply was pumped from an old mine, the raise being 200 ft., pumping being carried on during the day only. The tail water was settled and cleaned by passing through brush dams and approximately two-thirds of it returned by pumping, the lift being 90 ft. making the resultant available water for the sluice about 325 gal. per min., for nine hours.

With this plant the screened product of from 175 to 225 yds. of gravel was easily handled, this being all that the excavating and conveying equipment could deliver. It could, however, have handled 300 yd. if that amount could have been dug and transported.

The cost of handling the gravel from pit to tailings pile was estimated to be 22c. per cu.yd. and the installation was in the nature of an experiment to determine definitely the cost of the work under practical conditions as well as definitely to check up the value with that obtained through prospecting. As a matter of information it developed that with a saving which has been given as approximately 70%, this cost was a trifle more than the recovery.

The losses were from two principal sources. Owing to the small water supply, it was out of the question to wash the gravel through the screen, consequently there was a considerable loss of gold which would not separate from the coarse material; there was a loss also from lumps of fines which stuck together and would not pass the screen and from masses of the material which did not separate, an unavoidable trouble where a large quantity of material is dumped on a screen which has no motion to break it up. In addition there was the loss in the sluices of the fine gold as a result of the velocity of water required to carry over the coarse gravel and in addition, the loss of any black sand which might carry metal. These losses can be very largely corrected by mechanical improvement and of course the first and probably the greatest loss, that on the screen, would be entirely done away with if sufficient water were available.

The thing of most interest in this plant is that handling such a small amount of material under conditions which are anything but economical a cost as low as 22c. per yd. could be reached. No other factor so seriously influences work of this kind as low capacity. Office expenses and labor cost on a plant handling 500 yd. per day would total little more than a similar plant to handle 100 yd. The other overhead charges, of course, would vary in the two plants but would be proportionately larger in the smaller one. In addition to these there is the cost of transporting the gravel from the excavator to the washing plant and of transporting the oversize again from the washing plant to the tailings dump. The total of this charge is reduced to the cost of operating an elevating conveyer in the case of a self-contained plant and would not be a fraction of the other. A washing and screening device would eliminate almost the total screen loss and altogether this property would seem to be a rare one for profitable development in the light of what has been done in the five of six years since the above plant was operated.

Ordinary riffle sluices were installed for recovering the gold. The loss from these tailings ran 50% to 75% of the content, the first loss being due to the fact that it was attempted to screen the material just as it came from the ground, using no wash water, and a good deal of fine material stuck to the coarse. The loss in the riffles was increased because the old-fashioned booming was practiced, which consists of allowing the screen gravel to accumulate and then letting in a large quantity of water, always an inefficient method. The best results from this installation are in showing actual costs, which make it almost sure that a profitable plant could be installed.

Labor Required

There need be nothing complicated about an installation of this kind. One requisite, of course, is to have a thoroughly good man on the steam shovel, since it must do its maximum at all times, and this means also keeping it in good repair. One other man with brains and some mechanical ability would be all the high-priced help required, everything else being arranged about the same as for the usual mining plant, not forgetting that the blacksmith must have the usual versatility. A careful estimate and comparison of costs show possibilities in this particular field that are well worth investigation and which should easily be realized by earnest and competent effort.

Placer Mining in Victoria

The production of gold by placer mining in Victoria declined in 1913, although the yield per cubic yard of gravel was slightly greater than in 1912, according to the report of D. B. Sellars, engineer in charge. A production of 65,433 oz. of gold was obtained from 16,796,585 cu.yd. The yield of gold per cubic yard of material treated was 1.9 grains as against 1.8 grains for the previous year. In 1912 the total quantity of material treated was 19,722,227 cu.yd., which yielded 73,781 oz. The quantity of tin won in 1913 was 32¼ tons, valued at £3884. There were 51 bucket dredges actually working in 1913, 26 hydraulic-sluicing operations using centrifugal pumps and 15 jet-elevator operations, a total of 92 operations which are classed in this report under "dredge mining"; there were five hydraulic-sluicing plants working by gravitation, making a grand total of 97 placer-mining plants in operation.

The 51 bucket dredges worked for an aggregate period of 1905½ weeks, raised 14,946,933 cu.yd. of material which yielded 52,211½ oz. of gold or 1.6 grains per cu.yd.; 7¼ tons of tin valued at £844 were also recovered. The acreage treated by dredging was 498 and the quantity of gold saved per acre was 105 oz. The dredge which treated the most material won 1271 oz. for 52 weeks' work from 21.7 acres of ground, yielding 0.8 grain per cu.yd. of material treated. The average weekly return of gold per plant was 27.4 oz., and the weekly expense, including maintenance and repairs, averaged £78 14s., a sum equivalent to 19.7 oz. of gold. The largest weekly turnover of material by any dredge was apparently 14,000 cu.yd.; four others each handled more than 13,000 cu.yd. and two raised over 12,000 cu.yd. weekly. The 26 pump-sluicing plants which are classed with the dredge output operated for an aggregate period of 280½ weeks, handled 1,191,817 cu.yd. for a return of 8957½ oz. of gold, or 3.6 grains per cu.yd.; 25 tons of tin valued at £3040 were also obtained from these operations. The largest pump-sluicing operation handled over 9000 cu.yd. of material per week; another plant treated over 7000 cu.yd. per week and two others each treated over 6000 cu.yd. per week. Fifteen jet elevators, also classed as "dredge mining," worked during 1913 an aggregate time of 213 weeks, handling 567,273 cu.yd. for a return of 3665 oz., or 3.1 grains per cubic yard of material treated.

The five hydraulic-sluicing plants working by gravitation treated 90,562 cu.yd. for a return of 599 oz., or an average of 3.17 grains per cu.yd. The aggregate number of weeks worked was 64, and the area 4.3 acres, the quantity of gold saved being at the rate of 139.5 oz. per acre; the highest yield was 315 oz. from 1½ acres. The five plants employed 31 men.

Most of the dredge-mining operations were in the Beechworth and Castlemaine districts; of the 92 operations, 19 were in the Beechworth district and 19 in the Castlemaine; Ballarat had nine operations, Gippsland six, Maryborough five, Bendigo three, Ararat and Stawell one. The total amount of gold that has been won by placer mining in Victoria is estimated at 1,059,604 ounces.

Mining in Baja California

SPECIAL CORRESPONDENCE

Mining as well as all other business has been at a standstill for the past six months, and although a general feeling of confidence and security is more apparent now than at any time during the year, local conditions prevent the resumption of activities. Until a uniform currency is established all over Mexico, including Baja California, and until the transportation of merchandise on the gulf is made possible, little or no progress can be made in this section.

The merchants are compelled to accept local money which was printed in La Paz on a cheap grade of blotting paper, and resembles street-car transfers more than it does a medium of exchange. Besides this, it is not negotiable in other parts of the republic nor even in the northern section of Baja California. As very little is produced here but leather and *panocha,* most of the supplies must be brought in from other parts of Mexico or from the United States. As the merchants must receive the local money for their local sales, and cannot purchase with it, the result is that their shelves and warehouses are empty and their safes well filled with this paper.

The Mexican government has taken possession of the properties of the Cia. Minas del Triunfo. These include, besides their own mines and hacienda at Colombinas, the mines and hacienda of the Progreso Mining Co., which were leased to the Cia. Minas del Triunfo two years ago. There are 1800 pertenencias in all, 1100 of which belong to the Progreso Mining Co. Both haciendas are idle at present. This company had commenced the installation of a 400-hp. producer-gas plant to generate electric power for the mines. The plan was to unwater and ventilate some of the rich deep mines by communicating with a perpendicular shaft, El Vaso. This was to be sunk 200 ft. deeper to open up the Humboldt vein on the 17 level. As the Humboldt is connected with other important mines, those that would be drained would include La Fortuna, San Pedro, San Pablo, Malacate, San Nicholas, Humboldt and Ninety Nine. These mines have produced about ten millions of dollars, and with the new power plant and an expenditure of $150,000, they would again become large producers.

Besides the above mentioned mines there are many others, and in all there are about 50 miles of underground workings. The Triunfo vein is six miles long and the Gobernadora and San José veins nearly four miles long, uniting with the Triunfo vein close to El Vaso shaft. In fact, El Vaso shaft was started about 25 years ago to cut the formation about at the intersection of the two veins, but for some reason or other, the work was abandoned when within 200 ft. of it. With the completion of the sinking of El Vaso shaft, the Triunfo district should become one of the most important mining districts in Mexico. The values are in gold and silver. Included in the Progreso claims there are 300 pertenencias covering innumerable parallel gold veins of arsenopyrite, carrying about 1 oz. per ton and perhaps ½ oz. of silver. Mining in the Triunfo district has been pursued extensively for the past 40 years as the mountains of mine dumps will prove. About two million tons of these dumps would make profitable concentrating ore. As stated above, all these properties are to be operated by the Cia. Minas del Triunfo as soon as the government releases them.

The San Juan Reduction Co. has also been shut down for the past six months. The plant is in San Antonio, five miles east of Triunfo. The mine manager, J. C. Puttner, arrived here recently from Los Angeles. He had intended to start work again, but has been unable to do so on account of the delay in the arrival of his powder. This company treats its arsenopyrite gold ore by crushing dry in rolls and Hardinge mills, then roasting in superimposed-hearth, hand-rabbled furnaces and leaching with cyanide solutions. Their roasters were designed by their general manager, Paul Knappe, have given excellent results in roasting and are economical in fuel consumption, besides being easily and cheaply constructed.

David Lawrence is successfully operating a three-stamp mill and Deister table. Besides his own ores he has been treating custom ore from outlying districts.

There has been an awakening of interest in outlying districts south of Triunfo, and many small gold-bearing veins have been opened up. These are usually pretty rich, carrying coarse free gold, probably being the source of the large amount of placer gold found in the little *arroyos* draining that section.

A. C. Nahl and W. H. Rocholl are repairing the mill of the Mendoza Copper Co., at El Valle, for the purpose of testing a large mass of low-grade gold ore near by, about 12 miles south of Triunfo. This body is evidently a much-altered granite. The foot wall is granite and the hanging, hornblendite. It shows the effects of pressure, metasomatic replacement and impregnation. The chief secondary minerals are sericite and chlorite, replacing feldspars and mica. The deposit is particularly interesting on account of the vast tonnage of gold-bearing mineral. It carries free gold and sulphides, but only traces of silver.

Altogether, the future of this section of Baja California is exceedingly promising, but better transportation and a uniform currency are indispensable for the development of the mineral resources.

Arsenic in 1914

The arsenic market in 1914 was marked by no great changes or important happenings. The production increased slightly, but there was no great growth, and production may be said generally to be equal to the demand. American production acted as a balance wheel to the trade, increasing the demand for the commodity, and serving to keep the price shaken down to a standard which changes little or not at all.

The war had no noticeable effect upon the market here. The price continued about the same, and while there naturally was some trouble with shipments, the factor did not have sufficient influence to make any noteworthy change. So uneventful, in fact, was the market in arsenic that what could have been said about it six months ago can be said now with equal truth.

The sources of supply were about the same as last year. Mexican shipments continued to be interfered with by political troubles, but were somewhat increased over last year. Canada maintained the usual production, reduced output in some localities being offset by increases in others. The production of arsenic in the United States in 1914 amounted to 8,651,940 lb., as compared with 4,624,140 lb. in 1913.

Corocoro Copper District of Bolivia

By F. A. Sundt*

Corocoro is the most important copper district in Bolivia. It is now connected with the coast by the new Arica-La Paz R.R. Corocoro is 339 km. from the port of Arica, and its altitude is 4000 meters.

Native Copper Ores Worked for More Than a Century

Today there are only two important mining companies, the Cia. Corocoro de Bolivia, a Chilean company founded in 1873, and the Corocoro United Copper Mines, Ltd., a French company with headquarters in Paris.

The production of *barrilla* by the Cia. Corocoro de Bolivia is 1800 tons per year and the tenor of this *barrilla*, 84%. The *barrilla* is obtained from native copper ores of an average tenor in this company's property of 4%. The native copper is nearly pure and for this reason is sold in Europe at a premium. The *barrilla* is shipped chiefly to Havre, France, Livorno, Italy, and at times to Liverpool and Antwerp.

The Arica railway has brought about a considerable development in Corocoro during the last year. Before this railroad was built, the *barrilla* was sent to the coast through the port of Mollendo in Peru; the journey was long, required various transfers at Lake Titicaca and at the Rio Desaguadero. Today the *barrilla* is loaded in railroad cars in Corocoro and goes directly to the docks at Arica, with the great advantage of no breaks in the sacks or other important losses. Another of the great advantages of the railroad to Arica is that today the copper sulphides that occur abundantly in the veins can be exported without concentration.

Sulphide Veins Will Be Worked

The district contains many copper veins; for more than 100 years only the native copper ore has been worked. The sulphide veins were not touched because it was impossible to export the crude sulphide ore by way of Mollendo, on account of the difficulties of transport. At times there were not enough llamas and at other times the Rio Desaguadero contained very little water and, of course, the freighting was expensive.

The native-copper veins also contain ruby copper ore (Cu_2O); the *yanabarras* veins, as they are called in Corocoro, are accompanied by green sulphates. The *yanabarras* are the black sulphides without iron that correspond to chalcocite (Cu_2S) and are found in an arsenical gangue. The sulphide ores lend themselves to concentration; but this company has limited its efforts to the exportation of *yanabarras* and sulphates carrying 18% or more. There are veins of *yanabarras* that have a width of 9 m. with an average grade of 5%. These are not yet touched, as the company hopes first to study a method of concentration. The Cia. Corocoro of Bolivia was exporting in November at the rate of 1500 tons monthly of ore having a grade of 18%. The green sulphates of copper have little depth and at a few meters one encounters the unoxidized *yanabarras*.

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As the European war does not permit sending the ores to that continent, the company is today selling its ores to the American Smelting & Refining Co. and sending them to Perth Amboy, but it does not feel able to do the same with the 85% copper *barrilla* because the tariff is not satisfactory.

New Capilla Mine, Richest in Corocoro

The company recently opened another mine, the Capilla. Its native-copper ores are the richest of Corocoro, having an average grade of 7%. The mine is opened to 200 m. The Remedios mine is the deepest mine of this company having a vertical depth of 500 m. At this depth the veins still maintain their grade. The shafts are vertical, the veins having a dip of about 80°. All the shafts are rectangular in section, double compartment, and timbered with Oregon or California pine.

The Cia. Corocoro of Bolivia has only developed part of its territory. In one section of the property the deposits have been opened by tunnels and vertical shafts for a distance of 1300 m. along the strike of the vein and have been exploited to a depth of 150 m. It is shown that the mineralization continues in depth. In another part of the property, the Remedios mine to the south at 500 m. and the mines of the neighboring company at a similar depth have excellent ore. With these showings, the shaft of the Capilla mine was sunk to a depth of 200 m. in 1914; a Bleichert aërial tramway was installed to connect it with the mill, and in four months the Capilla mine production paid for the installation. The company is beginning another shaft 400 m. to the north, on the strike of the vein, and feels sure of encountering good ore, having already ordered another ropeway for this mine.

With the Arica railway connection completed, the company is now able to change its power installation. Up to the present, it has employed steam power, using as fuel *taquia*—llama dung—but the company is now installing Diesel crude-oil engines. A horsepower-hour from *taquia* costs approximately 3c., U. S. Cy.; from oil it will hardly cost 1c. The company expects to save the cost of the new installation in the first year. The milling machinery and the hoist will be operated by electricity.

The Corocoro camp is of much interest by reason of its native copper ore, and on various occasions North American capitalists have endeavored to invest in the district; lately the Amalgamated Copper interests have inquired regarding property, but the present status of the negotiations is unknown. The Corocoro camp has been worked more than two hundred years, but during this epoch only native copper ore was extracted. The sulphides and sulphates of copper were not touched; for this reason the company has had the good fortune of beginning and working practically from the surface.

The government of Bolivia is liberal in its tariffs and the crude ores do not pay export tax. Lately also the taxes on sacks for the *barrilla* and crude ore have been taken off; all mining machinery enters Bolivia free of duty. The freights from Corocoro to Arica for a ton of ore, including all expenses to the side of the vessel, are $1, U. S. Cy. The export tax on copper *barrilla* varies with the value of the product: On *barrilla* valued from £50 to £60, the tax is B. 1.40 (one boliviano equals 18d.) per 100 kg.; from £60 to £70, the tax is B. 1.61; from £70 to £80, the tax is B. 1.82. The wages of the miners are low in Corocoro; a man makes on an average B. 2 per day; the women, who also work in the mine, make B. 1 as *apires*.

Copper Costs £35 per Ton

The cost of producing copper, including all expenses up to the sale in Europe, is £35 per long ton. This is excellent considering the small scale of operation, the production having been reduced to 1800 tons of *barrilla* per year. But the real cause is that the native copper is easily concentrated to an 85% product, which is sold, without the expense of smelting or electrolytic refining, at a price superior to standard copper. In spite of the war the company is working at the usual rate, the low costs leaving no danger of loss in selling.

When the Cia. Corocoro de Bolivia has finished its installation of Diesel engines, it expects to produce copper at £30 per ton. One of the difficulties the company has had in augmenting its production was the scarcity of workers, the tin mines having taken the larger part of the miners of Corocoro by paying higher wages. However, it is expected that many Indians formerly engaged in securing and selling *taquia* will be released from this work when the mines begin to use oil for the production of power; the two leading companies in Corocoro have paid £25,000 annually for the collection of *taquia*.

The Zinc Situation at Broken Hill

At the recent meeting in London of the Sulphide Corporation, the chairman gave an interesting review of how the outbreak of the war had affected the lead- and zinc-mining companies of Broken Hill. He said:

> For generations Germany has cultivated and almost monopolized the industry of zinc distillation; the majority of the works which treat Australian zinc concentrates are situated in Germany, and the sudden closing of the German market for this class of material was an almost paralyzing blow to Broken Hill. We, perhaps, are in a slightly better position at the present time than some of our neighbors, because we have the works of the Central Zinc Co., in England, by means of which we have still an outlet for some portion of our production, but this portion is not very large. During the last two years we have produced 131,316 tons of zinc concentrates, and of these 19,633 tons have been treated at the works of the Central Zinc Co., while 116,296 tons have been sold at Broken Hill to Beer, Sondheimer & Co., of Frankfurt, under contracts which have been running for many years. These contracts were, of course, brought to an abrupt stop at the beginning of August. The expansion of the Central Zinc Co.'s works, owing to the great difficulty in finding in England an adequate supply of skilled labor, can only be gradually carried out.
>
> For the mines not possessing lead smelting works of their own there was also, on the outbreak of war, an immediate difficulty in disposing of lead concentrates, a large proportion of which had been previously sold under contracts to German buyers. This difficulty did not arise in our case, owing to our having a sufficient smelting establishment at Cockle Creek and contracts of long standing with an English company for the disposal of bullion. It has been overcome also in the case of most of the other mines, as they have now been able to arrange for the smelting of their lead concentrates at the works of the Broken Hill Proprietary at Port Pirie, they being considerably larger than is required for the proprietary company's own output. At the beginning of August there was so much uncertainty as to whether it would be possible for the mines to be worked at all under the new conditions without heavy loss that we suspended

mining and milling operations for three weeks, although we kept our Cockle Creek smelting establishment in full work, converting our accumulated stocks of lead concentrates into bullion. We realized, however, that it was our duty, if possible, to continue work also at Broken Hill, where a complete stoppage of operations would have inflicted very severe hardship and distress upon the large mining population, and especially upon those who were married and had made their permanent home at Broken Hill. We, therefore, tentatively resumed work at the end of August, and during September, October and November we continued to work the mine and mills alternate weeks, stacking the zinc concentrates produced and sending the lead concentrates to be smelted at Cockle Creek into lead bullion for shipment to our English contractors. So far as we can judge, we have been able, while doing this, to avoid loss and, thanks to a favorable lead market, to make some profit, so, at the beginning of December, we decided to increase our scale of operations at Broken Hill and to work the mine full time, at least so long as the lead market may warrant our doing so. We hope, therefore, that we shall now be able to make profits on a somewhat larger scale, and, as we are still without any substantial outlet for our zinc concentrates we have established a plant which enables us, whenever we find it necessary to do so, to dump the residues from our lead mill for future use, without passing them into the zinc mill and incurring the expense of converting them into zinc concentrates.

Australian Copper Production, 1914

By W. P. Geary*

The copper production for the Commonwealth will be approximately 34,000 long tons in 1914, as compared with last year's figure of 46,500 tons. Australia, like the rest of the copper world, has been seriously affected by the present European war, which has disorganized the metal markets for the time being, and also considerably reduced the price of copper. For the first six months of the year, the price of electrolytic copper was well over £60 per ton, and under normal conditions there was every reason to expect that the price would maintain a fairly high average which would stimulate copper mining to a great extent in Australia.

At the time of writing, it is interesting to note that the New South Wales government has decided to build the railway from Condobolin to Broken Hill, and we believe a start has already been made at the Broken Hill end. This railway should bring the Mt. Hope copper mine to a producing stage, as the chief difficulty of this property has been the heavy cost of transport. The Great Cobar, Ltd., has been closed down since April and has not resumed smelting since, development work only being carried on. Most of the smaller mines in New South Wales have ceased producing, owing to the fall in the price of copper and also the uncertainty of the market. This state's output should be 3500 tons.

Queensland will probably account for 18,000 tons this year, the chief producers being the Mt. Morgan and the Cloncurry fields. The Chillagoe, Ltd., closed down its smelteries early in the year, owing to the high cost of fuel and the slow progress made with the construction of the railway to Mt. Mulligan, whence the Chillagoe company intended drawing its supply of fuel. The Mt. Elliott, Ltd., has also closed its smelteries, being only engaged in development work at present, while the Great Fitzroy mines have been closed for the greater part of the year.

The Mammoth copper mine, in north Queensland, which promised so well in the early part of the year, has had to suspend smelting operations through the effects of the war.

Beyond Wallaroo & Moonta, there is not much of note in South Australia. This mine has been affected by the war, but should produce about 5000 tons of copper.

In Tasmania, the Mt. Lyell company is the biggest producer and should account for about 6500 tons. The other copper mine of note is Murray's Reward, which, under normal conditions, produced between 300 and 400 tons of copper per annum.

Western Australia should account for about 750 to 1000 tons, the principal copper fields being the West Pilbarra and Phillips River. In the latter district, the state government has recently erected smelteries for producing blister copper.

The properties in New Guiana are still in the prospecting stage and their production does not seriously affect the output of Australia.

Pato's Proven Area Now 528 Acres

According to a preliminary report, recently submitted by W. A. Prichard, who has been conducting a drilling campaign at the Pato property, of the Oroville Dredging Co., in Colombia, the area now proven should give a life of 20 years at the present rate of working. Mr. Prichard stated that as a result of his additional drilling, he had been able to measure up on Oct. 1, 1914, a total of 528 acres outside of the area already dredged, and that the value per acre would be about the same as originally estimated for the tested area. He further suggested that with the exception of about a month or six weeks during the dry season, it would be practicable to run two dredges continuously on the Pato property; also that there would be plenty of power for 10 months in the year for three dredges, which would include the new dredge now being constructed on the San Francisco property of the affiliated Nechi company. Camp conditions have been improved and with the machine shop and additional tools, the equipment for the two properties is now considered up to the highest standard. A considerable saving in the operating cost of the existing Pato dredge will be brought about by the operation of the Nechi dredge, which will be worked under the direction of the same staff.

The Production of Rutile

The only rutile produced in the United States during 1914, so far as is known to the U. S. Geological Survey, was, as heretofore, that put out by the American Rutile Co. at Roseland, Nelson County, Va. The company produced 94 tons of rutile carrying 95% of TiO_2 and as a byproduct 89 tons of ilmenite carrying about 55% of TiO_2. The company did not operate its mill in 1914 until the middle of August. During the earlier part of the year the mill was thoroughly overhauled and new stamps and other machinery were installed. Large foreign orders could not be filled on account of the effect of the war upon commerce.

The rutile-bearing rock is worked in opencuts. Most of the rock worked came from a bluff near the mill, on the east side of Tye River, but some rock was also taken from the west side of the river. The rutile forms about 5% of the rock worked.

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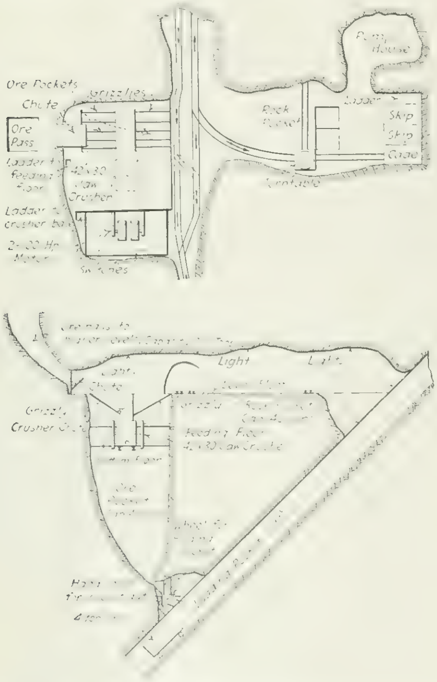
*Department of Mines, Sydney, N. S. W.

Details of Practical Mining

Underground Crushing and Loading Arrangements

By Albert E. Hall*

In order to facilitate hoisting and avert delays in tramming at the Creighton mine, Ontario, a change was made from dumping from the cars into the skips to dumping into a pocket. As the muck at Creighton comes through the chutes in large pieces, a pocket previously tried proved unsuccessful, since after drawing the muck from the chutes it would block in the skip loading chutes and have to be drawn all over again. For this reason, and also because the rockhouse crushers could not handle the large material, making blasting and long stops necessary in the rockhouse, an underground crusher was installed.



Figs. 1 and 2. Arrangement of Underground Station

A separate pocket is provided for rock, which is smaller than the ore pocket. When the rock pocket is filled, the regular hoisting of ore is interrupted and the pocket emptied. The only change necessary is the opening of the rock dump in the headframe, which is done in a few minutes by the surface skiptender when the signal for hoisting rock is rung. Tramming of ore goes on just the same while rock is being sent up.

All ore is hoisted from the large pocket on the lowest level. The shaft has four compartments, but only two of these are used for hoisting ore, and the two skips work in balance. To get the ore from the levels above, a large raise, known as the ore pass, was put up. At the bottom of this is a heavily constructed chute with a gate consisting of inclined rails on each post and a cross-timber. The chute feeds onto a 10-in. grizzly, which in turn delivers to a chute at right angles to itself. This chute feeds the crusher, and on the side opposite the chute grizzly, there is another grizzly, also 10-in., to take the muck from the cars on the level. A plan of the arrangements is shown in Fig. 1, while a cross-section appears in Fig. 2. It may appear that the construction is heavy, but it must be remembered that the ore to be handled is very heavy, being for the most part pyrrhotite mixed with a little chalcopyrite and a small quantity of pentlandite. In addition to this, the material to be handled is very large. It might appear that the grizzlies and crusher chute have little inclination, but it must be remembered that the material strikes them when it has considerable velocity and retains enough momentum to carry it to the crusher. Were they any steeper, the crusher would be blocked frequently.

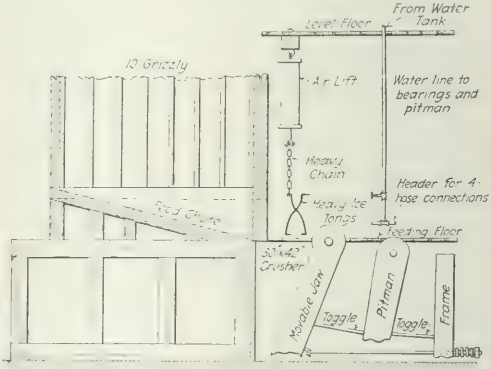


Fig. 3. Arrangement of Crusher and Bin

In connection with the grizzlies it can be said that various types of rails can be used. The ordinary railroad rail is all right if placed with the large side up, but cannot be used if placed in the usual method, as pieces which will pass the top will not pass the larger flange on bottom, and trouble will be experienced in keeping the grizzlies clean. Instead of turning the rails upside down, the large flange can be trimmed off, but in the present case this made the rail too weak. Another type of grizzly rail tried is an I beam with a hardened plate on the top. This worked fairly well, but the material is also inclined to stick at times in this, and these are not as good as a rail with the top decidedly bigger than the bottom. A round shape or one of triangular shape with the large side up and the point of the triangle down works best.

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*Mining engineer, Creighton Mine, Ontario.

The pocket holds about 400 tons and the ore pass will hold about 750 tons, so together they have a considerable storage capacity. The pocket is provided with a hand-operated gate of the arc type, with the convex side toward the muck. It moves up to allow the flow of muck into the loading pocket. The skips hold 4 tons and so do the loading pockets. The gate of the loading pocket is operated from the same floor as the gate of the main pocket by means of a pilot wheel and chain and sprocket. The front of the skip is made lower than the other three sides to facilitate even loading, and a depression in the rail serves the double purpose of acting as a skip chair and taking the load off the rope, so that the skip does not go down as it is loaded, and it also gives the skip a steeper inclination, making more complete loading possible. A block with rail to fit can be swung into the chair when it is desired to take the skip to the levels being developed below. The loading pocket is built of boiler plate and was constructed on the surface, taken down in one piece and put in place.

YEARLY DEVELOPMENT RECORDS, ST. LAWRENCE PYRITES CO

TABLE I. DRIFTING

Year	Feet Advance	Drill-Shifts Piston	Drill-Shifts Air Feed Stoper	Drill-Shifts Jack-hamer	Labor-Shifts DR	Labor-Shifts H	Labor-Shifts M TR	Total Feet Drilled	Feet Drilled per Foot Advance	Tons Broken per Foot Advance	Drill Shifts	Per Foot Advance DR+H	Per Foot Advance M+TR	Explosives $
1911	1769	1187	102	0	1316	1306	1557	63,321	35.2		0.728	1.481	0.879	2.350
1912	2369	1197	48	0	1364	1241	2101	60,636	29.8	8.22	0.525	1.109	0.887	2.025
1913	1282	652	191	33	937	697	1365	45,830	36.5	9.84	0.675	1.274	1.064	2.182

TABLE II. RAISING

Year	Feet Advance	Drill-Shifts Piston	Drill-Shifts Air Feed Stoper	Drill-Shifts Jack-hamer	Labor-Shifts DR	Labor-Shifts H	Labor-Shifts M TR	Total Feet Drilled	Feet Drilled per Foot Advance	Tons Broken per Foot Advance	Drill Shifts	Per Foot Advance DR+H	Per Foot Advance M+TR	Explosives $
1911	1575	508	249	0	787	782	659	44,562	28.3		0.474	0.995	0.418	1.750
1912	1374	4	388	0	437	174	406	31,739	23.1		0.285	0.445	0.338	1.285
1913	79	3	40	0	44	0	21	1,550	19.6		0.55	0.56	0.270	1.320

The arrangement of the crusher is seen in Fig. 3. It is a Farrel crusher of the jaw type. Two heavy 18-in. I-beams run across the pocket and are cemented into hitches, making them very solid and giving a firm foundation for the crusher. All the timbering in the pocket to support the grizzlies and crusher chute is 14x14 in., and is protected from wear by boiler plate. The crusher is 42x30 in., and is set to deliver 10-in. material. Two 100-hp. motors are needed to run it. No oil is used in the operation of the crusher, a water pipe having been provided with connection to each bearing and to the pitman. Grease cups are used in addition.

TABLE III. YEARLY STOPING RECORDS, ST. LAWRENCE PYRITES CO.

Year	Tons Trammed	Tons Broken	Drill-Shifts Piston	Drill-Shifts Air Feed Stoper	Drill-Shifts Jackhamer	Labor Shifts DR	Labor Shifts H	Labor Shifts M	Labor Shifts TR	Labor Shifts CL	Labor Shifts TM	Total Feet Drilled	Feet per Drill Shift	Tons Broken per Drill Shift	Tons Broken per DR+H	Tons Broken per DR+H+CL+TM	Tons Broken per Feet Drilled	Tons Tr per M+TR	Tons Tr per M+TR+TM	Average Distance Trammed, Ft	Tons Mined per Man	Total Explosives per Ton, Dollars
1911	95,391	93,512	3028	51	0	3523	3235	2718	4094	796	0	124,079	40.3	30.37	13.83	12.37	0.742	13.98	12.54	363	6.620	0.0893
1912	120,465	125,350	2409	1014	120	4525	2648	2248	6085	1968	332	182,402	51.4	35.37	17.47	13.23	0.687	14.45	11.69	539	6.907	0.0858
1913	119,128	118,025	0	1398	1421	3275	75	2647	5092	3238	510	189,169	67.1	41.86	35.23	16.62	0.580	15.39	10.85	462	7.993	0.0927

Key DR = Drill runner
H = Drill helper
M = Mucker (loads ore into car by shovel and trams)
TR = Trammer (loads ore from chute into car and trams)
CL = Cleaner (cleans down ore in flat stopes to loading chute)
TM = Timberman

$$\text{Tons Mined per Man} = \frac{\text{Tons Broken}}{DR + H + CL + TM + X}$$

$$\text{Where } X = \begin{array}{c}\dfrac{\text{Tons Broken}}{\text{Tons Trammed}} \\ M + TR\end{array}$$

Once in a while a large boulder will get wedged on top on the crusher jaws, and then an air-lift provided with a chain and a pair of ice tongs proves valuable, and a great time saver. A large piece can be swung to fit the opening in a short time, whereas it would be impossible to bar it through and blasting means a great loss of time, since in addition to the preparation of the powder, etc., all the electric lights must be taken out, and even then the wires may be injured. If the piece is very large, enough powder to break it cannot be put on the boulder, as the crusher might be injured. The capacity of the crusher has never really been tested, as it is much greater than that of the hoist.

⁂

Recording and Comparing Mining Data

By F. T. Rubidge*

It is customary in mining, as in any manufacturing business, to show the cost of producing in statements covering definite equal periods, and revealing the cost per ton of the various items. To obtain these costs it is necessary to keep records from which to determine the proper distribution of labor, supplies and power or other elements entering into the costs and it is also well to include these distributions in the cost statements. Sometimes, in addition to the costs of the current period, the average of all periods from the beginning of the year is given to facilitate comparison. Such a statement, however, is not sufficient for the manager who is continually trying to decrease costs through increased efficiency. For this purpose it is desirable to have records eliminating variables such as wages and cost of supplies, so that true comparisons may always be available. Separate records of various parts of the mine, or even separate records of every working place, may be desired to check the work of one part against another.

In most mines where drilling and blasting are done it is customary to keep some record of the footage drilled each shift by each drill runner. This keeps account of the runner's work and shows the tonnage per foot of hole drilled. However, the tonnage broken per foot of hole in development work usually varies from that in stoping and it is necessary to differentiate between them. This is desirable also because in development work the object is the cost per foot rather than the cost per ton. The cost of either class of work will vary also with the size and inclination of the opening, character of the ground, efficiency of the labor and character and efficiency of the equipment.

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*Manager, St. Lawrence Pyrites Co., 11 Broad St., New York.

In treating with the efficiency of the labor and equipment, progress is secured principally through experiment. For instance, it is practically impossible to forecast the best type of drill and mounting, the most economical placing of holes as to number, position, diameter and depth, best explosive, most economical method of handling ore in flat stopes, the best type and size of loading chute, best arrangement of crew or crews, effect of bonus giving, etc.

A system of recording such items, with the results obtained, is necessary to obtain full benefit from the tests. Having established the system, it is generally desirable to make it permanent, not only because the experimental period should never cease but because of the value to be derived from comparing results of similar working places in the mine and the monthly or yearly averages of each class of work as a whole. The value of such comparisons cannot be over-estimated, especially when copies of the monthly results are distributed among the men in charge of the various parts of the mine. Those showing the poorest results automatically receive a prod and those with the best are encouraged by knowing that their work is being recognized.

The data pertaining to the cross-section and inclination of the opening, the character of the ground, advance in development work and the tons broken in stoping, are preferably ascertained and recorded by the mine surveyor and appear only on the monthly or periodic summary. The recording of the daily data is intrusted to the foreman or shift-boss, and it is desirable to arrange the recording blanks so that the results may be inserted quickly and be both accurate and legible. Every working place in the mine should have some designating mark. The best system of marking is no doubt based on the coördinates established by the surveyor and used in conjunction with the numbers of the levels. Drifts are not easily so designated, but usually some other system based on location is available, such as 5B, FW, N for 5th level, footwall north on the "B" vein. Probably the most legible record is made with a punch on a form similiar to a street-car transfer. The application of such a system was discussed by me in the JOURNAL of Mar. 25, 1911, and some forms for the monthly summaries were also shown. There is some question, however, as to whether the punch system is better than the larger blank forms on which the data of all working places in each subdivision of the mine are entered in pencil on one sheet.

The information available from the monthly records is both interesting and valuable. From time to time special summaries must be made of each working place, to get the most from the data. The data for each stope, for instance, should be summarized on the completion of the stope, especially where the monthly results are inaccurate, due to the difficulty of estimating the broken ore in the stope at the end of each month. The annual summaries are not of much help in directing the mining work, but are nevertheless interesting historical records. The records (p. 193) of the St. Lawrence Pyrites Co. are interesting because they show the results obtained in changing drill equipment and from improvements in methods. It should be noted that the increase in the number of cleaner (CL) shifts is due to the flattening of the stopes, the cleaners being the men engaged in getting the ore in the stope down to the chute at the level, for loading into cars. It is also interesting to note that with the smaller holes drilled with the hammer machines less ore is broken per foot drilled, and the explosive cost is higher than with the piston type of drills; this result, however, was not unexpected and is more than offset by the difference in labor.

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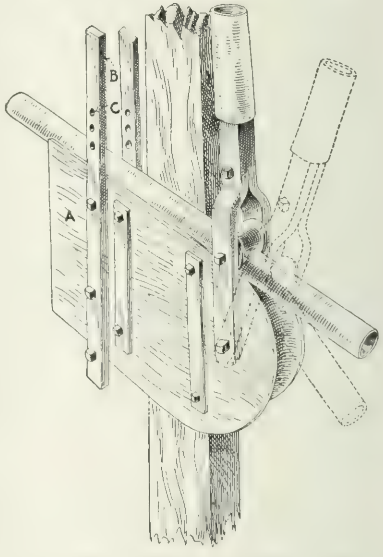
Pipe-Bending Device

In a plant where it was necessary to bend pipe of various sizes from 1 to 2½ in., the simple pipe bender shown did good work, writes W. E. Chandler in *Power,* Jan. 12, 1915. A 2-in. hardwood plank 18 in. long by 12 in. wide, rounded off at one end to a 6-in. radius, was fastened to a post in the shop. Two pieces of 1½x½-in. flat steel *B*, one on each side, and extending 5 in. above the top of *A*, had a number of ¾-in. holes for a pin to hold the various sizes of pipe. On the rounded end was fastened a swinging arm or lever and roller held in place by a bolt through two pieces of 1½x½-in. flat steel, and pipe extensions of different lengths furnished the required leverage to bend the various sizes of pipe.



PIPE BENDING FORM CLAMPED ON POST

The method of operating is to hold one end of the pipe to be bent in the space between *A* and a pin in *C*, and bring the roller to bear slightly, then draw the pipe forward an inch or two and repeat the operation until the required bend to any number of degrees is completed. This apparatus is inexpensive, easy to construct and is convenient for making offsets and lateral bends.

In many mine repair shops, a satisfactory bending apparatus may be improvised by mounting eccentrically on a column two old tram-car wheels. Flattening of the pipe may be prevented by filling it with dry sand or flue dust.

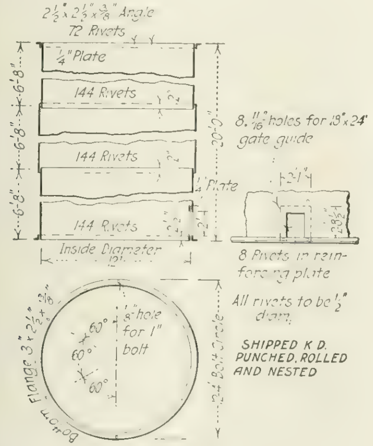
Details of Milling and Smelting

Steel vs. Timber Ore Bins

By Percy E. Barbour*

The usual type of timber ore bin is so familiar that we too often overlook the many advantages of the cylindrical steel bin.

The data herewith presented are from four ore bins in actual service; one of steel and three of wood. The 100-ton cylindrical steel bin described has recently been built at the Uwarra mill, at Candor, N. C. It is constructed of ¼-in. plate, is 12 ft. diameter and 20 ft. high, and stands on a concrete foundation recessed for the driving gear of a plunger feeder for a set of rolls. This is mentioned to show that the foundation cost is higher than otherwise would be the case. The dimensions and details of the bin construction are shown in the drawing. The steel for the bin weighed 10,000 lb., and cost 3.75c. per lb. The erection of this bin, including riveting, cost $32.14 and was done by green labor. The concrete foundation required 11 yd. of concrete which cost $7.50 per yd., and the foundation bolts cost $2. Freight on the ore bin amounted to $58.23, and the total cost of the bin ready for use was $549.87.



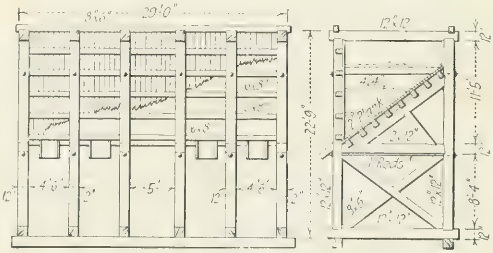
Steel Ore Bin

The 100-ton wooden bin was in use at the old Montgomery mill at Candor and was taken down and set up at the new Uwarra mill because it was too good to throw away and would cost only the labor of moving it.

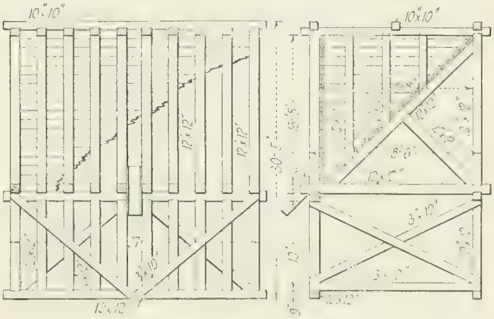
The 150-ton bin is at the loading terminal of the 3-mile aerial tramway of the Salt Lake Copper Co., at Tecoma, Nevada. The 350-ton bin is at the lower terminal of this tramway.

These four bins were designed by three minds, but the cubic feet allowed per ton of ore differ little, as will be seen by the table, and they average 23 cu.ft. per ton. To prevent undue influence of these slightly differing factors the costs have been figured out both per ton and per cu.ft. of capacity. The comparisons are not altered except in degree and that only slightly.

The cost of the steel bin in the table is the actual construction cost. The costs of the wooden bins have been estimated; the timber at $30 per 1000 ft. and the labor at the same figure per 1000 ft. for framing and erecting. This was the price of timber of this size and grade at Candor at the time the steel bin was constructed, hence gives the proper comparison. Probably this is as low as this timber can be purchased anywhere in this country today. It was found in our construction at Candor that the cost per 1000 ft. for labor for framing and erecting buildings and frame structures very nearly equaled the cost of the timber and lumber itself, which checks this way of estimating, now so commonly used. Two of these bins are tied with rods which, at 3c. per lb., increase the cost of the bin from 8 to 14c. per ton of capacity. For the purposes of this comparison that makes little difference. Nails and spikes would make a much less difference, and for this comparison may be safely omitted.



100-Ton Timber Bin



150-Ton Timber Ore Bin

The table shows the cost of these bins and shows that the steel bin is the most economical as to first cost, both as per ton and per cubic feet of capacity. The 100-ton wooden bin, which is the cheapest of the three wooden ones, cost 14½% more than the steel bin. Considering the elimination of the fire risk, the absence of dead corners and the concentration of gate discharge and finally the first cost, it seems as though the steel bin has not had the common and frequent use that it deserves.

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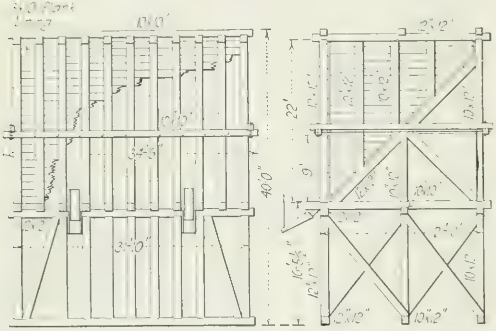
*Mining engineer, 887 Middle St., Bath, Me.

Some comment may be made on the comparative types of construction of the three wooden bins. In the 100-ton bin the posts are far apart and 6x8-in. girts are dapped into them to support the planking, which is vertical. Spacing the posts far apart eliminates some posts. If they had been spaced at the close intervals used in the 150-ton bin, 5000 ft. more timber would have been required. This style, however, increases the labor required for mortising and dapping. The figures seem to show that this makes for economy in the total cost.

The 150- and 350-ton bins undoubtedly have a little more timber than is necessary, as all bins do, but they are very good bins nevertheless. The posts are spaced nearer than is actually necessary. The two larger bins have the rear posts lighter than the front posts, which is good design.



350-Ton Timber Bin

Another striking difference in the design of the 100 ton bin and the other two is that the former has bents, each of which is bound together top and bottom into an integral section complete in itself. The other two bins have a shorter integral bent set up on what are in reality legs. This was made necessary by the height of bins required.

DATA ON THE ORE BINS CONSIDERED

	Cylindrical Steel Bin	Usual Type Timber Bins		
Nominal capacity, tons	100	100	150	350
Capacity of bin, cubic feet..	2262	2389	3594	7565
Cubic feet per ton of rock allowed	22.6	23.89	23.95	21.6
Feet lumber and timber required	10,000*	13,000	23,000	47,000
Total actual cost	$549.87	....	....	....
Total estimated cost	....	$794 40	$1380 00	$2850 30
Cost per cu ft capacity.....	$0 243	$0.332	$0 384	$0 377
Cost per ton capacity......	$5 50	$7.94	$9 20	$8.14

*Pounds of steel for metal bin.

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Increasing Battery-Screen Area

The area of battery screens may be increased by reducing the ends of the frames to a width of 1 in., and increasing the strength with a piece of $\frac{1}{16}$-in. sheet iron. In place of the regular wooden stay in the center of the frame, place a $\frac{3}{8}$-in. bolt, shouldered and threaded at both ends, washers being placed at the shoulders. The bolt should stand clear of the screen. This gives a total of about 3 in. more screen surface than when the wire cloth is tacked to the ordinary heavy frames.

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Selling Refractory Brick by the Ton*

In the past more or less confusion has existed in the matter of purchases and sales of magnesia and chrome brick used largely in the openhearth and copper-smelting processes. It has been customary in some cases to make a brick 9x4½x2½ in. as a standard, in other instances brick measuring 8¾x4⅜x2⅜ in. have been made. Nor has there been any uniformity in the method of making quotations.

Many users have been purchasing the 9-in. straights at a tonnage price and the sizes, such as keys, at so much per thousand. Others are buying entirely on the thousand basis while still others buy wholly on a tonnage basis.

In order to simplify this business the Harbison-Walker Refractories Co. has decided to establish for its chrome and magnesia brick a standard measuring 9x4½x2½ in. with the corresponding series of sizes, and, dating from Jan. 1, 1915, its regular form of quotation on all magnesia and chrome brick, whether standard sizes or special shapes, will be on a tonnage basis with a definite scale of extras given in the accompanying table.

MAGNESITE- AND CHROME-BRICK PRICES

Base Prices and Extras on		Magnesite Brick Per Net Ton	Chrome Brick Per Net Ton
Standard 9-in. (9x4½x2½)....		Base price	Base price
Standard No. 1, 2 and 3 arch.....	per catalogue	$5.00 over base	$5.00 over base
Standard No. 1, 2 and 3 wedge...		5.00 over base	5.00 over base
Standard No. 1, 2, 3 and 4 keys....		5.00 over base	5.00 over base
Standard soaps and splits and feather edge....		15.00 over base	15.00 over base
Special shapes—"Class A"—Rectangular shapes not exceeding 15x6x4 in. nor less than 8 in. in length, 4 in. in width or 2½ in. thickness, in lots of 1000 pieces or more		5.00 over base	5.00 over base
Special shapes—"Class B"—Rectangular shapes from 15 in. to 18 in. in length, 4 to 6 in. in width and 2 to 4 in. in thickness in lots of 1000 pieces or more		8.00 over base	8.00 over base

Prices on Class "A" and "B" shapes in less than specified quantities, or on specials not included in above, on application.

The quoting of a tonnage price throughout will not only avoid confusion but insure fairness in prices. A price per thousand pieces on brick made from an expensive commodity such as magnesite or chromite necessarily introduces the question of the weight of the brick. If sold on a tonnage basis the slight variations in size or weight automatically adjust themselves equitably to both buyer and seller. It is to be noted that the placing of definite extras per ton on the so called sizes such as keys, wedges, etc., does not actually raise the price per thousand, as their weight is considerably less than the straight brick. In the case of soaps, splits and feather edge at $15 extra per ton over the base price the cost is actually less than when purchased at a price per thousand pieces uniform with the 9-in. straights.

The scheduling of definite extras on what was termed difficult shapes will also tend not only toward fairness in prices but toward clearing up much confusion in the minds of the engineer and purchaser as to the relative cost of various types of design.

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*From data furnished by the manufacturers

Company Reports

Coniagas Mines

The report of the Coniagas Mines, Cobalt, Ont., for year ended Oct. 31, 1914, states that the total shipments from the mine during the year amounted to 2,497,391 oz. of silver which was contained in 484 tons of mine ore and 688 tons of concentrates. The cost of mining and concentrating was 12.444c. per oz. of silver and shipping, smelting, refining, and marketing, 3.585c., making the total cost 16.029c. per oz. The average price received for silver was 56.75c. per oz. During the year, in addition to dividends and bonus paid on Nov. 1, 1913, of $560,000, three dividends of $360,000 each were made up to Aug. 1, 1914, and a quarterly dividend of $240,000 payable Nov. 1, 1914, was declared. Dividends since Nov. 1, 1906, to Oct. 31, 1914, amount to $7,000,000 and the total shipments of silver aggregate 20,000,000 oz. of silver.

An average of 153 men worked throughout the year at the following occupations: 10 in mine office and supervision, 1 at camps and buildings, 2 in maintenance of buildings, 4 at camp expense, 3 on lands and roads, 97 mining, 7 on mine maintenance, 1 on drills, tools and hardware, 4 on mining contracts, 1 on fuel, oil and waste, 16 milling, 5 on mill maintenance, 1 loading ore and 1 sampling. As there were 62,595 tons of ore and waste removed during the year the average tonnage of ore and waste handled per year per man employed was about 410 tons. Development work during the period amounted to 2295 ft.; a total of 25,003 ft. has been driven to date. Ore reserves are estimated to contain 11,904 oz. of silver, this added to the past production gives in round figures 32,000,000 oz. opened up by development or about 1280 oz. of silver per foot of development.

The concentrating mill was operated 97.94% of possible time. The total tonnage of ore milled was 54,522 or an average of 2.93 tons per stamp per 24 hr. The mill heads averaged 24 oz. per ton. The sand tailings from the mill averaged 3.18 oz. per ton and the slime tailings, 6.66 oz., a general average of 4.21 oz. per ton.

The sleeping camps and dining room accommodated an average of 54 men, at a charge of 60c. per day; the actual cost to the company, however, was 75c. per day. The average disability from sickness and accidents was 32 hours per man as compared with 47 during the previous year. Seven of the company's employees enlisted and are now serving at the front in the British army.

The following data are given on the Reddington rock drill which is used by the company. The cost of repairs per drill per month: 3⅛ machine, $12.57; 2¾-machine, $11.65; 2¼-machine, $3.60. The average number of drills working for the year was: 5.75 3⅛-in. machines, eight 2¾-in. machines and one 2¼-in. machine; or an average of 14.75 drills per shift. The average footage drilled per hour was 3.18 ft., compared with 3.15 and 3.13 ft. for the previous years. These figures are based on the hours the drill was working.

Total receipts for working account amounted to $1,407,877, and working expenses, $418,261, leaving a working profit of $989,616. After payment of dividends and making other adjustments the surplus account was reduced $351,613 during the year.

Oriental Consolidated

The report of the Oriental Consolidated Mining Co., Chosen, Asia, for year ended July 31, 1914, shows net receipts over all expenditures amounting to $622,780. The total receipts were $1,731,472; operating costs, $994,733 and new construction and development work, $113,959. The mines produced 301,162 tons of ore averaging $6.85 per ton; of this, $3.44 was saved by amalgamation, $2.16 by cyanidation of concentrates, making a net yield of $5.60 per ton. The mines were estimated to contain 822,500 tons of $5.80 ore in reserve at July 1, 1914. Development work totaled 32,379 ft. for the year.

The total cost per ton was $3.68 made up of mining, $1.98; milling, 56c.; concentrate treatment, 32c.; transporting of ore, 1c.; general expenses, 43c; development of outside mines, 3c.; and construction expense, 35c. per ton. Total receipts per ton were: from ore, $5.60; store profit, 8c.; interest and other receipts, 5c.; profit from dump retreatment, 2c.; total, $5.75 per ton of ore. Dividends amounting to $644,085 were paid and quick assets after this totaled $938,116; $511,780 was in cash and $356,084 in supplies. The following table gives the result of cyaniding concentrates at the different plants:

	Tons Treated	Assay Value per Ton	Extraction Per Ton	Extraction Per Cent	Cost of Treatment per Ton
Tarcol tube mill plant	12,856	$30.83	$24.72	80.2	$4.58*
Tarcol cyanide plant...	10,285	29.83	24.60	82.5	1.63
K.S.D. plant..........	4,552	25.04	14.80	59.1	1.87
K.S.D. dump retreatment	12,646	7.37	4.70	63.8	3.18
Candlestick plant.....	7,778	3.56	1.91	52.4	1.08

Shut down on account of high cost

The consumption of supplies in cyanide treatment of concentrates follows: cyanide, 3.885 lb. per ton; zinc and zinc dust, 11.3 lb.; borax, 0.78 lb.; lime, 20.5 lb.; cordwood, 0.135 cord per ton; soda, 0.095 lb.; kerosene, 1 gal. for 41 tons of concentrates; engine oil, 1 gal. for 47.5 tons; cylinder oil, 1 gal. for 91 tons; miscellaneous oils, 1 lb. for 24.4 tons; bar iron, 1 lb. for 20.5 tons.

In the mill, 27.3 tons of ore were treated per cord of wood consumed; 460 tons per battery shoe; 666 tons per battery die; 42.4 tons per lb. of bar iron; 28.7 tons per lb. of sheet iron; 440 tons per lb. of miscellaneous iron; 101 tons per lb. of steel; 107 tons per lb. of candles; 201 tons per gal. of kerosene; 575 tons per gal. of cylinder oil; 223 tons per gal. of engine oil; 178 tons per lb. of lubricant; 12.5 tons per oz. of quicksilver; and 68.5 tons per lb. of nails. Other mill supplies used in treating 301,162 tons of ore were: 10 battery bosses, 31 tappets, 6 cams, 7 stems, 7 camshafts, 10 crusher shoes, 14 crusher dies, and 13 concentrator belts. The items of milling cost were: supplies, 25.75c. per ton; assays, 0.896c.; shops, etc., 2.716c.; electric power, 11.16c.; salaries and board, 8.239c.; and payroll, 6.764c.; total, $5.525c. per ton.

In mining, one pound of dynamite was consumed for every 2.01 tons of ore mined; 1 lb. of candles for 1.5

tons; 1 gal. of kerosene for 460 tons; 1 gal. of cylinder oil for 170 tons; 1 gal. of engine oil for 136 tons; 1 lb. of lubricant for 48.5 tons; 1 lb. of drill steel for 6.2 tons; 1 lb. of bar iron for 9.4 tons; 1 lb. of sheet iron for 13.4 tons; 1 lb. of miscellaneous steel for 154 tons; and 1 lb. of nails for 8.8 tons of ore mined. The items of mining cost were: supplies, 92.846c. per ton; assays, 0.516c.; shops, etc., 2.881c.; salaries and board, 13.592c.; payroll, 79.397c.; electric light and power, 8.73c.; total, $1.97962 per ton mined.

Broken Hill South Silver

The following data were taken from the semi-annual report Broken Hill South Silver Mining Co., Broken Hill, Australia, and cover the six-month period ended June 30, 1914. There were 172,421 tons of ore raised averaging 15.2% lead, 6.9 oz. silver and 13.8% zinc. There were 172,330 tons treated in the concentrating plant, producing 28,745 tons of concentrates averaging 68.5% lead, 22 oz. of silver and 7.1% zinc per ton. In addition to this there were 105,779 tons of zinky tailings produced assaying 3.2% lead, 3.2 oz. silver and 16.7% zinc. Of the ore hoisted 96.1% was broken on contract and 3.6% came from development work, leaving only 0.3% broken by men on wages. Of the ore trammed to shaft 99.7% was handled by contractors. There were 41,836 cu.yd. of filling placed in the mine at an average cost of about 92c. per cu.yd. or 21.6c. per ton of ore produced. Underground employees numbered 987 but only 806 were in daily attendance, the average daily tonnage per man underground, indicated from figures given, was about 1.37 tons. During this time 9500 ft. of development work was accomplished. The average earnings of contractors mining was $1.45 and of trammers, $3.50 per shift. Water consumption was about 201 gal. per ton of ore treated. The working cost as reported was $5.20 per ton made up of $3.13 for mining, 22c. for filling, 83c. for development, and $1.02 for concentration.

	Concentrates	Tailings			
		Zinc	Quartz	Slimes	Total
Net weight, tons	28,745	105,779	10,439	27,367	172,330
Proportion to whole	16.7	61.4	6.1	15.8	100
Assay value:					
Pb, per cent	65.8	3.2	1.5	10.6	15.2
Ag, oz.	22	3.2	1.9	7	6.9
Zn, per cent	7.1	16.7	4.5	13.1	13.8
Metal contents:					
Tons lead	19,679	3,393	153	2,903	26,128
Ounces silver	632,010	342,864	19,573	192,279	1,186,726
Tons zinc	2,034	17,634	471	3,589	23,728
Proportion of metal contents:					
Per cent. lead	75.4	13.0	0.6	11.0	100
Per cent. silver	53.3	28.9	1.6	16.2	100
Per cent. zinc	8.6	74.2	2.0	15.2	100

The above tabulation shows the classification effected by the treatment plant during the year.

Tomboy Gold Mines

The report of the Tomboy Gold Mines Co., Telluride, Colo., for year ended June 30, 1914, shows a profit of $409,511 on operations and a net balance of $343,974 after deducting London expenses, depreciation, and income tax. Of this balance, $301,320 was paid in dividends. The profit on the ore, excluding depreciation and other receipts, London expense, income tax, etc., was $351,682 from 137,156 tons yielding $6.98 per ton. The operating cost was $4.40 per ton made up of mining, $1.71; development, 79c.; milling, 51c.; concentrating, including transporting ore to railroad, 13c.; water-supply, 13c.; assay office, 4c.; general expenses, 24c.; taxes and insurance, 22c. per ton. Adding depreciation and other expenses deducted by the London office the total cost was about $4.48 per ton.

It is stated that experiments have demonstrated the amenability of the Tomboy ores to treatment by cyanidation and that a plant is being erected to have a capacity to treat 400 tons of tailings a day.

Liberty Bell

The figures given herewith were taken from the annual report of the Liberty Bell Gold Mining Co., Telluride, Colo., for year ended Sept. 30, 1913.

RECEIPTS PER TON OF ORE MILLED

	1913	1912	1899-1913
Stamp bullion	$2.25	$3.22	$3.87
Cyanide products	2.18	2.77	2.24
Concentrates	.56	.88	.82
Concentrates cyanide bullion	.25	...	.03
Slag	...	...	.01
Total ore proceeds	$5.24	$6.87	$6.97
Miscellaneous profits	.20	.22	.17
Total proceeds	$5.44	$7.09	$7.14

EXPENSES PER TON ORE

	1913	1912	1899-1913
General (per ton milled)	$0.50	$0.61	$0.72
Mining (per ton mined):			
Operating	1.43	1.68	2.39
Development work	.26	.17	0.07
Tramming	.16	.16	.29
Milling	1.41	1.47	1.63
Treatment and shipment costs	.19	.28	.22
Average cost on basis of tons milled	$3.95	$4.37	$5.32
Profit per ton milled	$1.49	$2.72	$1.82

During 1913, details of shipment and treatment costs were as follows: On stamp bullion, 3c. per oz. of gold; on concentrates, $15.10 per ton of concentrates; on cyanide bullion, 2c. per oz.; and on cyanide bullion from concentrate treatment, 3c. per oz. of bullion. In mining 179,178 tons of ore, 355 boxes of candles were consumed and 310 tons of coal used for heating. Some of the principal supplies consumed in milling follow: Quicksilver, 0.125 oz. per ton of ore; 0.985 lb. of cyanide; 0.526 lb. of zinc; 8.1 lb. of lime; and 0.312 lb. of lead acetate and litharge per ton of ore milled.

In mining 179,178 tons and running 5662 ft. of development work 148,200 lb. of powder was used. It is stated that the amount of powder consumed was due in part to the amount of drifting done and in part to the method of doing it. A bonus system of payment substituted for the older contract system led to an unusual consumption of explosives but it was made up in the saving of labor. The net results, however, were not good and the contract system was resumed. The width of the vein in the area mined was 5.4 ft. against 4.6 ft. for the previous year. The average width of the vein to date including pinched portions is three feet. The Liberty Bell has produced 1,397,168 tons of ore to date and performed 59,799 ft. of development work or about one foot for every 23.4 tons of ore produced. Including ore in sight the ratio is 35 tons per foot of development. Counting all possible ore within the property above the Stilwell tunnel, development work equals about one foot for 50 tons of ore. The total ore proceeds to date amount to $9,727,012, and expenses, after deducting miscellaneous receipts, $7,217,296. Profit balances amount to $2,509,716, but of this amount $360,486 for construction still stands on the books to be charged out. The total expenditure to date for construction is $712,012, or about 51c. per ton of ore produced. The ratio of concentration is 65:1 and has averaged 64:1 to date.

New Street Quotations

The *Wall Street Journal* says:

> Dow, Jones & Co. and the "Wall Street Journal" have been many times requested to publish quotations made in New St. during the suspension of the Stock Exchange in order that financial people might have a complete record.
>
> It is true that these quotations in part represented actual transfer of securities where cash was paid over for stocks; but to recognize the existence of this market, even at the present time, is to establish a dangerous precedent.
>
> Moratoria prevailed in the latter part of 1914 over the civilized world, which meant that the stress of war was such that everybody must be called upon for a time to stand still, and buy and sell only for food and drink, and what was absolutely necessary to human existence.
>
> The Stock Exchange and the bankers of Wall Street gripped the situation with a firm hand, and declared that the quotations that prevailed July 30, on the closing of the exchange, should stand as the quotations for all financial transactions and valuation of assets.
>
> The quotations that were made in New St. were no more legitimate quotations than the quotations that were made in Belgium, where people with securities in their pockets, and fleeing from war and starvation, sold them for cash at 30% and 40% discount to some itinerant peddler who could cross the channel and realize the full quotation in London. Neither in Belgium nor in New St. was there a free, fair or open market. Not one of the 1100 members of the New York Stock Exchange could execute an order in New St. or even advise, personally, by circular or by telegram, the purchase of a share of stock.
>
> Dow, Jones & Co. in its news services and in the "Wall Street Journal" took cognizance of these New St. quotations made right under their windows as incidents of some slight general news worth, but as in no way constituting a legitimate or quotable market.
>
> In the interest of public safety, and as a defensive war measure for the protection of the general credit, and for no other reason, would the "Wall Street Journal" refuse to give its subscribers the full details of everything transpiring at the circumference as well as the center of finance.
>
> To publish now or in any way to recognize these quotations, except on the same basis as quotations that might be made in Hoboken or Belgium, is to permit unwarranted attack upon a large volume of transactions and settlements that were passed by the committee of the New York Stock Exchange during the suspension of the market, and also to impugn the collateral loans of the banks, and the integrity of both sides associated with bank loans.
>
> It is all right as a matter of human interest to declare that if a man were in Belgium or Germany at certain critical points and times, with the gold in his pocket, he might have bought securities at half the value recognized elsewhere in the world. But neither such incidents nor the New St. "curb" or "gutter" markets constitute a basis of true comparisons in respect to financial values.
>
> The New York stock market closed July 30 on the inauguration of war, and for many weeks finance rested in the night of the war cloud. The strong position of American finance today is due to the fact of that resting. The men of the Stock Exchange and of banking finance in New York are entitled to the greatest credit for their patriotic and successful labors during that period.
>
> Of course, everybody suffered—newspapers and news publications; but any other course would have been toward bankruptcy and chaos. Neither the public nor the press can go forward in a bankrupt world. The less prominence given to quotations of sales representative of individual distress or disaster, and where there was no free market, the better.

New Keystone-Inspiration

The proposed sale of the property of the New Keystone Copper Co. to the Inspiration developed a very pretty fight, which is not yet ended. The management of the company issued a call for proxies for a meeting on Jan. 6, but the meeting was enjoined by certain minority interests, led by Carl F. Pforzheimer and F. E. Huntress. The latter issued a circular to stockholders, the management issued another, and both parties engaged in a contest for proxies, a vote of two-thirds of all the stock being necessary to authorize the sale of the property. The total number of shares issued is about 360,000.

At an adjourned meeting, Jan. 15, the management turned up with 255,000 shares and the opposition with 50,000. James S. Dunstan, one of the directors of the company, represented interests holding 17,000 shares, which he voted with the management, giving the latter the necessary three-fourths. The opposition, however, questioned the validity of certain proxies and the contest is not yet settled.

The dispute is over the terms of the sale. The majority interests in the company think a good trade is being made, while the minority is not sure about it.

The Cottrell Dinner

A dinner in honor of Dr. Frederick G. Cottrell was given under the auspices of the American Institute of Mining Engineers, American Electrochemical Society, and Mining and Metallurgical Society of America at the Hotel Plaza, New York, Jan. 15. About 120, including many ladies, were present. This dinner was given to express the high esteem in which Doctor Cottrell is held among his technical brethren, both for his scientific attainments, especially in developing the Cottrell process, and for his munificence in bestowing that process upon the Research Corporation for the enrichment of scientific research.

Dr. F. G. Cottrell

The matter is concisely set forth in a minute adopted by the Research Corporation in recognition of the services rendered by Frederick G. Cottrell, B.S., Ph.D., to the advancement of science. This minute was adopted at the annual meeting of the Research Corporation, Jan. 15, and was as follows:

> In 1911 Frederick G. Cottrell, B.S., Ph.D., offered to transfer to the Smithsonian Institution substantially all his rights in his inventions and patents covering the processes known as the electrical precipitation of suspended particles in order that the profits resulting from the application of the patents, already well assured, might be applied to the advancement of scientific research and investigation. Naturally this proposition was at once recognized as both generous in spirit and highly original in conception. It was Dr. Cottrell's ideal to render discovery already made the mother of new discovery, and thus contribute to the scientific and technical development of the industrial arts.
>
> This far sighted and patriotic conception found its realiza-

tion through the "Research Corporation," which for administrative reasons was substituted for the Smithsonian Institution as the custodian of Dr. Cottrell's endowment. The objects of the Research Corporation as stated in its charter are:

> To provide means for the advancement and extension of technical and scientific investigation, research and experimentation by contributing the net earnings of the corporation, over and above such sum or sums as may be reserved or retained and held as an endowment fund or working capital, to the Smithsonian Institution, and such other scientific and educational institutions and societies as the board of directors may from time to time select in order to enable such institutions and societies to conduct such investigations, research and experimentation.

Organized in 1912 as a stock corporation, but precluded by its charter from paying dividends and capitalized by a group of gentlemen desirous of furthering Dr. Cottrell's objects, without personal profit, the Research Corporation undertook and successfully accomplished the installation of the Cottrell processes in various industries throughout the country, with the result that in two years' operation its surplus has provided the capital of $20,000 required by its charter, and a fund of over $100,000 for scientific research.

The accomplishment of this remarkable result, which both justifies Dr. Cottrell's expectations and realizes his hopes, is due to his generosity and foresight, and the directors of the Research Corporation take this occasion to express to Dr. Cottrell their appreciation of his contribution to scientific achievement and to the advancement of science, and tender him their cordial congratulations and sincere thanks for the public service which he has rendered.

At the dinner, Sidney J. Jennings presided. The speakers were: Dr. Charles D. Walcott, director of the Smithsonian Institution, representing the Research Corporation; William L. Saunders, representing the American Institute of Mining Engineers; F. A. Lidbury, representing the American Electrochemical Society; Walter Renton Ingalls, representing the Mining and Metallurgical Society of America; and Doctor Cottrell.

In his remarks Doctor Cottrell laid special emphasis on the assistance he had been given by his several associates, and insisted that he must only be considered a codonor with them, in giving his patents to the Research Corporation. Excerpts from his remarks follow:

The earliest coöperation and assistance received in the work was from Dr. Harry East Miller, a consulting chemist of San Francisco, who became actively interested in the problem of acid- and smelter-fume control even before any serious consideration had been given to the use of electrical methods and while the work still centered around centrifugal separators. He was the first man directly engaged in industrial work who sufficiently appreciated the possibilities foreshadowed and had the courage to spend real money, and particularly his own money, for their development.

The experiments already commenced on a very small scale in the laboratories of the University of California, at Berkeley, were transferred and continued in Doctor Miller's private laboratory in the old Stock Exchange Building, in San Francisco, until the earthquake and fire of 1906 made a clean sweep of the entire equipment.

The business difficulties and responsibilities of the work commenced to develop in earnest almost in direct proportion to the degree of technical success met with, and the necessity became apparent for effecting a commercial organization strong and stable enough to adequately handle negotiations with the corporations being dealt with.

At this stage of the development, Doctor Cottrell and Doctor Miller were joined in the undertaking by E. S. Heller, a lawyer and business man closely associated with some of the strongest financial interests of San Francisco and the West generally. He and Doctor Miller had been classmates and chums in the College of Chemistry of the University of California back in the early '80s before Mr. Heller decided for the law and business. He had taken from the first a friendly interest in the work and had drawn for them such papers as had been necessary, but now he came forward with substantial financial assistance and what was even more important took personal direction of the larger and more important legal and business phases of the venture.

Prof. Edmond O'Neill, Dean of the College of Chemistry at the University of California, who had been teacher and inspiration to all three of these friends and coworkers, formed the fourth member of the little group who, under the name of the Western and International Precipitation Co., owned and developed, for the next five years, the patents which were, at the end of that time, given jointly by these four associates to the Smithsonian Institution, and by it later turned over for administrative purposes to the Research Corporation, which had in the meantime been organized for the purpose under the direction of the Smithsonian.

E. S. Heller F. G. Cottrell
E. O'Neill H. E. Miller

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The Engineering Foundation

The Engineering Foundation, inaugurated by the United Engineering Society, is the name given to a fund to be "devoted to the advancement of the engineering arts and sciences in all their branches, to the greatest good of the engineering profession and to the benefit of mankind."

The administration of this fund will be entrusted to the Engineering Foundation Board, elected by the trustees of the United Engineering Society and composed of 11 members, nine from the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the American Institute of Electrical Engineers, and two chosen at large.

The initial gift for the Engineering Foundation is from a noted engineer whose name will be announced at the inauguration ceremonies, Wednesday, Jan. 27, 1915, at 8·30 p.m., in the auditorium of the Engineering Societies Building, 29 West 39th St., New York City.

The speakers at this inauguration meeting will be: Gano Dunn, president of the United Engineering Society and past-president of the American Institute of Electrical Engineers; Dr. Henry S. Pritchett, president of the Foundation for the Advancement of Teaching; Dr. Robert W. Hunt, past-president of the A. I. M. E.; Dr. Alexander C. Humphreys, past-president of the American Society of Mechanical Engineers.

The Marquette Range Sixty Years Ago

To those who think of the several ranges in Michigan and Minnesota, which constitute the "Iron Country," as being about the most accessible and highly developed region in which the metal miner is likely to have a chance to work, a glimpse of conditions as they were in the '50s when operations were just beginning, is most instructive. The New York *Evening Post* of Sept. 8, 1853, published an account by Robert Kelly, father of William Kelly, now manager of the Penn Iron Mining Co. on the Menominee, describing a water journey from Detroit to Marquette and the Marquette range. The account was read before the meeting of the Lake Superior Mining Institute last summer and is reprinted in *Iron Ore*.

Mr. Kelly visited the Soo and his remarks anent the terms on which the canal was built are uncannily prophetic. He writes:

> The Saut Sainte Marie Canal Co. was incorporated by the legislature of the State of Michigan at the last session. They advance all the capital that may be necessary, and when the work is completed, according to specifications, they will become the owners of half a million acres of the public lands, appropriated by Congress to the State of Michigan for the construction of the canal. The idea was, perhaps, that the work would be constructed with the property of the government, but the question of constitutionality would be avoided as a direct issue. The State of Michigan has transferred the task, and her rights to the lands, to the company she has incorporated. They have, it is understood, the privilege of indicating in advance the sections which they wish to secure and have actually, as the first step, marked every unentered section of land in the upper peninsula of Michigan, good, bad, and indifferent, amounting to something less than two hundred thousand acres.
>
> All the mineral treasures that may be discovered hereafter in this territory, will be theirs. The general expectation is that a large profit will be realized by the company, and they will have earned it fairly. But is not this a portentous monopoly of lands and mines? **The vast gifts of lands to private corporations that have been made within a few years past, will, at no distant day, excite the astonishment of the nation.**

As for Marquette in those days:

> Marquette is the port of an important and extensive iron district, lying south from it at a distance of from 12 to 25 miles. This region is as yet almost inaccessible, except in winter, from the want of proper roads. But within a year from this time, probably, a plank road or a railroad will establish an easy and constant communication, bringing the mountain to Marquette and Marquette to the mountain. There is a blast furnace located there for the manufacture of blooms, erected originally by the Marquette company, but now owned and kept in operation by the Cleveland company, their successors. The ore is made into blooms without the intermediate process of running into pigs, and yields the same quantity of blooms per ton as pig iron.

From Marquette Mr. Kelly and his party proceeded over a somewhat arduous route to the Marquette iron range:

> The main object of our party in landing at this point, was to visit the iron district. . . . The resources of the place were put in requisition to equip the expedition, and furnish supplies for several days. Two or three saddle horses were obtained and two wagons for the conveyance of bedding, stores and baggage, and the transportation of those who felt disposed to undergo the dislocating process of the wheel torture. The major part performed the journey afoot, over a road terribly rough in its best state, and now full of sloughs, by reason of long-continued rains. We established our quarters at Jackson Forge, on the falls of the Carp River, a distance of 10 miles from Marquette, converting a small unoccupied and unfurnished house into a hotel . . . . The neighboring Carp furnished us with trout, a spring some rods distant supplied us with water, and a store of wood was at hand to furnish smoke-fires as our night watches against countless hordes of pestiferous mosquitoes and flies. . . . We made an early start, and, after a walk of four or five miles over a road similar to that which had tried our patience and our boots the previous day, reached Jackson Iron Mountain. . . . We spent several hours in the exploration of Jackson Mountain. The whole smithy of Vulcan with all his Cyclopean helpers, could never have heaped up and would never exhaust this vast pile of mineral that has been thrown out from Nature's deepest laboratory. The only idea that can be given of it is, that it is a hill of iron-stone, broken into fragments or cracked in seams, three-quarters of a mile long, half a mile wide, and rising to a height of 150 feet.
>
> It would be an interesting proposition for such as choose to undertake it, to calculate from these data the quantity of iron contained in the mass above the surface. One side of the hill is nearly precipitous, showing the iron from top to bottom. The most of it is covered with trees which have found their nourishment in the thin deposit of earthy substances and decayed vegetable matter that in the lapse of centuries has been formed over the mineral upheaval. In several places we tore away with our hands a matted bed of mosses and leaves, and picked up from beneath fragments of ore with no mark of rust upon them. There are differences in the appearance of specimens obtained from various parts of the moss, but the results of analyses and of working the ore, show that it is singularly uniform throughout in quality and purity. All the ore that has been used at the Jackson Forge and at the Marquette Forge, was obtained from a single small spot, and from it has been manufactured all the iron known as Lake Superior iron, already celebrated for its remarkable toughness and valuable properties for shafts and axles. It is quarried at very small expense, blasting easily, and breaking up at each blast into convenient fragments, differing in this respect from the mountain masses of Missouri, which are quarried with great difficulty.

An interesting picture this, of the infancy of Michigan's most famous range.

Average Metal Prices

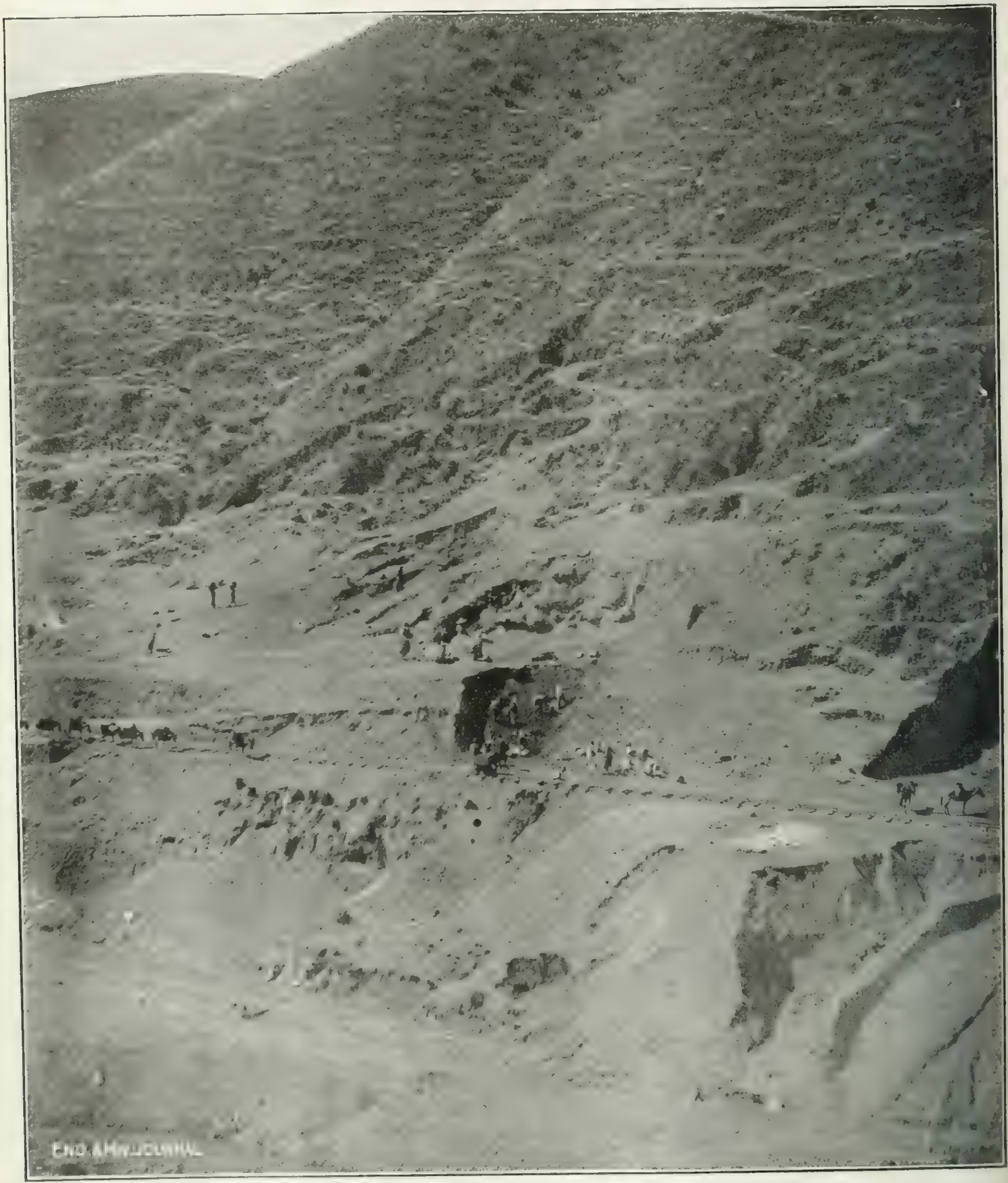
The accompanying table gives in a convenient form the average prices of the principal metals during the last 20 years.

	Copper		Lead		Tin		-Spelter-		
Year	Lake	Electrolytic	New York	London	New York	(a) London	New York	St. Louis	London
1895	10.76		3.23		14.05	63.333	3.63		
1896	10.88		2.98		13.29	59.496	3.94		
1897	11.29		3.58	12.367	13.67	61.400	4.12		
1898	12.03		3.78	12.983	15.70	71.204	4.57		
1899	17.61	16.67	4.47	14.933	25.12	122.429	5.75		
1900	16.52	16.19	4.37	16.987	29.90	133.575	4.39		
1901	16.55	16.11	4.33	12.521	26.74	118.633	4.07		
1902	11.887	11.626	4.069	11.262	26.79	120.720	4.84		
1903	13.417	13.235	4.237	11.579	28.09	127.320	5.40	5.191	
1904	12.990	12.823	4.309	11.983	27.99	126.733	5.100	4.931	
1905	15.699	15.590	4.707	13.719	31.358	143.083	5.882	5.730	25.433
1906	19.616	19.278	5.657	17.370	39.819	180.646	6.198	6.048	27.029
1907	21.001	20.004	5.325	19.034	38.166	172.638	5.962	5.812	23.771
1908	13.424	13.208	4.200	13.439	29.465	133.121	4.726	4.578	20.163
1909	13.335	12.982	4.273	13.042	29.725	134.774	5.503	5.352	22.185
1910	13.039	12.738	4.446	12.920	34.123	155.308	5.520	5.370	23.080
1911	12.631	12.376	4.420	13.970	42.281	192.353	5.758	5.608	25.281
1912	16.560	16.341	4.471	17.929	46.096	209.130	6.943	6.799	26.421
1913	15.686	15.269	4.370	18.743	44.252	201.679	5.648	5.504	22.746
1914			3.862		34.301	156.564	5.213	5.061	22.544

(a) From statistical report of Metallgesellschaft, Frankfort-on-Main.

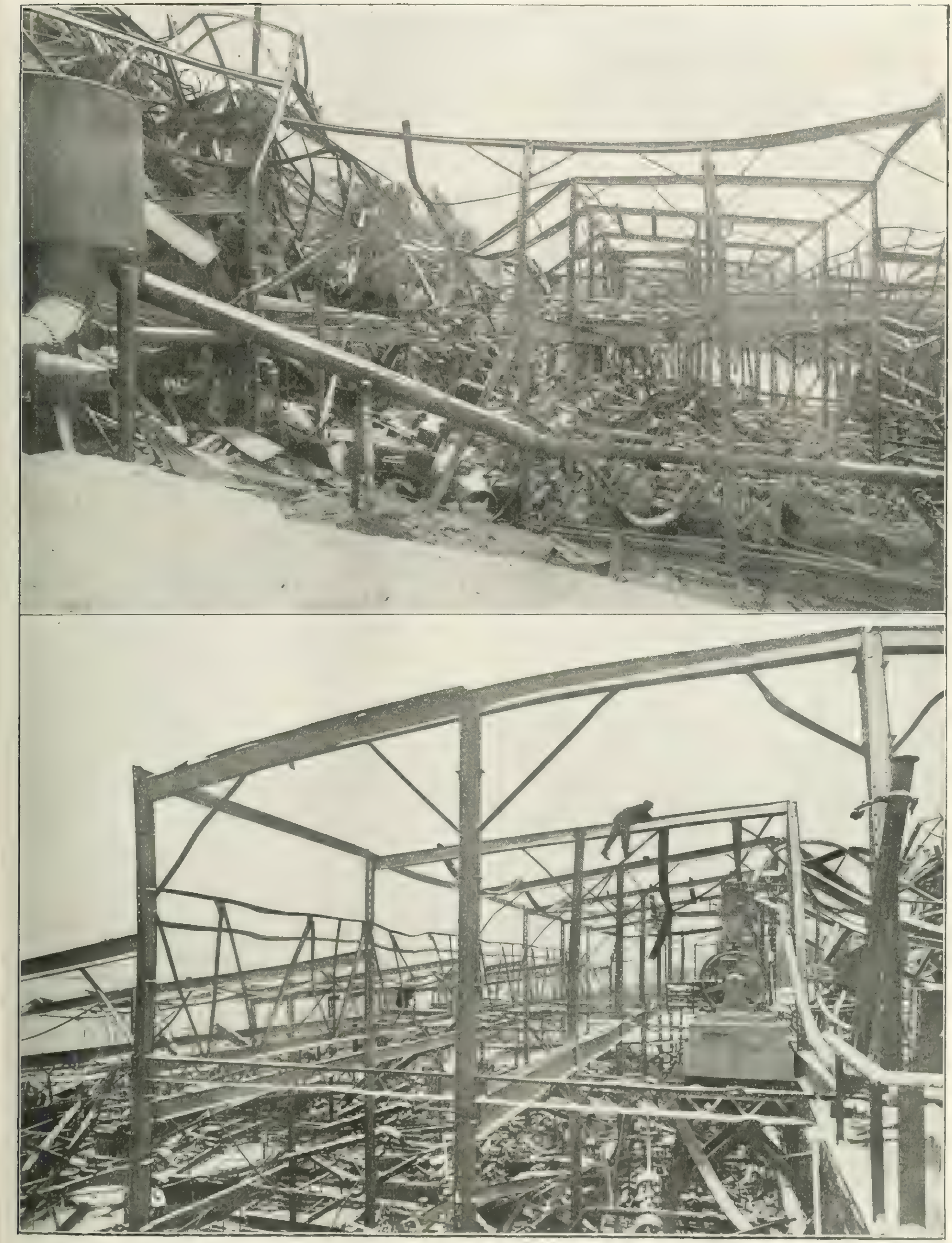
New York and St. Louis, cents per pound. London, pounds sterling per long ton.

Photographs from the Field



OLD SLAG DUMPS AT THE BAWDWIN MINES, NORTHERN BURMA

The Bawdwin mines were long worked by the Chinese for silver, the ancient slag dumps were resmelted in a modern lead blast furnace first erected at Mandalay, but later removed to Namtu, 13 miles from the mines. Development of the last two years has indicated large bodies of complex sulphide ores remarkable for their lead-silver-zinc content Copper-silver ore is also found, along later fault planes in the Shan lode



THE WRECK OF THE ISLE ROYALE MILL

This mill was recently destroyed by fire. In the upper view the stamp heads and jigs are shown, while in the lower one the concentrator tables may be seen. Photographs supplied by courtesy of J. T. Reeder.

The State of the Mining Industry in Germany

Special Correspondence*

We still have to post our letters unsealed, but incoming mail arrives sealed without any trouble. Printed matter has always come through regularly, only about 12 days later than at normal times. I have not lost a single copy of the Journal yet, though sometimes there will be a number lagging behind. However, it is sure to turn up sooner or later.

As no statistics about the state of industrial enterprises during 1914 are available yet, I can give but a few vague notes. According to my information there is no lack of raw material for at least a year to come except in the case of nickel, mercury, petroleum and perhaps tin. The production of metals, though fostered by the military authorities, is hampered by the lack of men. For a time the impossibility of getting transportation on account of the movement of troops and war material and for want of cars was also a serious disturbing factor, but this has been overcome largely by the running of freight and passenger trains on a regular schedule time and by the acquisition of cars captured in the hostile countries.

From an official publication I gather that the decrease of males employed in November, 1914, amounted to 25%, as against the same month in 1913. From Kattowitz, Upper Silesia, a newspaper correspondent wires the startling news that round about that town all blast-furnaces are running and all the cages in the shafts are whirring up and down, most of the work being performed by women and girls. This may be exaggerated; still, one fine day we had about 4000 young men from Upper Silesia quartered upon us, an equal number being sent to Lower Silesia when there was a possibility that the Russians might break through the lines of the allied Germans and Austro-Hungarians into that industrial district. After a lapse of four weeks, when all danger had passed, the exiles were shipped back to their homes.

For the present scope of operations, being two-thirds of normal, the iron-ore supply is sufficient. Of it, 57% comes from local mines, 8% from Austria-Hungary, 15% from Sweden and 20% from Siegerland. If the Swedish supply should fail, there are other sources to draw on. Scrap is abundant. No ore has been imported from Russia since 1912. The monthly output of pig iron with 24 furnaces running at present amounts to 62,000 tons.

The extraction of ore from the minette country about Briey, Lorraine, has been kept up at a small scale by the German owners and the water pumped out to prevent the flooding of the mines. Some of the large iron works and rolling mills have started, or are about to start up, part of their plants, to save them from destruction. The German administration in Belgium is running the Cockerill works at Seraing, presumably on repair work for the army. None of the zinc works has been damaged by the ravages of war, but none are running, inasmuch as they lack both ore and men.

The German government has urged the public to make more extensive use of coke in household and industry in order to stimulate the production of gas; and, what is more important, of benzol, which is used extensively by the motor cars in the field, instead of benzine, which is procurable in limited quantities only. The scarcity of petroleum is distressing to the poorer classes, who cannot afford to pay for an expensive installation of gas or electric light in their homes. Before the advent of mineral oils rape oil was the current article for lamp lighting. But since its abolition for that purpose, its consumption has become limited and rape is not cultivated to the former extent. Hence there is also a scarcity of that article.

The question of employing prisoners of war to do work for the public good has been often mooted, but dropped when it was found that tuberculosis was a prevalent disease amongst the French soldiers, and the Russians are suspected of harboring occult cholera bacilli.

It may be interesting to many pupils of Prof. Carl Schnabel to learn of his death at Berlin, Prussia, in the 71st year of his age.

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*Dated Dec. 29, received Jan. [illegible]

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El Cobre Mine Unwatered in 1914

The long fight against water in El Cobre mine, near Santiago de Cuba, has been won at last by Manager Edward H. Emerson, who succeeded in accomplishing the final unwatering of this copper mine in May, 1914. His difficulties were aggravated by the fact that the *antiguos,* before abandoning the mine, had done a large amount of underhand stoping. These stopes filled with water, forming underground lakes, of unknown extent and impossible to locate, constituting a constant menace. The entire force was driven out of the mine on one occasion when unexpectedly a large body of water was encountered. Fortunately, provision had been made for taking care of such happenings, and no serious accidents occurred.

In addition to the water menace, mud and débris had accumulated in the bottom of all the shafts and workings, and when tapped, it flowed into the workings; this greatly retarded the work of unwatering as it was most difficult to handle. Pumping was done with compressed air wherever possible.

As far as can be ascertained, this mine has been under water since 1861. The questions to be decided were: (1) Had the mine been abandoned—as claimed by a number of authorities—on account of difficulties resulting from depth and heavy water, the mine being 1100 ft. deep? (2) Was it abandoned because of a revolution which occurred sometime about the beginning of our Civil War? (3) Had the mine been abandoned because the ore had decreased in grade as well as in quantity?

The results of Mr. Emerson's latest exploration seem to show that the abandonment of this historic mine was due to one of the first two reasons mentioned above. His development showed that the unoxidized chalcopyrite ore occurs in substantial widths, and shipments of ore from the lowest level demonstrated a value of at least 8% copper in this ore. In addition, there were found substantial bodies of lower-grade ore, which is particularly amenable to the Minerals Separation process, with which it is now being handled. These results promise a revival of the Cobre mines, under a reasonable price for copper. It has been seven years since the first effort was made to reach the bottom of this famous old mine, and its final accomplishment is a matter of congratulation for the management and for the stockholders.

Correspondence and Discussion

Packing of Machinery, Etc., for Shipment Abroad

The following notes are compiled from the point of view of the one who has to receive, check and assemble goods at their destination. In each case wherever an error or source of trouble is indicated, such error has been found to occur many times and these remarks cover a large and varied number of shipments:

(1) All shipping marks, case numbers, etc., should be on at least two sides of each case or package, and where there will be much handling or trans-shipment before the end of the journey, it is advisable in addition to the usual stencil work to have the marks, etc., on stamped-metal plates, as after a long journey some or all of the stencil work often cannot be deciphered.

(2) Small details, such as keys, collars, etc., should not be in same cases as heavy pieces such as shafting; often the case arrives broken, and the details, being small, are lost.

(3) Instructions on packages and cases, such as "Do not stow near boilers," should be written in the language or languages which apply to the steamships or means of transport in question—the English language only is not necessarily sufficient.

(4) Steel plates, angle irons, etc., and generally material for steel tanks, buildings, etc., should not only have the erection marks boldly painted on, but these marks should also be stamped on after the plate has been painted, and at a spot clearly indicated, as by a paint mark—often these stamped marks are entirely buried by the last coat of protective paint which is put on before shipment.

(5) The corners of steel plates for tanks, especially those that are "drawn out," should be protected, otherwise they are likely to get badly bent in handling, especially when the plates are in heavy bundles.

(6) Rivets, bolts, etc., in drums with lids only roughly clipped on, often arrive open and are subject to much loss—in general, these drums are altogether too weak for much handling.

(7) Fragiles, such as some assay goods, should always be in cases with some sort of handles, conveniently of rope, to facilitate careful handling.

(8) Crucibles for assaying and smelting work are very often in casks too weak for the purpose.

(9) Chemicals, at least those from England, which are packed in corked wide-mouth bottles, have useless corks on them; the corks should be about half their depth in the neck of the bottle and the other half sticking out, so that after once opening the bottle, the cork can be replaced practically air-tight again. Usually an absurdly thin cork is used and this is countersunk, and the air-tight joint is made by the packers by dipping the neck of the corked bottle in paraffin wax. After the bottle is once opened, the cork, being too thin, is no use for properly closing it again. In this way, especially in out of the way places, any chemicals which spoil by exposure to air, moisture, etc., have every chance of doing so. Again, it is quite usual practice to pack deliquescent chemicals in paper or in other parcels which are anything but air-tight and this when the goods are going to wet countries like West Africa.

(10) Heavy chemicals are often in tins or casks without anything to show the nature of the contents—the man at the receiving end has plenty to do without having to test to find out what the contents of a cask are.

(11) Some manufacturers do not yet appear to have learned that lead acetate cannot safely be shipped in zinc-lined cases; the same remark also applies to cyanide, more especially when the place of its destination is a wet country.

(12) Cards and pamphlets of working instructions, such as are often sent by makers with machines, should be mailed, or at least packed separately; such working instructions being often packed in with heavy machinery get lost or damaged when unpacking.

H. T. Durant.

London, England, Dec. 16, 1914.

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May the Institute Indorse Opinions?

In the *Mining Press* of Jan. 2, the editor says that under the present constitution of the A. I. M. E. "in even so innocent a matter as joining the other national technical societies in issuing a common style sheet, it has been held that the Institute could not bind itself." Since the use of a style sheet is distinctly a part of the work of "publication," the adoption of such a regulation is explicitly authorized by the constitution, and, so far as I know, nobody has ever "held" otherwise.

In the same journal, Edmund B. Kirby, writing on the same subject, says: "In short, when the Institute wants to do anything, it should be free to do it." Of course, he proceeds to explain, the thing must be suitable—not the tariff, or the European war, or religion or socialism. Common sense, he thinks, will take care of that. Among the "suitable" things, according to the editorial quoted, is the amendment of the Federal mineral-land laws. Mr. Kirby entitles his article, "Shall the Institute Express Opinions?" There is but one answer to that: the Institute was organized for that purpose, and has been expressing opinions, with or without facts, for 44 years. The new proposition is that the Institute shall stop mere talking, and do something. It should not merely express opinions, but decide upon them, determining by a majority of the directors, or of members voting, which opinion should be officially expressed and which officially condemned. The proposed amendments would permit the directors to commit their own board without consulting the members at all, while the Institute could be committed formally, perhaps, only by a postal referendum.

Now let us see how this would work in the case of the movement to amend the Federal mineral-land laws. Those laws affect a few states and territories only. An over whelming majority of the members of the Institute—geologists, chemists, engineers, electricians, etc., residing and operating in the Eastern States, Texas, Canada, and Mexico, do not come into contact with them, do not understand them, and can form opinions concerning them only upon the arguments advanced by others. In other words, this majority is not a body of expert judges. It is simply an audience of intelligent listeners to be persuaded.

But in the small minority of members who do understand this subject, realize its importance, and desire to promote a much-needed reform, there is a decided difference of opinion. On the one question concerning which any considerable and unanimous party is in evidence, namely, the abolition of the extra-lateral right, some members, admitting the existence of grave evils, do not think the abolition of the extra-lateral right would cure them, and recommend different remedies. Others think that the extra-lateral right was a bad thing, and has done much harm, but that its abolition at this time, after more than 40 years of practical operation, and judicial construction, and the establishment of innumerable vested rights under it, would be unwise. Others, again, while willing to express their unfavorable opinions of the "apex law" in a free discussion, are not willing to be active in a political movement which they fancy is premature, and believe to be, in their own districts, unpopular. And, finally, there is the party to which I belong, and which advocates the abolition of the apex-rights, whatever incidental inconvenience may result. I think it probable, though I am not perfectly sure, that a vote of those members of the Institute who are qualified to judge would result in the victory of my party. But I would certainly not wish to put such a question to a general vote of members, and have it decided by a non-qualified and uninterested and unrepresentative majority.

The moment we go beyond this one issue, and consider the other "suitable" amendments to the mineral-land law, we are lost in a chaos of conflicting proposals. The contributions on this subject to the discussions of the Institute and of the Mining and Metallurgical Society are pathetically amusing. Mr. Kirby thinks that common sense may be relied upon to keep "socialism" out; but some of the amendments proposed to the mineral-land law rest upon clearly socialistic grounds. And one of the most distinguished members of both societies declares (with implied approval) that the coming reform will include the permanent ownership by the Federal government of all the "public" mineral resources and their perpetual administration under a system of leasing! The entrance of the Institute into such a field would be preposterous.

But, recurring to the notion of "suitable" subjects, I wish to say that so far as I can see the limit to be set by "common sense," as Mr. Kirby expects, must logically apply also to the acceptance of papers for publication. If a contribution is regarded as pertinent and valuable, why should it not be officially approved or disapproved by the Institute? There is, so far as I can see, but one escape. The directors may regard it as not sufficiently important. In other words, it is not connected with any "burning question" of the day, or movement for reform—in short, with some sort of political, federal or state, American, of course; nobody has yet proposed the adoption of "official" opinions about Mexican or Canadian affairs. Yet, after all, why not? Are not Mexican and Canadian reformers entitled, as members of the Institute, to have their patriotic schemes of mineral-land legislation approved or condemned by an American majority of their fellow members? If not, why are they permitted to vote on American reforms?

R. W. Raymond.

New York, Jan. 11, 1915.

Fettling Reverberatories

Referring to H. L. Charles' letter under "Correspondence and Discussion," in the Journal of Oct. 31:

The first fettling through the roof of a reverberatory furnace of large size, of which I have knowledge, was planned and put in operation by the late Charles F. Shelby and William Gmahling, in the winter of 1906, at Cananea, Sonora, Mexico. The arch was old and would soon need repairs. Mr. Gmahling thrust holes through the arch with a crowbar along the side walls and the bridge and experiments were tried on fettling the furnace through these holes. The device proved so successful that when the furnace was closed down in December, 1906, and given a general overhauling, fettling holes were made in the arch at about 2½-ft. intervals along both walls and over the bridge, and when the furnace was started up immediately thereafter, and prior to March, 1907, the method of fettling was proved to be a success, and has been followed ever since. The fettling material was marginal material from the start. At Cananea we still have men working who assisted in installing and fettling through these ports in the arch, and I believe that Harry Charles, who was employed at the Cananea smelting plant at the time these experiments were made, can confirm these facts.

L. D. Ricketts.

Warren, Ariz., Nov. 13, 1914.

Mond Nickel Co.'s Bond Issue

In a recent issue of the Journal, the statement regarding the success of the recent bond issue of the Mond Nickel Co. referred to its former bond issue as amounting to 10 times what it actually was. The actual amount of the first debenture bonds was £375,000, not £3,750,000 as stated. The total amount of the two bond issues is, therefore, £875,000, or a trifle over one-fifth of the amount which was given out by the press.

All the press notices had the same error, so the mistake was probably in the original cable.

The Mond Nickel Co., Ltd.,
C. V. Corliss, Manager.

Coniston, Ont., Jan. 5, 1915.

Sand Filling of Copper Mines

Noticing an article regarding the above subject in the Journal of Dec. 12 I wish to state that sand filling has been in use for several years at the Foldal Copper Co.'s mines at Foldalen, Norway.

There have been installed several kilometers of aërial ropeways from the river bottom whence the sand is taken to the mines, where the sand is guided to its place through iron pipes from the surface. The system has proven very satisfactory.

Vantrent, Calif., Jan. 2, 1915. N. A. Sansteby.

Editorials

The Rise in Copper

We doubt if any further rise in copper is to be regarded with the same enthusiasm as is exhibited by those gentlemen who are trying to engineer a boom in copper shares. If the unsold accumulation of copper has been reduced to a moderate figure, a rise is, of course, justified; and if the tendency continues to be to draw further on stocks some resumption of the former scale of production will be justified. The ideal condition would be a price of about 14½c. per lb., net cash, New York, for copper and a production substantially adjusted to the demand for copper at that price. There is need, however, to proceed very cautiously in departing from the previous basis of copper production, reduction to which was the only thing that saved the copper industry last fall. The present danger is that some producers will forget that we are still deprived of our largest customer, Germany, that domestic consumption in this country is still not what it ought to be, and that the present large demand for copper is to a considerable extent for military purposes; and forgetting these things will be tempted to increase output and produce conditions from which we may suffer later.

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Production of Spelter in 1914

The production of spelter in the United States in 1914 was reported by us, in our annual number, Jan. 9, 1915, as 360,789 tons, the output of one small smelting company, which did not report, being estimated at the same figure as in the previous year. Most of the producers gave their production by quarters, but two, one small and the other large, reported only their totals for the year. Both of these, however, were producers who operate under especially uniform conditions, their production varying but little either from year to year or from quarter to quarter, and by prorating their productions for the year we may obtain an approximate idea of the total production of the United States in 1914 by quarters, and may compare it with the corresponding figures for 1913, as follows:

Quarter	1913	1914
I	92,082	87,791
II	94,336	90,599
III	83,062	90,523
IV	88,782	91,876
Total	358,262	360,789

The chief curtailment of production occurred in the third quarter of 1913. During the first half of 1914 two works in Kansas went out of operation and another large plant reported only a nominal production. Two of the Kansas plants which suspended in 1913 were idle throughout 1914. Three of the survivors of the old coal-fired plants were also idle throughout 1914 and one of them was scrapped. These three coal-fired plants had an aggregate of 3094 retorts. The five gas-fired plants had an aggregate of 11,464 retorts.

The time when a zinc-smelting works should be removed from the list of smelting capacity is uncertain. When a plant is scrapped, as was the plant at Nevada, Mo. (648 retorts), in 1914, there is no doubt about the end having come, but almost always there is a period in the latter part of the life of a zinc smeltery when it is inactive but potential. This was the position of seven works with an aggregate of 16,910 retorts at the end of 1914. It is improbable that the five idle gas-fired smelteries of Kansas will ever obtain a new lease of life, but they will no doubt be fitfully employed, just as were the gas-fired plants of Indiana as their ending drew nigh.

The increase of production in the second quarter of 1914 was due chiefly to two large plants of Illinois, which brought new capacity into use. Among the other plants of the country there were some increases and some decreases. The record of the fourth quarter was similar, but a new plant in Oklahoma had come into operation. On the other hand, one of the big plants of Kansas made a considerably diminished production, advantage having been taken of an opportune time to reline some of its furnaces.

The production of bonded spelter in 1914 was 5950 tons, compared with 5904 tons in 1913. The exports of bonded spelter in 1914, as reported by the several smelters, amounted to 6620 tons.

In 1912 there was a production of 492 tons of commercial zinc dust. In 1913 the production was 380 tons. After the outbreak of the war the high price for this commodity induced several smelters to engage in its preparation and the production in 1914 was 750 tons, with strong probability that the amount will be larger in 1915.

Our statistics of spelter production are based, as for a long series of years, upon the reports of what we class as "ore smelters" and include the entire product of such smelters. At the beginning of 1914 these concerns held 40,115 tons of spelter in stock at their works; at the middle of the year about 64,000 tons; at the end about 23,500 tons. We refrain from trying to compute consumption or deliveries, about which it is impossible to do anything more than guess.

The total supply of spelter is the sum of what is produced by the ore smelters and the dross-and-scrap smelters. The aggregate output of the latter is large and some of the smelters of that class are of very respectable caliber, certain of them turning out nearly as much as 10,000 tons per annum, and a good deal of their spelter is as good as, or even superior to, prime Western virgin spelter.

The U. S. Geological Survey in reporting spelter production makes a distinction between primary and secondary, the former being limited to what is directly derived from ore, and the latter comprising what is recovered from other products. Such recovery is practiced by (*a*) remelting and (*b*) redistillation. In pursuing a statistical investigation there are so many opportunities for confusion and errors of both omission and commission that results are next to meaningless unless there be precise definitions of just what they represent. For example, some consumers remelt their own scrap, others send it to outside smelters for resmelting on toll and have it returned to them, while others sell it outright and let it reappear as marketable spelter. What shall be reckoned in the statistics? Again, among the smelters there are some who treat dross-and-scrap only, while there are others who smelt a little ore along with the dross and scrap, and others who smelt ore chiefly but take a little dross and scrap. The ore smelters produce annually from 8000 to 10,000 tons of spelter that is derived from dross, skimmings, etc. What the U. S. Geological Survey wants to know is the quantity of spelter derived from ore. What we want to know is the production of spelter that is destined to be marketed. The combination of statistics of part of the marketable production with part of the stock in smelters' hands and the exports as reported from ports to which spelter is two weeks or more in transit from the smelteries does not permit of any very reliable deductions as to deliveries for domestic consumption, and still less as to domestic consumption itself.

The Directorship of the Mint

The Bureau of the Mint is one of the offices in Washington with which the mining industry, especially the gold- and silver-mining industry, comes intimately in contact. In certain ways it comes more intimately in contact with this than with any other, there being in fact the relations of buyer and seller. A very large part of the production of gold and silver is taken by the Mint and is sampled, assayed and settled for just as by a private smelter and refiner.

The Mint is moreover an important factor in the collection and reporting of the gold and silver statistics of the country. Until a few years ago it was the sole factor. The main work of the Mint is in fact a metallurgical and metal manufacturing business.

George E. Roberts, who was a successful director of the Mint during many years, lately resigned. Since then his place has been filled by Frederic P. Dewey as acting-director. The appointment of a new director will be made by the President ere long.

It is very rare indeed that the JOURNAL advocates the appointment of any person to public office, but we think that we may say that the mining and metallurgical industry would be very much pleased if the President should appoint Mr. Dewey director of the Mint.

Mr. Dewey has been assayer of the Mint for upward of a score of years and is an analyst of high distinction, indeed an authority in his science, and a metallurgist of no little reputation. Just as Roberts-Austen was for many years assayer of the British Mint and was finally honored by being made Master of the Mint, it would be fitting that Mr. Dewey should be so honored here.

With such an opportunity awaiting the President, we should feel badly to see the directorship of the Mint assigned to a politician, a time server, or a lame-duck.

A Novelty in Placer Mining

The article by Mr. Hartley on "The Opportunities in Placer Mining," which appears elsewhere in this issue, is suggestive. Mr. Hartley reveals a vision, but we understand that he has a very substantial basis for his dream.

Such a procedure as he outlines can be proved only by actual operation and, moreover, by an operation for a considerable period. We understand that this has been done in one case, a certain plant treating 500 cu.yd. per 10 hours in the way suggested by Mr. Hartley at a cost of about 15c. per cubic yard.

Some Figures of Industrial Insurance

In the Nevada Consolidated Copper Co.'s excellent monthly bulletin, *Safety First,* for October, 1914, are given some illuminating figures of the economic workings of the state industrial-insurance act. In the year ending June 30, 1914, 328 mining companies paid $154,394 in premiums, of which Nevada Consolidated paid $49,424. The total number of employees in mines, mills and smelting works protected by the industrial-insurance act averaged 8863, of which 2437 were employed by the Nevada Consolidated.

The employees of the Nevada Consolidated received compensation to the amount of $30,926. It is provided in the industrial-insurance act that 10% of the premiums shall be used to pay the administration expenses, and that another 10% shall be set aside as a reserve fund. Adding these percentages to the sums paid out by the commission, the Nevada Consolidated employees got back 82% of what the company paid in. In other words, the company paid into the state insurance fund a total of $49,424, of which $40,811 was devoted to the protection of its employees.

Other figures are even more interesting. By the provisions of the industrial-insurance act, compensation is not allowed for injuries resulting in disability for less than 14 days. The commission, however, has kept a record of all accidents resulting in personal injury. Summarizing these data, the wage loss of employees of the Nevada Consolidated in 12 months averaged $1.27 per man per year, while the wage loss of employees at all other mining companies in the state was $2.17 per man per year, based on the average number of men employed.

These figures are interesting and instructive in several ways, viz., for the economy with which the administration of the state insurance system is conducted; for the relatively small loss of time that is suffered by the miners, millers and smelters of the state by reason of industrial accidents; and finally, the very favorable showing in this respect that is made by the Nevada Consolidated, which has distinctly been a leader in the movement of "Safety First."

The Institute Amendments

Doctor Raymond, in a further communication about the Institute amendments, elsewhere in this issue, makes the effective point that the A. I. M. E. is an international organization. It has a great many members in foreign countries, but especially a large number in Canada. Are foreigners to be asked to vote upon questions of American policy, asks Doctor Raymond, and is the Institute to consider questions of Canadian and Mexican policy, as well as American?

A distinguished member of the Institute in Colorado addressed the following letter to the secretary of the Institute:

> With reference to announcement No. 5, dated Dec. 28 last, of the Institute, which has just reached me, I respectfully pro-

test against the manner in which the proposed amendments to the constitution are set forth. Announcement No. 7 shows neither the wording of the original articles, which it is proposed to change, nor the proposed changes. While briefly summarized arguments pro and con are submitted, there is no means of ascertaining, from the announcement itself, what bearing the arguments have on the questions at issue. The voting slip shows the proposed new wording only.

Any member reading the new articles, by themselves, without referring to the present constitution (a copy of which he might not happen to have conveniently at hand) would naturally suppose them to be entirely unobjectionable; whereas if he were shown the originals and the proposed amendments side by side, he would at once be able to gage precisely the effect of the proposed changes.

The directors of the Institute appointed a committee to present to the members the pros and cons of the pending amendments. If the committee failed to make the case clear in such a matter as amendments to the constitution, a similar obscurity is to be reckoned as a danger in less fundamental cases. This is always one of the difficulties of the letter-ballot system.

* * *

The Copper Producers' Association was dissolved on Jan. 13. This was generally expected. Some of the remarks that have been made about its demise are amusing. It was never intended to be an altruistic organization, or one to be conducted merely for the benefit of the public. It was a certain expense to the copper producers, and when they saw that it was of no advantage to them it was merely common sense to discontinue it. As soon as certain of the producers resume their monthly reports we shall have regular returns of the smelters' production and the Government will report the exports. Except for the matter of stocks, the principal items necessary to show about how copper stands will be available.

BY THE WAY

The latest recruit to the ranks of safety-first publications is the *Anode*, got out by the Anaconda company and entirely up to the standard of all Anaconda work. In fact it is one of the best looking safety-first magazines that has come to this office. What counts for more than looks is the fact that it is full of good articles, brief, interesting, authoritative and to the point. We note short accounts of the progress of safety work in the mines, the railway, the reduction works, and the other departments of the Anaconda Copper Mining Company.

* * *

The Stock Exchange firm of A. A. Houseman & Co., in a recent market letter, writes as follows respecting some possible effects of the war:

> Under all its disabilities we dare say the world today is saving capital faster than before the war started. It was saving very little before. The trouble economically was that the world's expenditures had overrun its ability to save; hence the rise in the price of capital everywhere in the last few years. Nobody can predict with certainty what the economic effects of the war will be, but here are things to think about. The world obviously has been arrested in its rakish career. It has broken off suddenly with the habits of the spendthrift. New habits are forming, and they will continue long after all physical traces of war have disappeared.
>
> The war has caused 500,000,000 of people to begin to save even their potato peeling. It has caused 200,000,000 people in Russia to be sober, all at one time, a thing that never happened in this world before. It has caused you and your neighbor in this country to reduce household expenses and to stop spending money on unnecessary things. It has suddenly checked the waste of capital by individuals by corporations and by the government, for even the government is seized with a spirit of economy. Of course, there is much unemployment in consequence, and some of the readjustments are painful, but the economic effect will be wonderfully beneficial, and the ratio of productive to unproductive labor, in the economic sense, will be higher afterward.

We are very skeptical about the world accumulating capital faster than before the war started and also about the war being economically a good thing, but we are ready to agree that the new spirit of economy is an ameliorating condition in what is an extremely bad mess.

* * *

Uncle Sam is a good deal of an artist in some kind of sharp practice. Thus it appears that since the outbreak of the war, the Government has shipped nearly 200 tons of gold from Philadelphia to New York and bilked the railways out of the freight by sending it by parcel post instead of by express as formerly. The largest single shipment was 100 tons, for which the railroads had to furnish four special cars and haul them part of the way by special locomotives. The Postmaster General cackles over running his department at a profit, but the ways and means thereof look to us very much like downright cheating. Some one, we believe, has computed that Uncle Sam is skinning the railroads out of about $8,000,000 per annum in the parcel-post business.

* * *

The Gentleman Mucker

By Berton Braley

The gentleman mucker comes out from the East
In his nattiest college clothes,
With the legs of his trousers nicely creased
And the classiest sort of hose,
But he changes his tweeds for overalls
His coat for a flannel shirt
And down on a level he works like the devil,
Shoveling copper dirt!

For he is a gentleman mucker
Who's learning the miner's trade,
Who acts as an ore car trucker
And pushes it up the grade,
He has to sweat, you bet, to get
The wages that he is paid,
But he's learning a lot in his new employ—
The gentleman mucker's Quite Some Boy!

The day's work ends and the miners troop
Toward home or a near hotel,
And the gentleman mucker eats his soup
And his porterhouse steak as well,
Then he tumbles out of his flannel shirt
And his muddified overalls,
And away he goes in his evening clothes
Making a round of calls!

For he is a gentleman mucker
In the swellest of "happy duds,"
In his noblest bib and tucker
His shirt with its gleaming studs,
At night, all right, he's a handsome sight,
The gayest of gay young bloods!
The hostess' pet and the ladies' joy,
The gentleman mucker's Quite Some Boy!

The gentleman mucker learns the ropes
And he talks in the miners' slang,
Of "chutes" and "raises" and "sumps" and "stopes,"
Of mining he gets the hang,
And the first you know he's a man of fame
And boss of a mine or two,
And he digs no more in the copper ore
With the mucking job he's through!

But he's proud he was once a mucker
Who worked in the mine below,
This fellow who wouldn't tucker
But ever was on the go,
A man whose plan was "Sure I can,
If you'll give me half a show!"
A right good man in a good employ,
The gentleman mucker's QUITE SOME BOY!

PERSONALS

J. W. Mercer has just returned from six months in Ecuador.

H. V. Winchell expects to be in New York during February.

J. V. N. Dorr has gone to Denver to remain about a month on business.

Charles L. Lawton, of the Quincy Mining Co., has been visiting New York.

Dr. Eugene Haanel, director of mines of Canada, has been elected vice-president of the Faraday Society of England.

Samuel Hale has resigned as general manager of the Algoma Steel Co., Ltd., Sault Ste. Marie, Ont. There has been no appointment of a successor.

R. C. Canby has gone to Miami, Ariz., where he will be until February, in connection with the flotation case which is expected to come up for trial in Delaware this spring.

T. H. Jenks, of Denver, Colo., having completed some mining examinations in Arizona, is now engaged upon professional work at Blend, in the Cochiti District in New Mexico.

Dr. T. Poole Maynard of the association of Maynard-Carter-Simmons, geological, mining and civil engineers, is taking up his residence in Atlanta, Ga., and will have charge of the Atlanta office.

L. D. Ricketts has gone to Miami, Ariz., where he expects to remain until next summer, attending to the starting-up of the Inspiration mill and the new smelting works of the Anaconda company.

A. E. Borie has resigned as chairman of the board of directors of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., in order to devote his time to some other business. He remains a director of the company.

Hubert Merryweather, formerly with the Juragua Iron Mines Co., of Cuba, is now vice-president and general manager of the Bethlehem-Chile Iron Mines Co., operating the Tofo iron mines near Coquimbo, Chile.

Walter M. Rossberg, superintendent of the Timber Butte Milling Co., of Butte, Mont., has been visiting in New York. He is going to visit some of the zinc-smelting works in Oklahoma on his way home to Butte.

S. R. Guggenheim has been chosen president of the Braden Copper Co. and the Braden Copper Mines Co. in place of the late Barton Sewell. John K. McGowan has been elected a director in both companies to succeed Mr. Sewell.

P. E. Hart, late resident engineer of the Donada Ry. ropeway extension at Honda, Colombia, has left that position and returned to England, where he now holds a commission in the Royal Garrison Artillery. He expects to leave for the front soon.

Paul W. Meyers, formerly with L. H. Taylor, Jr., in Philadelphia, sailed from New York, Jan. 20, to take a position in the Cauca Valley, in Colombia, with the Colombia Exploration Syndicate of Philadelphia. His address is care Empress Hauseatic, Barranquilla, Colombia.

Henry D. Bolsinger, James A. Shinn and Thomas Mansfield left Central City, Colo., about seven weeks ago to visit the Nuevo Deloro mine, some 50 miles from Almos, Mexico. Nothing has been heard from them since they left Almos in December, and a search is now being made for them.

Forty-five men have enlisted at Cobalt, Ont., in Major Holland's automobile quick-firing gun battery, nearly all of whom are prospectors. The list includes many whose names are well known in mining circles since the early days of the Cobalt and Porcupine camps. Among them are Alex Gillies, "Doc." Dowsley and Alexander McIntyre.

Roswell H. Johnson and L. G. Huntley announce that they have opened an office in Pittsburgh, Penn., under the name of Johnson & Huntley, for undertaking examinations and reports on oil and gas properties. Professor Johnson is professor of geology, University of Pittsburgh. L. G. Huntley leaves the office of the Associated Geological Engineers at Pittsburgh.

A bequest of $3,000,000 to Oberlin College by Charles M. Hall, the distinguished electrochemist and manufacturer of aluminum, is announced. The bequest includes a $2,000,000 endowment to be used for any purpose, $500,000 to be used to build an auditorium, $100,000 for the auditorium's maintenance, $200,000 to be spent for campus improvements; all property in Oberlin owned by Dr. Hall, and a valuable art collection.

OBITUARY

Dr. William D. Crumbie died at his home in East Orange, N. J., Jan. 16, aged 60 years. He was born at Milburn, N. J., and graduated from the Columbia School of Mines. He devoted himself to metallurgical chemistry, and had been for 32 years in the New York Custom House, where his services as metallurgist and expert examiner were highly valued.

SOCIETIES

Technology Clubs, Associated—The third annual convention will be held at Pittsburgh, Feb. 19 and 20. Arrangements are in charge of the Pittsburgh Association.

Mackay School of Mines—The Nevada State Mining Laboratory has been made a department of this school at Reno. During 1914, 6533 Assays were made in this laboratory free of charge for prospectors and miners.

Colorado School of Mines—The short course for prospectors, heretofore mentioned, will be given at Golden, beginning Feb. 8, 1915, and continuing for three weeks. No fees will be charged for this course other than a nominal charge to cover the cost of supplies used, which should not exceed $3. The course is open to prospectors and others interested in the more intelligent prospecting of our mineral areas.

Colorado Metal Mining Association—The second annual convention was held at the Brown Palace Hotel, Denver, Jan. 11-13, the program shows a meeting devoted chiefly to reports of committees, and to the arrangement and division of the work for the ensuing year. The association was organized in Denver, Feb. 19, 1914, at which delegates from 29 metal mining counties were present. The objects are to foster and encourage the metal and rare-mineral mining industry and all its branches; to stimulate coöperation between the metal mining districts of Colorado; to aid in the development of the mineral resources of Colorado; and, generally, to further and promote all the mining interests of the state. The association maintains branches in each county.

Northwest Mining Convention—The meeting under the joint auspices of the Spokane Chamber of Commerce, Mining Men's Club and Spokane Engineering & Technical Association will take place Feb. 24-27, at the Hotel Spokane, Spokane, Wash. From every mine in Idaho, British Columbia, Montana, Oregon and Washington will be invited mineral displays, and every effort will be made to bring the investing public into touch with the owners of promising properties. H. H. Shallenberger is chairman of the committee in charge of the ore exhibition. The convention side of the event is being arranged by the Spokane Engineering & Technical Association. The Spokane chapters of the American Society of Civil Engineers and the American Institute of Electrical Engineers, and the Columbia Section of the American Institute of Mining Engineers each will have charge of a day's program at the convention. L. K. Armstrong, a mining engineer, is chairman of the convention program committee.

Michigan College of Mines—Some additions to the equipment of the ore dressing and metallurgy department have recently been made at this college. A machine for testing ores by flotation, of size and type generally used in experimental mills, and made by the Minerals Separation Co. has been loaned to the college. Another machine for testing by flotation is being constructed at the school, the blueprints having been furnished by the Inspiration Consolidated Copper Co. The electrolytic laboratory has been overhauled and placed in condition to demonstrate the latest methods. The crushing and grinding room has been fitted with a new "chipmunk" crusher, and a standard size Wilfley table has also been installed. The purchase of the new equipment was made possible through the gold recovered from ores treated at the College mill.

The extension lectures of the college, on "The Copper Industry in Michigan," will be given this year between Jan. 28 and Feb. 17, at Big Rapids, Adrian, Mt. Pleasant, Grand Rapids, Detroit, Monroe, Nashville, Plainwell, Otsego, Allegan, Wyandotte, Tecumseh, Powers, Escanaba and Iron Mountain, all in Michigan. These lectures, which are given by Professor Grant, of the mathematical department, are illustrated by slides showing the geology of the district, the underground workings, mills and smelters.

University of Illinois—The university has since 1907 maintained 10 research fellowships in the Engineering Experiment Station. These fellowships, for each of which there is an annual stipend of $500, are open to graduates of approved American and foreign universities and technical schools. Appointments to these fellowships are made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the master's degree will be granted. Not more than half of the time of the research fellows is required in connection with the work of the department to which they are assigned, the remainder of the time being available for graduate study. Nominations to fellowships, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the director of the station each year not later than Feb. 1. These nominations are made within the month of February by the station staff, subject to the approval of the faculty of the Graduate School and the president of the university. Appointments are made in March, and they take effect Sept. 1. Nominations to these fellowships are based upon the character, scholastic attainments and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following their undergraduate work. There are four vacancies to be filled this year.

Canadian Mining Institute—At a recent meeting of the Toronto Branch, President Lindsey gave some account of the condition of affairs of the Institute, and asked members not to forget that the Institute needs their assistance more than ever this year on account of conditions brought about by the war. Mr. Dowling gave some account of the situation in the Calgary oil field.

INDUSTRIAL NEWS

The Western Pipe & Steel Co. has just sold to the Round Mountain Mining Co. nine miles of riveted steel water pipe $\frac{5}{16}$-in. gage, average diameter 15 in. A small amount of this pipe was lap welded.

The Mesta Machine Co., of Pittsburgh, has recently acquired the rights from the Stumpf Una-Flow Engine Co., of Syracuse, N. Y., to build the Stumpf Una-Flow type of engine in the United States.

Joseph T. Ryerson & Son, of Chicago, is conducting a contest in which prizes will be awarded for the best suggestions for a name to cover the tool steels handled by this company. Details will be sent by it on request.

W. G. Swart, of Denver, Colo., has joined the Hardinge Conical Mill Co., in the capacity of consulting engineer in the West. His office is in the Foster Bldg., Denver, and he will assist users of the Hardinge mill in the proper selection and operation of their machines.

A new paste for making up pipe joints is being marketed by Chard & Howe, of New York. It is adapted to steam, oil, water, air, gas, and ammonia plants and piping; has three time the bulk of red lead, is not poisonous; and does not harden or dry out. A test was seen on a badly cut joint in which this paste stood 600-lb. pressure.

The Merrill Metallurgical Co. has recently secured a large contract for Merrill automatic sluicing slime filters from the Aurora Consolidated Mines Co., of Aurora, Nev. The equipment will include three 124-frame, 3 ft. by 4 ft. by 2½-in. filters of the most improved design, and will have a minimum capacity of 500 tons of slime per day.

The Erie Pump & Engine Works, of Erie, Penn., reports that it has recently been consolidated with the Northern Equipment Co. The new name is the Erie Pump & Equipment Co. John G. Pfadt, former president of the old works, is no longer connected in any way with the new concern John H. Dougherty is in charge of the designing of the pumps

The Orenstein-Arthur Koppel Co., of Koppel, Penn., has just perfected a new locomotive embodying two distinctly new features, a flexible diamond shaped trolley and a double truck, permitting the use of the car on track layouts where sharp curves are encountered. It can take a curve of even 12-ft. radius while hauling a train, without excessive power being required and without derailment.

The Westinghouse Electric & Manufacturing Co. has just issued a preliminary statement of a liberal plan covering sickness and accident relief, accident compensation and service pensions. The relief department is maintained by the employees by the payment of small monthly dues, but all dues are used for benefit payments, the company paying the operating expenses of the department. It also duplicates the employees' contributions for death benefits. The accident compensation plan covers total and partial disability and death. For total disability the company pays two-thirds wages during its entire duration; for partial disability it pays an amount equal to two-thirds of the reduction in earning power. The pension system provides for retirement at 70, and for those who are members of the relief department and have completed 20 years of continuous service are to be granted a pension of 1% of their average monthly wages during the last 10 years, for each year of continuous service, with a minimum of $20 per month and a maximum of $100. Widows' and dependent children's pensions are also provided for.

TRADE CATALOGS

Burd High Compression Ring Co., Rockford, Ill. Catalog. Directory of Piston Ring Sizes. 68 pp., illus., 4½x6½ inches.

The Neil & Smith Electric Tool Co., Cincinnati, Ohio. Catalog No. 4. Portable Electric Tools. Fifty-six pp., illus.; 9x6 inches.

The Armstrong Cork Co. has issued a booklet, "Permanent Fortifications," on the insulation of pipes against heat or cold with cork.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Penn. Bulletin 3002-A. Central Station Power in Coal Mines. 16 pp., illus., 6x9 inches.

Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill. Bulletin No. 34-K. Fuel Oil and Gas-Driven Compressors. 24 pp., illus., 6x9 inches.

The Lagonda Manufacturing Co., Springfield, Ohio, has just issued a new Bulletin Lagonda Boiler Tube Cleaners. Copies may be had upon request.

American Steam Gauge & Valve Mfg. Co., 19 North Market St., Boston, Mass. Booklet. Steam Boilers and Boiler Feed Water. Eight pp., 8x5 inches.

The Waterbury Co., 80 South St., New York, has issued a new catalog descriptive of their "Fiberclad" wire rope. This a wire rope of standard construction except that each strand is covered with tarred Russian marlin.

What is probably the most complete commercial publication devoted solely to centrifugal pumps is being distributed by the De Laval Steam Turbine Co., of Trenton, N. J. This book has 298 pages and over 300 illustrations.

The Western Electrical Co. issued its "Electrical Supply Year Book" in the shape of a veritable encyclopedia of 1216 pages. That a firm should find so voluminous a catalog necessary is a testimonial that renders any other unnecessary.

Goodyear Tire & Rubber Co., Akron, Ohio. Catalog. Mechanical Rubber Goods. 109 pp., illus., 6x9 inches. Other Goodyear booklets received recently are devoted respectively to: Flat Conveyor Belts; Mine Equipment; Balata Belting and Kantkink Flexible Metallic Hose.

"Cochrane Multiport Valves"—A booklet of 72 pages, just issued by the Harrison Safety Boiler Works, Philadelphia, Penn., describing the multiport valves introduced by that company for back pressure, relief and vacuum service, flow service in connection with mixed flow turbines, and check-valve service with bleeder or extraction turbines. The essential idea of the multiport valve is the use of a number of small disks instead of one large disk, in order to secure greater safety, quietness, lightness of moving parts, and tightness.

Connersville Blower Co., Connersville, Ind., Catalog No. 16. Connersville Cycloidal Pumps. 48 pp., illus., 9x12 inches. This catalog, prefaced by a short account of "More than 20 Years of Successful Manufacturing," reviewing the steady growth of the Connersville Blower Co.'s business, deals especially with this company's line of two-impeller cycloidal rotary pumps, used in power houses for circulating pumps, in irrigation work and other low-lift service. The catalog is handsomely illustrated with half-tone illustrations of actual installations, and diagrams both of two-lobe and three-lobe impellers, the latter type being adapted to higher lifts.

NEW PATENTS

[illegible] obtained from "The Engineering and Mining Journal" at 25c. each. British [illegible]

ALKALI-SILICO-ALUMINATE—Method of Making Alkali-Silico-Aluminate. Alfred Hutchinson Cowles, Sewaren, N. J., assignor to The Electric Smelting & Aluminum Co., Sewaren, N. J. (U. S. No. [illegible])

ALKALI METALS—[illegible] of the Alkali Metals for the Obtainment of Useful Products Therefrom. James Alfred Kendall, Streatham, London, England. (U. S. No. [illegible])

AMALGAMATING PROCESS. [illegible], Darby, Penn., assignor to Russell Thayer, Philadelphia, Penn. (U. S. No. 1,124,482; Jan. 12, 1915.)

AMALGAMATOR. [illegible] and Charles C. Glidden, Birmingham, Ala. (U. S. No. 1,123,116; Dec. 29, 1914.)

BORE HOLES—Apparatus for Measuring the Inclination of Bore Holes and Making a Photographic Record Thereof. Hermanus Mattheus Smitt, Utrecht, Netherlands. (U. S. No. 1,124,668; Jan. 5, 1915.)

CAST IRON—Process of Treating Cast Iron. [illegible] E. Johnson, [illegible] No. [illegible] of 1914.)

CEMENT—Process of Making Hydraulic Cement. William R. Warren, New York, N. Y. (U. S. No. 1,123,964; Jan. 5, 1915.)

CHLORIDIZING ROASTING OF ORES, Method for. Arthur [illegible], Sweden. (U. S. No. 1,124,519; Jan. 12, 1915.)

CONCENTRATION—Adjustable Swinging Spray for Mineral-Washing. Wilton E. Darrow, Sutter Creek, Calif. U. S. No. 1,123,254; Jan. 5. 1915.)

CONDUIT SYSTEM for Mines. Louis Zwiesler, Kansas City, Mo. (U. S. No. 1,120,880; Dec. 15, 1914.)

CONVERTER. [illegible], San Francisco, Calif. (U. S. No. 1,123,868; Jan. 5, 1915.)

COPPER—Process of Extracting Copper from Ores. Noak Victor Hybinette, Christiania, Norway. (U. S. No. 1,122,759; Dec. 29, 1914.)

COPPER—Process of Hardening and Welding Copper. [illegible] Bittner, Stafford, Kan. (U. S. No. [illegible]; Dec. [illegible], 1914.)

CRUCIBLE FURNACE. Grenville Mellen, Mount Vernon, N. Y. Filed Feb. 23, 1911. (U. S. No. 1,120,732; Dec. 15, 1914.)

CRUSHER. [illegible] F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. [illegible]; Dec. [illegible], 1914.)

CRUSHING MILL. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. [illegible]; Dec. 29, 1914.)

CYANAMIDE—Process of Producing Calcium Cyanamide. Dettifoss Power Co., Ltd., and J. H. Lindholm, London, Eng. (Brit. No. [illegible] of 1914.)

CYANIDING—Precipitant for Recovering Metals from Solutions. Galen Howell Clevenger, Palo Alto, Calif., assignor to Merrill Metallurgical Co. (U. S. No. 1,123,685; Jan. 5, 1915.)

CYANIDING—Precipitating Metals from Solutions. Louis David Mills, Johannesburg, Transvaal, South Africa, assignor to Merrill Metallurgical Co. (U. S. No. 1,123,778; Jan. 5, 1915.)

DREDGE. Benjamin Bernard, Seattle, Wash. (U. S. No. [illegible])

[illegible] R. [illegible] and Vernon, [illegible] (U. S. No. [illegible]; Jan. 5, 1915.)

DRILL. Albert Scott and Joseph George Grattan, Van[illegible]

DRILL—Fluid-Operated Percussive Tool. Caid H. Peck, Waverly, N. Y., assignor to Ingersoll-Rand Co., Jersey City, N. J. [illegible] (U. S. No. [illegible]; Dec. 29, 1914.)

DRILL SHARPENER. Theodore Hiram Proske, Denver, [illegible]

[illegible] Combined Drill-Bit-Holding Chuck and Front [illegible] Rock-Drilling Engines. John George Ley[illegible] (U. S. No. [illegible])

[illegible] Moines, Iowa, assignor of [illegible] (U. S. No. [illegible])

DRY SEPARATOR and Concentrator. Fritz Henry Gordon, Portland [illegible]

[illegible]

[illegible]

[illegible] York, [illegible]

[illegible]

[illegible]

[illegible] Bacon, [illegible]

[illegible] Seattle, Wash., [illegible] Seattle, Wash. (U. S. No. [illegible])

GOLD-SAVING MACHINE. Frank A. Monroe, Jamestown, N. Y. (U. S. No. [illegible]; Jan. 12, 1915.)

HARDENING IRON AND STEEL, Method of. Eli Sweet, Binghamton, N. Y., assignor to Joseph W. Boyd, Denver, Colo. (U. S. No. [illegible]; Dec. 15, 1914.)

HOT-BLAST SYSTEM. Albert S. Hanson, Billings, Mont. (U. S. No. [illegible]; Jan. 5, 1915.)

MAGNETIC QUALITIES OF ALLOYS—Process for Improving the Magnetic Qualities of a Magnetic Body. Robert Abbott Hadfield, Sheffield, England. (U. S. No. 1,122,385; Dec. 29. 1914.)

MANGANESE STEEL—Heat Treatment of Manganese Steel. [illegible] Potter, Pittsburgh, Penn. (U. S. No. [illegible]; Dec. 29, 1914.)

MELTING FURNACE. Pietro Vergnani, Somerville, Mass. (U. S. No. [illegible]; Dec. 22, 1914.)

MINE CAR—Dumping Mine Car. Charles Layton, Mount Pleasant, Penn. (U. S. No. 1,124,147; Jan. 5, 1915.)

NICKEL-BEARING ORE—Improved Process of Extracting Cobalt or Nickel and Copper from Cobalt- or Nickel-Bearing Copper [illegible] de Burlet, Hoboken, Belgium. (Brit. No. [illegible] of 1914.)

NODULIZING ORES. Niels S. Borch, Copenhagen, Denmark. (U. S. No. 1,123,672; Jan. 5, 1915.)

ORE CAR. William S. Atwood, Montreal, Que., assignor to Canadian Car & Foundry Co., Ltd., Montreal, Canada. (U S. No. 1,123,655; Jan. 5, 1915.)

OXYACETYLENE CUTTING TORCH. Prior F. Willis, St. Louis, Mo. (U. S. No. 1,119,917; Dec. 8, 1914.)

PHOSPHATES—Method of Drying Superphosphates and the Like. Thomas Leopold Willson and Maximilian Mattheus Haff, Ottawa, Ont., assignors, by direct and mesne assignments, to Southern Ivestment Co. of Canada, Ltd., Montreal, Canada. (U. S. No. 1,122,183; Dec. 22, 1914.)

PIGMENTS—Process of Making Pigments. Clifford D. Holley, St. Louis, Mo., assignor to Acme White Lead & Color Works, Detroit, Mich. (U. S. No. [illegible]; Jan. 5, 1915.)

PLACER MINING—Separator and Classifier for Placer Material, Ground Ore, and the Like. Edwin B. Goodwin, Boulder, Colo. (U. S. No. 1,122,908; Dec. 29, 1914.)

PLACER-MINING MACHINE. Arthur E. Custer, Salt Lake City, Utah. (U. S. No. 1,121,985; Dec. 22, 1914.)

POTASSIUM AND ALUMINUM, Process of Producing Soluble Salts of. Melville F. Coolbaugh and Elwyn H. Quinney, Rapid City, S. D. (U. S. No. 1,125,007; Jan. 12, 1915.)

REFRACTORY UTENSILS—Method of Manufacturing Utensils and the Like from the Oxides of the Rare Earths, Thorium Oxide, Zirconium Oxide and the Like. Hans Arnold, Charlottenburg, Germany, assignor to The Firm of Dr. O. Knöfler & Co., Piotzensee, near Berlin, Germany. (U. S. Nos. [illegible]9 and 1,121,890; Dec. 22, 1914.)

ROASTING FURNACES—Improvements in Rabble Arms for Roasting Furnaces. H. H. Stout, New York. (Brit. No. 15,643 of 1914.)

SAFETY DEVICE for Muffles, Cupolas, and other Furnaces. [illegible], Vienna, Austria-Hungary. (U. S. No. 1,121,969; Dec. 22, 1914.)

SCREEN—Pulsating Screen for Pulp and the Like. Theodor Qviller, Lilleströmmen, near Christiania, Norway. (U. S. No. [illegible]; Jan. 12, 1915.)

SLAG STEAM GENERATOR. Charles H. Smoot, New York, N. Y., assignor to Slag Steam Generator Co., New York, N. Y. (U. S. No. [illegible]; Dec. 22, 1914.)

SMELTER GASES—Apparatus for Collecting Solids Suspended in Gases. Willard E. Playter, Collinsville, Ill. (U. S. No. [illegible]; Nov. 24, 1914.)

STAMP MILLING—Ore-Feeder for Stamp-Mills and the Like. Edward Henry Moyle, Los Angeles, Calif. (U. S. No [illegible])

STAMP MILLS—[illegible] for Stamp Mills. Edward Henry Moyle, Los Angeles, Calif. (U. S. Nos. 1,121,117 and 1,121,118; [illegible])

STEEL—Improvements in or Relating to Converters for Use in Steel Making. R. Hyde and J. R. Hyde, Sheffield, Eng. (Brit. No. 16,653 of 1913.)

STEEL—Method for Hardening Steel. Gottlieb Wuelser, [illegible] (U. S. No. 1,118,723; Nov. 24, 1914.)

STEEL—[illegible] of Steel. William R. Walker, New York, N. Y. (U. S. No. 13,861, reissue; Jan. 5, 1915.)

STEEL—[illegible] of Steel Articles. Henry M. Howe, [illegible], N. Y., assignor to Taylor-Wharton Iron & Steel Co., High Bridge, N. J. (U. S. No. [illegible]; Dec. 29, 1914.)

STEEL CASTINGS—Method of Making Sound Steel Castings. [illegible], Steelton, Penn. (U. S. No. 1,116,-[illegible]; Nov. [illegible], 1914.)

TIN—[illegible] Pure Oxide of Tin. Gustav Spitz, [illegible], Austria-Hungary, assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. [illegible]; Dec. 1, 1914.)

TINNING OR GALVANIZING MACHINES, Feed Mechanism for. [illegible], New Castle, Penn., assignor to American Sheet & Tin Plate Co., Pittsburgh, Penn. (U. S. No. [illegible]; Nov. 17, 1914.)

TUBE MILL. Charles F. Spaulding, Denver, Colo., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. [illegible]; Dec. 8, 1914.)

WELDING—Method of and Apparatus for Electric Welding. [illegible], Cleveland, Ohio. (U. S. No. [illegible]; Dec. [illegible], 1914.)

WELDING—Oxyacetylene Welding Torch. Prior F. Willis, St. Louis, Mo. (U. S. No. 1,119,916; Dec. 8, 1914.)

ZINC BLENDE—Dry Treatment of Ores. Wilhelm Buddeus, Charlottenburg, Germany. (U. S. No. 1,121,226; Dec. 15, 1914.)

Editorial Correspondence

SAN FRANCISCO—Jan. 13

Oil Pipe Lines operated by the five largest petroleum carriers in the state have been declared by the state railroad commission to be common carriers and public utilities subject to the provisions of the public-utilities act. These companies are the Standard Oil Co., Associated Oil Co., Producers' Transportation Co., Associated Pipeline Co. and General Pipeline Co. of California. They control 95% of the production of California.

Protection of Oil Lands menaced by water is contemplated by F. McN. Hamilton, state mineralogist, in a bill which has been submitted to the public for criticism or suggestion before introduction in the present legislature. A public meeting will be held at the state capitol, Jan. 15, for discussion of the subject. The Mining Bureau has issued advance chapters upon this subject, taken from the oil bulletin which is practically ready for publication. In investigation of the petroleum industry, Mr. McLaughlin, in charge of that department of the bureau, has given a great deal of time to the study of the subject of water infiltration and to discussion of remedies.

Riparian Owners' rights to the waters of Wolf Creek flowing in Nevada and Yuba Counties have been decided by the superior court of Yuba County in an action brought by the E. Clemens Horst Co., hop growers in the Wheatland region, against the New Blue Point Mining Co. operating at Smartsville. Other complainants brought similar suits. Judge McDaniels ruled that the water for power purposes brought from South Yuba River and allowed to escape into Wolf Creek is lawfully appropriated by the mining company at the intake of its ditch, together with the major portion of the water in the stream, and that it may be carried out of the Wolf Creek watershed, as it is not a part of the natural flow of the stream.

DENVER—Jan. 14

Resignations of about 25 salaried office men of the Colorado Fuel & Iron Co., at Pueblo, were required on Jan. 2. No public explanation has been vouchsafed for this action but it is assumed to have some connection with the payroll padding discovered last spring.

The Cresson find had scarcely become generally known when there appeared the ubiquitous counterclaim for ownership. Whether the claim of H. W. Keiser and wife, of Denver, is valid or based upon bluff, remains to be determined, but these persons state that in 1913 they grubstaked a prospector and became partners with him in the location of a fractional area contiguous to the Cresson claims. This ground was filed upon and surveyed for patent during the early days of the district but was permitted to revert to public domain by failure of the original owners to proceed with patent proceedings. Upon statements of Edward P. Arthur, Jr., mining surveyor, of Cripple Creek, these new claimants say that the bonanza is within the Jewell location. Possession of a deposit like this, worth millions of dollars, will be fought for and any legal proceedings will be followed with interest. The Cresson management declares the affair is pure blackmail and that their strike is well within their property lines. If the principle of apex rights be applied in this instance, the plaintiffs have provided themselves a nice task in discovering the outcrop of this pocket's vein and in tracing it, by sinking, the 1900 ft. to the chamber in question.

BUTTE—Jan. 14

Washoe Output during 1914, according to latest reports, was approximately 225,000,000 lb. of copper as against 272,000,000 lb. in 1913. Predictions are rife that with the perfection of the leaching and oil-flotation processes, blast furnaces will disappear and that the future will witness a smokeless reduction of copper and other ores.

SALT LAKE CITY—Jan. 14

Phosphate deposit locations made in good faith under the placer laws are validated by a bill recently passed by Congress. This will enable the Department of the Interior to issue patent on phosphate claims in northern Utah and southern Idaho entered as placer. Subsequent to entry these were held eligible only under the lode laws. Before Dec., 1912, when the Department decided that phosphate entries could be made only under lode laws, many entries were made in good faith as placer or association placer claims, and these will be validated if the necessary assessment work has been performed.

SEATTLE—Jan. 13

The Broad Pass section of Alaska which is attracting so much attention at this time is not a new field. In fact, the property which Wells Bros. sold to the Guggenheims, through Thomas Aitken, was discovered at least eight years ago and some work done on it. The locators were Curley Hickman and a partner, the former now being a resident of Cordova. They were in the Broad Pass country and located the claims in 1906, and after doing the assessment work abandoned them because of their remoteness from transportation. Later the claims were relocated by Wells Bros. and with the prospect of transportation the claims have acquired considerable value. Notwithstanding there have been some adverse reports coming out from that section, the Broad Pass country is attracting attention in all parts of the North and of the Pacific Coast from prospectors and investors. At Knik there are known to be over 200 persons waiting for conditions favorable for travel so that they may go to look over the ground with a view to investing in some of the properties already located. Many are waiting at Valdez to start for the district and several parties have already left from the Fairbanks end. So far no high-grade finds have been reported, the claims located covering immense ledges of low-grade ore. Most of these ores are base, but with transportation at a reasonable cost, which it is thought the Government railroad will supply, these properties can be operated, it is claimed, on a large scale at extremely low cost. The report is given general belief that the railroad commission in making its report on the route for the proposed Government road in Alaska had already determined by an investigation of the Broad Pass country that a road tapping that district and the coal fields would pay for itself in a short time on account of the coal and ore that would be handled.

SPOKANE—Jan. 13

Inland Empire mining companies paid $7,493,171 to their stockholders in 1914, as given by their official statements, or $987,017 in excess of the disbursements in 1913, the best previous record, according to a compilation by James A. Duff, mining editor of the "Spokane Spokesman-Review." The most remarkable feature is the great increase in net profits of the Hercules, which, according to one owner, reached a little more than $3,000,000 for the year. This property eclipsed all previous records and takes first rank among mines of the Northwest. The next record is that of the Stewart, which made an increase of $371,541 in disbursements over the previous year. Bunker Hill & Sullivan also showed a material increase, having disbursed 25c. per share each month to its stockholders, or $3 for the year. Canadian Consolidated showed a gain of $2661. These are the only companies to pay more than in 1913, and the others, with the exception of Caledonia and Kendall which were not among the operating properties in that year, paid less. British Columbia Copper, Knob Hill, Le Roi No. 2, Snowstorm and Success mines which paid in 1913, disbursed nothing in 1914. Granby reduced its payments $1[illegible]1,061, Federal $120,00, Hecla $100,000, Hedley $20,000, International Coal & Coke $90,000, and Standard Silver Lead $175,000. The reports show that the copper companies were the hardest hit, and this reflected with particular severity on the properties in British Columbia, even on the silver-lead mines, as nearly all the smelters were closed down for several months, necessitating suspension of mining operations also. Canadian Consolidated is the only exception. British Columbia mines paid $2,611,219 to their stockholders in 1913, but last year the disbursements amounted to but $1,752,866, and it is estimated that earnings, including both dividends and the amounts diverted to the surplus and sinking funds, did not exceed $3,000,000. Mines of the Coeur d'Alenes paid $5,740,304 in 1914, as against $3,894,937 in 1913. Most of the earnings were devoted to dividend payments and the best figures obtainable indicate that the entire profits will not exceed $8,000,000 for the Coeur d'Alenes and British Columbia together.

SILVER CITY—Jan. 14

The Mogollon telephone exchange has just been installed and put into service. There is much snow in the mountains and a hard spring is anticipated. Transportation conditions are better and fuel oil and supplies are now going in. Bullion shipments are slight. The Mogollon saw mill which has supplied most of mine and mill timbers for the last 25 years has been sold by Harry Herman to Frank Kelly. At the Ernestine a more modern laboratory is being erected and rumor has it a new shaft will soon be started. The company continues to operate despite the shortage of fuel oil in camp. E. A. Wayne has resigned as manager and the new manager has not been selected. Ex-Postmaster Frank Hitchcock, president of the company, is still on ground. The Socorro shipments from the Pacific mine during the month averaged $15 to $20 per ton. The company is blocking out ore in the Johnson mine. The Enterprise Mining Co. has closed down for lack of oil and supplies. The Oaks is pushing development work on the Eberle, McKinley and Admiral Dewey tunnels and the shaft on Johnson 7.

DULUTH—Jan. 16

The Suit of the State of Minnesota vs. the White Iron Lake Mining Co., et al, as to the ownership of iron ore under Longyear Lake on the Mesabi range, has reached a conclusion. The supreme court held that the state has no ownership, in a proprietary sense, of the ore removed from under the lake bed, but that it has a soverign right of control over the waters of the lake and can enjoin interference with the lake bed below low-water mark.

In The Niles Land Co. suit against the Oliver Iron Mining Co. and the Chemung Iron Co., Federal Judge W. F. Booth in Minneapolis has by his decision established a precedent as regards compulsory mining under the terms of leases. The Niles Land Co., fee owners, brought suit to cancel a lease held by the Chemung Co. and subleased to the Oliver, alleging that the defendant companies had refused to mine the property, although paying all royalties due and otherwise keeping lease agreements. The court decides that a lease does not necessarily contemplate actual mining operations at or within any stated period, and that the lessor's acceptance of annual minimum royalty payments acknowledges his acquiescence in the manner in which the lease terms are being complied with.

CHICAGO—Jan. 16

The Cuyuna range, as indicated by recent events, is to have an independent miner and shipper of ore within the next year or two, in the Hill Mines Co., which will begin operations about the first of March, at the Hillcrest mine in Sec. 9, T. 46, R. 29, Ironton, Minn. The orebody on this property was discovered by the C. M. Hill Lumber Co., of Saginaw, Mich., in the early days of exploration on the range, and though reported to be one of the best and cleanest orebodies in the district, the owners of the lease have preferred to allow it to remain idle until now. It is intended to develop it as an openpit, and at the commencement of operations the upper, sandy part of the overburden will be removed with hydraulic giants and centrifugal sand pumps. This method of stripping, as will be recalled, was used recently with considerable success at the Rowe mine at Riverton, also on the Cuyuna range. The same method has also been used, of course, for some time in the phosphate fields of Florida. The operation at the Hillcrest will eventually include a cleanup of the top of the ore with steam shovels, and the mining of the shallower ore in the same way. Wilbur Van Evera, Virginia, Minn., will have charge of the operations.

HOUGHTON—Jan. 16

Rock Tonnage from the copper mines of the Lake Superior district indicates a remarkable efficiency on the part of the underground forces of all the properties. The following figures are unofficial, but they are accurate averages of the daily tonnages from all of the mines of the district thus far during January: Baltic 1400, Trimountain 1300, Champion 2700, making a total of 5400 for Copper Range Consolidated; Victoria 300, Mohawk 2500, Allouez 1600, Isle Royale 2000, the Kearsarges and Old Osceola 3800, Wolverine 1700, Centennial 700, Mass Consolidated 900, Superior 700, Calumet & Hecla 8600, Quincy 4200. This gives a total daily average of 32,400. Assuming 14 lb. of refined copper to the ton the daily output of copper becomes 453,600 lb. The mines average 21 days' work a month.

IRON RIVER—Jan. 16

A Better Feeling now prevails in the Iron River district since orders were received by the management of the Munro Iron Mining Co. to resume operations on Feb. 1. The company, which is a subsidiary of the Rogers-Brown Ore Co., owns the Rogers, Chicagon and Hiawatha mines. The Rogers and Chicagon stopped mining in the fall, while the shaft at the Hiawatha had not been bottomed when work there ceased at the same time. This work will be taken up where it was left off when the shut-down notice arrived. General Manager G. L. Woodworth states that many of the old hands are still in Iron River and their places will be held open for them until the first of the month. Employment will be given to several hundred men. Most of the ore which the Munro company mines goes to the Rogers-Brown furnaces in the East. It is reported that several other mines in the Iron River field are to be reopened at an early date but the managements have given out nothing definite as yet. The Reserve Mining Co., which has operated its Buckeye mine only five days a week for several months past, is now working full time and the force has been increased. The company has not received orders for ore for 1915 delivery but believes that the inquiries will soon be coming in and desires to be prepared to take care of them.

PULASKI, VA.—Jan. 16

Iron and Zinc deposits in the New River-Cripple Creek section are receiving attention again and there is a prospect of an important revival in that historic mining region soon. Recently zinc ore has been found in connection with the iron mines of the Ivanhoe Furnace Co., at Ivanhoe, and experiments with the S. L. Boggs washing process to concentrate the iron and zinc ores are being made. It is assumed that the furnace, which is controlled by Pittsburgh interests, is planning to resume operations. The deposit of zinc-sulphide ore at Allisonia, owned by Messrs. Forney and Caldwell, is being developed and it is reported that the ore which is exposed in the bed of New River has been found to extend to both sides of the river in interesting amounts. The ore is a finely intercrystallized mixture of iron and zinc sulphides replacing limestone and its economic treatment is considered difficult by any of the usual methods. Experiments with electrostatic treatment and with oil flotation are being made. An old mine on the south side of the river here was extensively worked for lead during the war. It is apparently an extension of the same formation now being explored in the river bed and north of the river. The same people have developed an important deposit of iron ore adjoining the old R. D. Woods iron mine about a mile north of the river at Allisonia.

TORONTO—Jan. 16

Total Dividends and bonuses paid by mining companies in Cobalt and Porcupine during 1914 amounted to $8,049,810, while the dividends paid since the inception of these two camps are $60,365,285 to date. The disbursements for 1914 are about $1,000,000 less than for the preceding year. The largest single contributor is Nipissing which has paid $12,240,000 to date. Of dividends for the year the Porcupine district contributed $1,250,000 from the Hollinger and Porcupine Crown; the balance came from Cobalt. During the year Buffalo, Coniagas, Crown Reserve, Cobalt Townsite, La Rose, Nipissing, Hudson Bay and Trethewey paid decreased dividends while Cobalt Lake, Caribou Cobalt, and Seneca Superior paid increased dividends.

The Nickel Agitation has quieted down since the last statement on the subject was made by the Canadian government, the public being generally disposed to accept the view that if the steps already taken are regarded as satisfactory by the British government there is no need for further action to prevent nickel shipments from reaching Germany. The propaganda is still being continued by a few sensational and ultra-protectionist journals, but with little success, since no important public body has taken up the question. At a recent meeting of the Sudbury Board of Trade resolutions were adopted in favor of refining nickel in Canada "if the same is economically practicable and can be done without injury to Canadian trade," but at the same time the Board declared that there was no reason for believing that the product of Canadian nickel-matte was reaching Germany via the United States since the beginning of the war, and placed itself on record against an export duty without first making a thorough investigation "as this Board of Trade and this community do not wish large industries, such as the Canadian Copper Co. and the Mond Nickel Co., jeopardized by misguided patriotism or rival interests.

Hollinger stock has experienced a rapid rise during the past few weeks. This has been interpreted as an indication that the dividend rate would be increased and this increase was authorized at a meeting of the directors which was held in Toronto, Jan. 14. The previous rate was 3% and the new rate will be 4% for each 28-day period, making a total of 52% a year. This new rate will call for the distribution of $120,000 for each period, but with the new milling equipment rapidly nearing completion, the mine should have no difficulty in earning the dividend. The new power station, which is being erected by the Canadian Mines & Finance Co., will have its capacity still further increased. One Fraser & Chalmers, and two Nordberg machines are already installed, and in operation, while another Nordberg machine is being erected. Each of these compressors has a capacity of 5000 cu.ft. of free air per min., and the new plant will be used as a central distributing station for the Hollinger, Acme, and Miller-Middleton which are all controlled by the Canadian Mines and Finance Co. It is thought in some quarters that these three properties will eventually be merged, and as the development work on the Acme and Miller-Middleton progresses, the capacity of the Hollinger mill will be gradually enlarged until a total crushing capacity of 3000 tons a day is reached.

The North Bay discovery of a precious-metal and radium deposit on the basis of which application was recently made for the Ontario government bounty of $25,000 offered for the discovery of commercial bodies of radium ores, exhibits curious features. A Buffalo chemist who received some of the ore gave a return of 6% molybdenum, 25% graphite, 17% copper, 56 dwt. of platinum, 43 dwt. of gold, 104 oz. of silver and small amounts of zinc and nickel. In addition it was stated that the ore was highly radioactive. It appears, however, that when the chemist went to North Bay to interview the owners of the claims, he was more anxious to sell stock in an electric furnace which he was promoting, than he was to treat any of the ore. One assay of $4.60 in platinum has been reported by a reliable assayer, but the majority of the samples, some of which were sent to Ledoux, showed no platinum, about 20c. in gold and small amounts of silver.

EL PASO—Jan. 14

At Santa Eulalia, Chihuahua, the San Toy, the Chihuahua Mining Co., the Potosi Mining Co. and the Buena Tierra are operating with full forces, and the output of the camp is probably about 75% of normal. The Guggenheim properties there are not operating at present, and so far as known they will not resume for some time. There are several smaller properties doing some work, but the four mentioned are the most important.

Among Outside Mines the Dolores is practically closed, since the district is too far from the railroad for supplies to be delivered regularly, and only a few men are being kept at work. The Republica, one of the heavy producers before the revolution, has been closed for many months, as it also is too far from any base of supplies for present operation. The Yoquivo is being operated with about normal force producing the usual quota of gold-silver bullion. The Virginia is operating a high-grade copper mine in the vicinity of Yoquivo and is shipping copper ore to Terrazas. At Batopilas, mines are operating and both mills are running, notwithstanding that they are farther from the railroad than any of those just mentioned.

At Parral, the Alvarado Mining Co. is operating at full capacity, and is turning out both bullion and concentrates. This company has had some trouble in keeping a supply of cyanide on hand for the 500-ton mill, and there has been some delay on account of fuel, but little time was lost during the year. Practically all the other large properties in Parral are temporarily closed.

At Santa Barbara, the Tecolotes mine is being pumped out, and active operations will be resumed in a short time. It was reported some time ago that the 1000-ton mill of this company had been seriously damaged by fire, but the damage proved to be comparatively light. At present, only the zinc plant in which the zinc concentrates are magnetically treated is being operated. Some little development work is being done on the Cabrestante mine in Santa Barbara, and the other larger properties are closed. El Rayo, located about 15 miles southwest of Santa Barbara, is operating with full force, and preparations are being made to increase the tonnage of the mill and cyanide plant to 300 tons per day.

The Terrazas smelting plant is closed at present, but is receiving some ores, and will probably resume in a short time. It is reported that the government has taken hold of the plant at Santa Rosalia and is preparing to operate it on ores from the many confiscated properties in the state.

GUADALAJARA—Jan. 2

Irritation exists here over the way Mexican news is garbled or actually "faked" in the United States newspapers. In the New York "Tribune" of Nov. 30, one can see the statement: "One thousand men in killed and wounded and 20 cannon captured by the enemy is the cost to Villa's army of the latest attempt by Gen. Felipe Angeles to wrest Guadalajara from Carranza control." As a matter of fact there was no fighting between the Carranza and Villa factions in or near the city of Guadalajara and not a shot fired near enough to be heard there. On the approach of the Villa forces the Carranza element left hurriedly in the direction of the Pacific Coast, and the city was abandoned completely by the Carrancistas two days before Villa and his troops arrived, being policed meanwhile by a special guard hired by the business and better social elements. Reports to the State Department are understood to have been equally misleading.

TORREON—Dec. 21

The Situation Is Still Mixed down here. It would appear that in view of Villa's personality and the way things are turning out he made a mistake in letting the convention deliberate so long. He rather swapped horses in crossing a stream; that is, dropped his fighting policy, his scheme of hewing his way through to the City and issuing his terms there, for a policy of conciliating, placating, and uniting all factions in his favor or in favor of the convention. This has introduced new elements and new factors into the scheme, many of them not so sympathetic with him as they might be, and this is bound to result in complications. If he had fought his way right down the line, as he was fully prepared and equipped to do, there is no doubt that he would be really stronger than he is today. Events prove that the Carranza forces were absolutely unable to resist his advance, and in spite of the newspaper talk, there was not a single combat between Aguas and Mexico, since the Carranza forces would not face Villa. There was a little fighting at Pachuca, and none in Guadalajara. Now Villa has united with him in the government a lot of people from the West Coast, together with the Zapatistas and others, and unless the character of these men has changed it is hard to see how everyone is going to pull together in harmony. While it looks all right on the surface, and many people are figuring that although Zapata will buck sooner or later, Villa is strong enough to eliminate him, the fact remains that in such elimination the other inharmonious elements are likely to bob up again. Villa is in the position of a man who starts up a prospect, sees it grow into a mine, and then into a much larger proposition, where it demands many aids in the shape of superintendents and foremen. He handles it all right up to a certain point, where his knowledge of details and his personality dominate. When the work expands, however, and he has to trust his aids to handle the different departments without personal supervision, the test comes. So now the question of intervention and nonintervention would appear to depend upon the way in which Villa handles the country when his convention dominates it entirely; and it is certainly true that foreigners are not a bit optimistic; although they are glad to see the Carrancistas go, as are a large part of the Mexicans, they are doubtful whether peace and harmony are going to reign after the election. There are too many men making money out of the trouble to allow the trouble to stop short, unless other means of getting money are substituted, and if the people with property are pressed too hard, trouble is bound to come sooner or later. Everyone is hoping that they will get together and that peace will come; but if Villa is not the man to handle it, if he cannot hold the different factions together, irrespective of who is elected president, then everyone is in for it again some day and one not far distant either. It is surprising how many Mexicans have come around to the conclusion that intervention is the only way of bringing peace.

LA LIBERTAD, CHONTALES, NICARAGUA—Dec. 15

The Babilonia Mines, Ltd., one of the largest operators of the district, has been forced to stop construction work on the new mill, due to the financial stringency following the war. The new slime plant, which began operations last June, was running on the slime bank from the old mill. There is about a year's supply of this material on hand, averaging $10 per ton. The drainage tunnel to the shaft is practically completed and the cornish pumps are being placed in position. The new gas engines operating on producer gas made from charcoal have been a great success, giving ample power with little attention and few repairs. Construction work on the new cyanide plant for the Javali mine is under way. Part of the machinery is on the ground and the rest will arrive soon. This mill will have a capacity of 150 tons. The grinding is to be done with Holman pneumatic stamps followed by a Hardinge mill. The sands will be leached and the slimes agitated by Dorr agitators. The continuous decantation process will be used to separate the slime from the pregnant solution. The Esmeralda mine is still running but at a reduced capacity while the San Juan has been forced to shut down. Supplies are difficult to secure at present, especially cyanide. A Wilfley table has been installed at the Escandalo mine and is giving good results. Another will be put up at the Cedro. The great drawback to concentration is the high price of freight, $76 per ton, to the American smelters.

The Mining News

ALABAMA

GULF STATES STEEL CO. (Gadsden)—Rolling mill put in operation. Large orders for wire and nails reported.

OLD SPENCER dolomite quarry at Boyles being put in shape for production. Product said to be best quality of flux in district. Walter Moore and associates interested.

VALLEY VIEW NO. 2 (Birmingham)—This mine, also known as the Frank White lease, has begun shipping iron ore to Sloss-Sheffield Steel & Iron furnaces. Gordon Robinson operating mine.

ALASKA

GRANITE GOLD (Valdez)—Contract said to be closed with Hunt, Mirk Co., of Seattle, for entire power plant equipment and transmission line.

MOTHER LODE COPPER (Shushanna Junction)—Ore reported struck in north drift and in raise, both new bodies. Shipped 250 tons to Cordova, Jan. 15.

ALASKA GOLD (Juneau)—Special stockholders' meeting called for Jan. 21, in Portland, Me., to authorize issuing $1,[illegible] of 6%, 10-yr. debentures, convertible at $30, and to authorize issuing 250,000 $10 shares to take care of debentures or to be used as required. Money needed to proceed with enlargement of milling plant. Stockholders have right to subscribe to $2 worth of debentures for each share of stock.

ARIZONA

Mohave County

TOM REED (Oatman)—A 150-hp. hoist installed for sinking to 1050-ft. level soon. Depth of 950 ft. reached in winze from 750-ft. level.

CALIFORNIA

Amador County

SOUTH JACKSON (Jackson)—Mine closed down first of year. Date of resumption indefinite.

Calaveras County

UNITED MILLING & MINING CO. (Angels Camp)—Bond taken on Brunner mine, together with adjoining properties. Expected to undertake extensive development.

Kern County

GOLD PAN DISTRICT name given to new mining section near Amalie district, but said to be entirely separate. Some recent discoveries made indicate possibilities of developing producing mines. One of these is Mystery No. 4. Development contemplates running three levels and if results warrant, five-stamp mill will be installed. Wasco is nearest post office.

GREENBACK (Woody)—Weringer Mines Co. organized with [illegible] capital stock to operate this copper property. Ore has been shipped from McFarland, but when county highway is completed shipments will be from Oil Center. The two shafts are to be connected by crosscut at 200-ft. level.

BALD EAGLE (Bakersfield)—This property in White River district, leased to Miles R. Martin. There are six claims in group; fine showing of free-milling ore reported. Property equipped with five-stamp mill.

Mariposa County

MOUNTAIN KING (Bagby)—New power house with capacity of [illegible] hp. being installed. Installation of new 60-stamp mill also begun. Old mill consisted of 20 stamps. Large body of good ore recently reported. Fifty men employed.

RUTH PIERCE (Hornitos)—Mine, former producer, taken over by stock company and mill will be put in commission to treat ore on dumps while development underground is in progress. William Shearer, of Jamestown, manager.

Nevada County

ORLEANS (Grass Valley)—This one of Sultana group to be reopened and developed by 1000-ft. shaft. Small number of men now employed; will be increased as work progresses.

COLLING (Rough and Ready)—Mine reopened after being closed for two years. Three small veins crossing main ledge show good ore. Development includes three-compartment shaft [illegible] ft. deep.

EL ORO (Grass Valley)—Development in progress by means of [illegible] drills. Shaft will be [illegible] gravel channel will be [illegible]. Ground yielded large returns to hydraulic [illegible].

EMPIRE (Grass Valley)—New [illegible] mill in commission [illegible]. Stamps weigh 1250 lb. [illegible] old [illegible] stamps and other improvements [illegible] reserves of milling ore blocked out on [illegible] upper levels.

Plumas County

DEAN (Seneca)—Property [illegible] to J. D. Wilson and contract let to drive [illegible] quartz ledge.

SENECA CONSOLIDATED [illegible] New air compressor being installed. Mill [illegible] two months. Long tunnel will be driven to tap [illegible] ledge. Forty men employed.

LITTLE JAMISON MINING CO. ([illegible])—First dividend in several years [illegible]. Development until recently absorbed [illegible] reported now in good condition for renewed [illegible]

Shasta County

DREDGING ground recently located and filed upon near Gas Point and Igo for purpose of prospecting with view to installing dredge. There are 1160 acres in claims. Locators San Francisco men.

SHASTA BELMONT (Heroult)—Owners purpose resuming operations in February. Mine was closed down indefinitely on account of war. Ore carries copper and silver.

GLADSTONE (French Gulch)—Vein cut on 1200-ft. level at 125 ft. below working level, 2000 ft. vertical depth below outcrop. This persistence expected, but by no means positive, when new hoist was installed with a view of deeper sinking. I. O. Jillson managing owner.

Tuolumne County

EMERSON RANCH (Stent)—Hoist and five-stamp mill being installed on property recently developed.

ADVANCE GOLD MINING CO. (Jamestown)—This gravel mine at Peoria Flat, being developed with steam shovel, has recently been working in good pay gravel.

PEORIA FLAT (Jamestown)—Steam shovel used to cut sluiceways and open up heavy gravel and prepare ground for tram tracks and other equipment. Fenner mill being installed.

GOLD RIDGE (Sonora)—Bond held by Henry T. Gage, of Los Angeles, extended under favorable conditions. Property will be thoroughly explored and if development warrants mill will be installed.

Yuba County

GUGGENHEIM interests have made final payments on large acreage of dredging ground extending north of Yuba Consolidated Gold Fields grounds to Parks Bar along Yuba River.

COLORADO

Clear Creek County

JACKSON MILL (Idaho Springs)—Beginning Jan. 1 this amalgamating and concentrating mill increased operating time from two 8-hr. shifts to three. Ore supply coming from Big Five, Saratoga and Golden Edge properties. Paul Roberts manager.

ENGINEERS LEASING CO. (Idaho Springs)—Company operating on Dyke vein through Newhouse Tunnel has sunk winze 40 ft. and will continue to depth of 100 ft. below tunnel level. Hoisting station and ore bin cut, pump will soon be installed. Company has also secured lease on Concrete property which will be operated through tunnel.

ISABELLA (Altman)—Number of lessees increased from 30 to 40 and about 25 of these shipping ore. Numerous improvements made in surface equipment, including new sill timbers and headframe at Lee shaft, new ore bin, additional railroad siding, reroofing and repainting several buildings. Leyner sharpener added to the blacksmith equipment. Railroad siding built to ore house at Empire State shaft. Several old underground workings caved in, reopened and repaired; 40 new mine cars added to underground equipment. Some underground development being done on company account but bulk of such work performed by lessees.

IDAHO

TUSCUMBIA (Sunset)—Leased to G. Ehrenberg and associates. Raise completed in November from No. 3 tunnel to No. 4 tunnel, blocked out ore which will be mined as soon as mill can be provided.

AMERICAN PLACER (Pierce City)—Company erecting dredge to begin operation Mar. 1, on Orofino River 7 miles below Pierce. Daily capacity 2500 cu.yd.; 3½-cu.ft. buckets; steam driven. J. M. Porter, chief owner, supervising work. Part of deposit formerly worked by hydraulicking using elevator.

STEWART (Kellogg)—Company has taken option and bond on three-fourths of stock of Slavonion Mining Co., and on property of Keating Mining Co., both at Wardner. Development work must be commenced before Mar. 1 and continued during life of bond. First payment due Jan. 1, 1916. Present crosscut tunnel of Slavonian will be continued to vein, about 300 ft. beyond present face. Keating mine now developed through shaft [illegible] ft. deep.

ONTARIO vs. STEWART—Case occupied week in district court. Plaintiff now claims $70,000 worth of ore taken from Ontario claim. Defendant contends boundary of Ontario as held by plaintiff is not true boundary between them, but that southwest corner of Switchback claim establishes boundary. Has been proved that part of trespass has been committed since Aug. 21, date of injunction issued by court, restraining Stewart from mining within disputed area.

MICHIGAN

Copper

COPPER RANGE reported as resuming full production.

WINONA (Winona)—Shipping 200 tons of rock daily to Trimountain stamp mill, transferred from Calumet & Hecla subsidiary, saving freight charges.

CALUMET & HECLA (Calumet)—Total rock shipments averaging [illegible] tons monthly, compared with 250,000 tons normal. No intention of resuming normal shipments until European war ends.

ISLE ROYALE—(Houghton)—Over half debris from wreck of stamp mill cleared away and rock removed from bins. Reconstruction will be rushed and mill rebuilt by July. Government engineer says sand pile is still 400 ft. from harbor line. Turbine engines will furnish power in new mill.

OSCEOLA CONSOLIDATED (Osceola)—Total rock shipments again normal and copper output up to restricted basis established at beginning of war, following curtailment from Dec. 18 to Jan. 6. Destruction of boiler plant at No. 3 shaft, North Kearsarge branch, put that plant out of commission. Efforts directed toward establishing No 1 North Kearsarge as shipper and miners from No. 3 started work there. This plant has undergone thorough remodeling, can now hoist and handle larger tonnage than ever before. Not yet decided as to reconstruction of No. 3 boiler plant. Possibility of erection of plant midway between Nos. 1 and 3, to supply both shafts. January 6 saw beginning of heavy rock shipments from No. 1. Osceola tonnage now 4000 daily.

LAKE AND SOUTH LAKE—(Houghton)—Consolidation may take place. Lake has fully equipped shaft pointing to South Lake, which carries western extension of the lode worked by Lake. South Lake also carries two other lodes near it, neither of which developed commercial copper on Lake. On South Lake these lodes were developed by six diamond-drill holes, two of them close to boundary. Other four extended over 1300 ft. west of center of South Lake. All carried copper. W. R. Wallace, diamond-drill contractor, pronounces one of these cores richest ever taken from Lake Superior drill hole. These lodes now being further developed by crosscut from 600-ft. level of South Lake shaft which is 1400 ft. north from drill holes. Crosscut has just reached and passed through first lode. It showed copper for 11 ft.; 5½ ft. next to hanging exceedingly rich; 200 lb. small masses taken from 7x7-ft. crosscut. This showing met expectations of drill results. Exploratory South Lake work has bearing on future of Lake, as the Lake lode was turning decidedly to west when development ceased, and it would be practicable to develop and mine this South Lake rock from Lake shaft. Under circumstances talk of consolidation is based on mutual advantages. Will become more pronounced when South Lake crosscut further opens lodes it is tapping. South Lake developing lode cut in shaft 110 ft. down from crosscut on the 300-ft. level; drift 400 ft. long has fair commercial ground from end to end. This lode 20 ft. wide. Two other lodes show in shaft and crosscut but not so good as drift showing.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Sinking of concrete drop shaft somewhat delayed owing to shaft's getting out of line.

BRAINERD-CUYUNA (Brainerd)—Third shaft has just reached ledge. Two previous shafts were lost on account of quicksand and water.

WILCOX (Woodrow)—Large Cameron electric pump will be installed on 200-ft. level at once. Headframe practically complete. Underground work concentrated on crosscut through orebody to south wall. New changehouse equipped with hanging lockers just completed.

BRAINERD MINING CO. (Barrows)—Company operating drills on Barrows mine property. Hole 13 recently indicated considerable tonnage of 63% ore with low silica content. Presence of large percentages of silica has heretofore militated greatly against value of South range ores, and this discovery has renewed interest in district.

Mesabi Range

RUDDY (Biwabik)—Mine resumed operations, employing 50 men.

MONTANA

Madison County

FLORIDA GIANT (Twin Bridges)—At properties of company in Bear Gulch, another vein of gold ore encountered which promises to increase greatly value of property. Runs parallel with vein now being exploited and appears to be main vein in region. Work to develop will be pushed.

Silver Bow County

RAINBOW LODE DEVELOPMENT CO. (Butte)—Payments for mineral claims under bond being completed. Directors have not decided when exploration work will be resumed.

NORTH BUTTE (Butte)—Before leaving Butte Thomas Cole stated development work would be carried on, to employ married men and to open up orebodies for economical extraction later.

MOUNTAIN VIEW (Butte)—Interesting engineering feat just accomplished. Mine [illegible] July. In retimbering shaft, bringing it up vertically from below, collar came so that old position of headframe was no longer true. Had to be made plumb with shaft before it was practicable to continue operations. Ground around collar had settled 2 to 3 ft. in various directions. Steel headframe weighing 120 tons and 108 ft. high, was supported on heavy timbers and then moved with jacks. Later, men put cement foundations around frame and shaft collar. New structure in course of erection to house Fortier engine which will also have to be aligned with new shaft collar and sheaves.

NEVADA

Esmeralda County

SPEARHEAD GOLD MINING CO. (Goldfield)—Lease taken on south 850 ft. of [illegible] claim to run 2½ years with extension of six months more. Company formed called Spearhead Extension Mining Co. and capitalized for 1,000,000 shares, par value $1. Work will begin at once and two-compartment shaft will be sunk 300 ft.

JUMBO EXTENSION (Goldfield)—Report for November: Tons produced, 1,593; gross value, $133,900; net profit, $93,375. Headframe being removed from Oriental Velvet lease shaft preparatory to installing larger headframe, 75-hp. hoist, and eight-drill compressor. Shaft, now [illegible] ft. deep, will be enlarged from two compartments to three, and sunk to 1017-ft. level. Connections will be made with 700, 865-, 921- and 1017-ft. levels of Polverde shaft, present main working shaft.

Humboldt County

NO POTASH in Black Rock Desert according to statement of M. I. Goodwin, U. S. Geological Survey. Well sunk 1500 ft. Possibility of extracting niter from soil under discussion.

Lyon County

MASON VALLEY MINES CO. (Thompson)—Demurrer to complaint of Pacific Livestock Co. sustained in district court. Pacific sought to obtain temporary restraining order against future operations at smelting plant on grounds that damage would result.

Mineral County

ROGERS & LALLY (Aurora)—Ten-stamp mill nearly completed; expected to be in operation in February.

Nye County

BIG PINE (Manhattan)—New mill proving superior to expectations. Tube mill handles 250 tons per day. Waste stocker eliminates several carmen. Trommel will take place of grizzlies.

WHITE CAPS (Manhattan)—Reported Tonopah Mining will sample, preliminary to taking short-time option. If preliminary development is satisfactory will then form new company for 60% interest and finance thorough development and treatment-process experimentation.

BIG FOUR MINING CO. (Manhattan)—Supreme court of Nevada decided in favor of plaintiff in suit of John Ryan for damages. Ryan fell from bucket while being hoisted after having spit round of holes. No safety ladder was provided in shaft and no iron-bonneted safety cage, as required by law. Award of $2500 made plaintiff.

NEW MEXICO

Lincoln County

WILD CAT LEASING CO. (White Oaks)—Company has filed incorporation papers for $210,000 to construct power transmission line from Homestake mines to Carrizozo. A. A. Lane, E. L. Queen and D. L. Jackson incorporators.

UTAH

Juab County

BULLION BECK (Eureka)—Hoist overhauled and in running order. Operations by lessees resumed. Eureka Mill also worked again by lessees through Bullion Beck.

Salt Lake County

UTAH METAL & TUNNEL CO. (Bingham)—This company, formerly Utah Metal Mining, drifting on some prominent mineralized fissures opened by its tunnel between Bingham and Tooele. Company in good financial condition to carry on work.

ALTA TUNNEL & TRANSPORTATION (Salt Lake)—Tunnel being driven toward Alta from Big Cottonwood side in 992 ft. Progress of 5 ft. daily being made. Face in white limestone; mineralization shown in places from 850-ft. point.

WISCONSIN

CHAS. KISTLER at Platteville has completed two-jig mill on Alderson tract.

C. C. MATHEY, of Galena, has assembled 50-ton mill on Dinsdale property, formerly operated by Appleton-Galena Co.

CANADA

Ontario

ALEXO (Porcupine)—Mine in December shipped 878 tons high-grade nickel ore to Coniston.

HURONIA (Larder Lake)—Mine shipped $3000 in gold bullion, as result of two weeks' cleanup.

ACME (Timmins)—In drifting on one of veins on the 200-ft. level short shoot of ore encountered that assayed $700.

METEOR (Cobalt)—Power plant and blacksmith shop on this property, adjoining McKinley-Darragh, were destroyed by fire Jan. 15.

McINTYRE (Schumacher)—Company has started sinking main shaft from 500- to 600-ft. level. Company expects to maintain monthly output of between $60,000 and $70,000.

TEMISKAMING (Cobalt)—Spectacular oreshoot opened on 530-ft. level shows at present between 4 and 5 in. high-grade in drift, and good width of mill rock in addition. Vein was originally found on Beaver, being developed from Beaver workings. Find made in Beaver territory.

MINING CORPORATION of CANADA (Cobalt)—This company, which controls Cobalt Townsite, City of Cobalt, Townsite Extension, and Cobalt Lake mines, has decided to bring all its properties under one management. Charles E. Watson will be placed in charge.

WETTLAUFER (South Lorrain)—Annual report shows credit balance of $79,650 and sundry investments of $109,912. Profits for year $[illegible]. Property was not worked during the year. Large number of properties examined with view to purchase, but report states majority were worthless and those of interest were valued too high.

HOLLINGER (Timmins)—Company during 1914 distributed $12,000 bonus for loyal service. System adopted in 1913 based on graduated scale. After first year bonus is 15c. a day, 30c. for third year of service and 45c. for fourth. Expected annual report will show reserves above 400-ft. level equal in value to the whole of reserves for previous year. Development during year successful to extraordinary degree.

Quebec

BELL ASBESTOS MINES (Thetford Mines)—Operations resumed after suspension of four months. Mines and mill will run day and night employing about 300 men.

The Market Report

Metal Markets

NEW YORK—Jan. 20

The copper market has exhibited further strength. Tin also has been stronger. In spelter there has been a sharp rise. Lead on the other hand has manifested a weaker tone.

Copper, Tin, Lead and Zinc

Copper—The strength noted in our last report continued, and under the influence of important buying, the market became firmly established on the basis of 13¾c., regular terms, on Jan. 14, while by Jan. 18 sales began to realize 13⅞c., and on Jan. 19, the market was fully on that basis. Talk about 14c. having been realized is misleading. If that price has been paid in any cases it has been for delivery to points whither freight and other charges are correspondingly high.

The leading interests in copper selling have, indeed, exhibited a very wise moderation. It is distinctly a sellers' market, but there is no disposition shown in any quarter to jack up the price arbitrarily.

The sales of the last week were rather large in volume. In fact, ever since Jan. 1 sales have been running far in excess of the current rate of production, which last week we estimated at 70 to 80 million pounds per month. Gossip about one very large sale to an unusual quarter appears to have some foundation in fact.

Copper sheets, base price was advanced ¼c. on Jan. 16 and is now 18¾c. for hot rolled and 19¾c. for cold rolled. Usual extras charged and higher prices for small quantities.

The Department of Commerce reports the exports of copper from the United States for the week ended Jan. 9, at 16,882,000 lb. The larger shipments were 7,896,000 lb. to France, 6,252,000 to Great Britain and 2,622,000 lb. to Italy. Imports for the same period were 635,000 lb. metal and 2,014,000 lb. in ore and matte; 2,649,000 lb. in all. Imports were from Cuba, Canada and Chile.

Visible stocks of copper abroad on Jan. 15 were reported as follows: Great Britain and France, 18,750; Rotterdam, 1150; afloat from Chile, 2500; afloat from Australia, 4400; total, 26,800 long tons, an increase of 875 tons over the Jan. 1 report.

By regulation effective Dec. 14, 1914, the Federal Council fixed the maximum price for copper in Germany at 200 marks per 100 kg., equal to 21.6c. per pound.

Brass Prices, base, are announced by the American Brass Co. as follows, to date, from Jan. 15: Sheets, high brass, 15½c. net per lb.; low brass, 17⅛c. Wire, high brass, 15¼c.; low brass, 17⅛c. Rods, high brass, 15¼c.; low brass, 17⅞c. Tubes, both brazed and open seam, 19¼c. Angles and channels, 19¼c. Scrap allowances are 10c. net per lb. for high brass; 11⅛c. for low brass.

Tin—The London market showed an advancing tendency throughout the week, and rules very firm. The domestic market moved in sympathy with that of London, quotations being marked up in proportion to the advance in London. No great interest was shown, however, by American consumers who viewed the strength abroad with a good deal of apathy.

Lead—Business was dull and again there was a weaker tone which is reflected fractionally in the quotations. Several sellers reported failure to consummate business although they made what they considered to be low offers, business being in fact taken by other sellers who went still lower. The sentiment in this trade is, however, mixed. Some sellers express themselves pessimistically, others are moderately optimistic, and others still say that they are all at sea.

Imports of lead for the 11 months ended Nov. 30 were 48,107,091 lb., against 108,626,616 lb. in 1913. Exports for the 11 months were 111,162,129 lb. domestic lead and 37,387,325 lb. foreign lead; 148,549,454 lb. in all. In 1913 there were 86,399,134 lb. foreign lead reëxported; no domestic lead was exported.

Spelter—This market was excited and it is hard to quote it accurately, there being differences of 10 points or more in prices realized in the same [illegible] to day, and similar differences among different [illegible] The [illegible] being tendency was apparently foreseen by certain sellers who themselves were large buyers on the way up. Up to Monday the market was strong, but well in hand. On Monday Europe began to buy largely and prices advanced steadily, £29¾ being realized on export business on Monday, £29¾@31¼ on Tuesday, and £31@31¼ on Wednesday. Considerable domestic business was done during the week, but the export business predominated. Sales aggregated many thousands of tons.

Very unusual conditions prevail in the market for zinc dust. This material is selling at 11@12c. per lb. when put up in zinc-lined boxes holding 200 lb., which is the packing desired and bought by the cyanide mills. At present only American zinc dust is available in that packing. On the other hand, imported zinc dust, put up in 1500-lb. casks, is quoted at 7c. per lb. in bond, to which the duty of 15% has to be added. Some zinc dust thus put up is now coming through from Germany, but the arrivals are very irregular.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
14	4.8363	49⅛	13 50 @13.60	33⅜	3.70	3.50 @3.55	6.02½ @6.12½	5 85 @5.95
15	4 8369	49	13.55 @13.60	33¾	3.67½ @3.70	3.47½ @3.52½	6.07½ @6.17½	5 90 @6 00
16	4.8388	48¼	13.55 @13.60	33½	3 67½ @3 70	3.47½ @3 52½	6.07½ @3 17½	5 90 6.00
18	4.8400	49	13.65 @13.70	34	3.65 @3.70	3.47½ @3.52½	6.12½ @6 22½	5 95 @6.05
19	4.8400	49	13.65 @13.75	33⅞	3.65 @3.70	3.47½ @3 52½	6.22½ @6.32½	6 05 @6.15
20	4.8375	49	13.65 @13.75	34¼	3.65 @3 70	3.47½ @3 52½	6.37½ @6.47½	6.20 @6 30

The quotations herein are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0 20c. on domestic business and 0 25 to 0 37½c. on European. The price of electrolytic cathodes is 0 05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c

LONDON

Jan.	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb.
14	22⅞	59¾	12 98	59⅞	..	151½	146	18⅝	4.05	29½	6 41
15	22 13/16	60⅝	13.06	60¼	65¼	152	145½	18½	4.02	29¾	6 46
16	22¼	.			.	.	..	.			
18	22 11/16	60⅞	13 23	61	.	154½	147	18½	4 02	30	6 52
19	22 13/16	60¾	13 20	60¼	66	54	147½	18½	4 02	30½	6 63
20	22 11/16	61	13.25	61⅛		155	148¼	18½	4 02	31¼	6 78

*No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2 17⅜c.; £15 = 3 26¼c.; £20 = 4 35c.; £30 = 6 52c.; £60 = 13 05c. Variations, £1 = 0 21¾c.

Other Metals

Aluminum shows no material change, business remaining quiet and sales moderate. Current quotations are 18¾@19¼c. per lb. for No. 1 ingots, New York—**Antimony** has been in demand and there has been quite active buying, some of which is thought to be for export. Prices have advanced sharply, especially for ordinary brands which are selling now at 16@17c. per lb. For Cookson's 17@18c. per lb. is asked—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** is rather more active and inclined to be stronger. New York price is $52 per flask of 75 lb. San Francisco, $51 for domestic orders. London price is higher, at £11 12s. 6d. per flask.

Minor Metals—Current sales of **Bismuth** have been at $2.75 per lb., New York. **Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.

Gold, Silver and Platinum

Gold in the United States, Jan. 2, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $967,974,869; in Treasury current balances, $216,393,851; in banks and circulation, $631,607,599; total, $1,815,976,319, a decrease of $1,145,381 during December.

A small lot of gold, about $200,000, was taken in London, Jan. 14, for shipment to New York.

Platinum—The market continues dull and sales have been light. Prices range from $40@43 per oz. for refined platinum, and $44@49 for hard metal.

Our Russian correspondent writes that the platinum market improved essentially during the last half of December. The market for small lots at Ekaterinburg was more active and prices advanced 45 ropeks, to 7.75 rubles per zolotnik—equal to $29.14 per oz.—for crude metal, 83% platinum. No official quotations are given, either at Ekaterinburg or Petrograd.

Three new dredges are being installed at the placers of the Nikolo-Pavdinsky Co. in the North Ural district. One dredge was built at the Putilov works in Petrograd; the other two were built at the Marion works in the United States.

Silver market has ruled steady around 22$\frac{13}{16}$d. in London without special feature. Demand continues limited.

For the week ending Jan. 7, Messrs. Pixley & Abell report shipments of silver from London to India at £157,000, against £65,000 in the first week of 1914. No shipments to China.

Coined silver in the United States, Jan. 2, is estimated by the Treasury Department as follows: Standard dollars, $565,921,478, of which $480,259,000 are held in the Treasury against silver certificates outstanding; subsidiary coins, $184,533,627; total, $750,455,105, an increase of $449,952 during December.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 16

Blende, high price, $56; assay base 60% zinc, $48@53.50; metal base 60% zinc, $46.50@48.50; average, all grades of zinc, $47.70 per ton.

Lead, high price, $49.10; base, $47 per ton of 80% metal content; average, all grades of lead, $46.96 per ton.

Another week of fair weather increased the lead output from shallow workings, but the week closes tonight with a blizzard raging. Some reserve zinc ore came upon the market at the increase in price offerings.

SHIPMENTS, WEEK ENDED JAN. 16

	Blende	Calamine	Lead	Val
Total this week.....	11,600,420	478,700	1,770,280	$323,[illegible]
Total this year.....	31,633,220	2,362,530	4,299,040	894,410

Blende value, the week, $275,120; three weeks, $761,400.
Calamine value, the week, $6980; three weeks, $32,110.
Lead value, the week, $41,550; three weeks, $100,900.

PLATTEVILLE, WIS—Jan. 16

The base price paid this week for 60% zinc ore was $51.50 per ton. The base price paid for 80% lead ore was $44 per ton.

SHIPMENTS, WEEK ENDED JAN. 16

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Year..........	9,259,300	160,000	1,203,500
Week..........	2,867,290	80,000	111,100

Shipped during week to separating plants, 3,431,070 lb. zinc ore.

Iron Trade Review

NEW YORK—Jan. 20

The month of January so far has shown only a small increase in new business, but specifications are better, and the mills are running to a higher percentage of capacity. Rail orders come in slowly, but bars and sheets are more active, and there is quite a demand for plates and shapes for ship work. Structural material is still rather slow.

The pig iron market has rather quieted down, but there is still a fair demand for foundry and basic iron.

The mills at Sault Ste. Marie, Ont., have taken orders for 20,000 tons of rails for railroads in the United States. It is reported that these orders were taken at $26 and $26.50 per ton; some rumors give even lower prices. It is also reported that the Dominion Steel Co. has been bidding for some rail orders.

PITTSBURGH—Jan. 19

The steel market has shown a slight increase in the volume of commitments in the past week but the improvement thus far in January does not altogether come up to expectations. According to theories entertained in December there would be a lull in the first half of January, on account of inventory taking and other adjustments, but thereafter a return would occur to the December activity. Thus far the market is quieter than in December, with the exception of tubular goods, which are making a better showing.

Steel prices are steady. The price of 1.10c. on bars, plates and shapes, as definitely advanced at the end of December, is barely maintained, and it develops that whereas the 1.05c. price named in December was supposed to apply only to prompt deliveries, there were some contracts made at this price, permitting specifications to be furnished early in the present quarter.

Railroad buying is very moderate, and shows improvement only by comparison with the complete inactivity of the late months of last year.

The steel mills are operating at an average of 45 to 50% of capacity, or considerably better than in November and December. Tinplate production is between 80 and 90% of capacity, an usually good showing for January.

Pig Iron—Prices are quotable at the same level as formerly: Bessemer, $13.75; basic, $12.50; No. 2 foundry and malleable, $12.75@13; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market continues quiet, consumers being well stocked for the present and being unwilling to pay the asked price of $68, which they regard as high when delivery is not assured. The Jones & Laughlin Steel Co. is now operating one of its Aliquippa furnaces on ferromanganese, making about 100 tons daily, on ore imported a few months ago. Manganese ore imports dropped from 39,000 tons in October to 2000 in November.

Steel—The mills continue to quote $20 for billets and $20.50 for sheet bars, delivered Pittsburgh, but there is hardly any buying, consumers being well covered at considerably lower prices. Rods are regarded as firm at $25, Pittsburgh.

COKE

Connellsville—Yesterday the First National Bank of Uniontown, Penn., was closed, and this morning receivers were appointed for the properties of its president, Josiah V. Thompson, who for years has been a spectacular buyer of coking coal lands, particularly in Greene County, representing an extension of the Connellsville seam. Liabilities are given at $22,000,000, of which $15,000,000 was secured by mortgages and collateral and $7,000,000 was unsecured except by Mr. Thompson's notes. Assets are stated to amount to $70,000,000, comprising coal acreage, securities and several parcels of real estate taken in payment for coal acreage sold. Estimates are that Mr. Thompson was interested in approximately 200,000 acres of coal. The steel industry in recent years has turned so largely to byproduct coking that it has taken less interest in Greene County and similar coking coals than was anticipated when Mr. Thompson began his accumulations over 10 years ago. The coke market is not apparently affected by the developments mentioned and is not likely to be, as there was little to disturb. Prompt furnace coke is a shade easier. The market is quotable at $1.55 for prompt furnace, $1.75 for contract furnace, $2@2.29 for prompt foundry and $2.15@2.25 for contract foundry.

PETROLEUM

Estimating December, the total production of oil in California in 1914 was 102,904,426 bbl.; deliveries, 95,356,791 bbl. Stocks on Dec. 31 were 57,405,836 bbl. In addition to the production there is reported a total of 6,728,000 bbl. "oil shut in."

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev	Jan 5	Jan 27	$0.05
Belcher Silver, Nev	Feb 8	Mar 1	0.10
Blue Bird, Nev	Jan 4	Feb 8	0.01
Booth, Nev	Jan 25	Mar. 1	0.02
Carbonate, Ida	Jan 28	Feb 28	0.001
Cash Boy, Nev	Jan 15	Feb 15	0.005
Cedar-Talisman, Utah	Feb 8	Mar 1	0.005
Century, Utah	Jan 2	Feb 2	0.01
Clear Grt., Ida. (post.)	Feb 9	Mar 3	0.0015
Clearwater Cop., Ida		Feb 17	0.001
Con. Imperial, Nev	Dec 23	Jan. 15	0.01
East Hercules, Ida (post.)	Jan 1	Feb 1	0.001
Emerald, Utah (three instal.)		June 9	0.01
Golden Le Roy, Utah	Feb 2	Feb 23	0.02
Grt. Copp. King, Utah	Dec 21	Jan 21	0.001
Gypsy Qn., Nev	Jan. 12	Feb. 16	0.01
Happy Day, Ida	Dec 24	Jan 25	0.0025
Hypotheek, Ida	Dec 17	Jan 29	0.006
Idaho-Nev., Ida	Jan 7	Feb 1	0.001
Keystone, Utah	Dec 21	Jan 21	0.02
King Pine Crk., Ida	Feb 12	Mar. 13	0.002
Laclede, Ida	Jan 12	Feb 3	0.003
Lehi Tintic, Utah	Dec 17	Jan 16	0.0025
Lucky Friday, Ida	Dec 14	Feb. 11	0.003
MacNamara, Nev	Jan 12	Feb 3	0.03
Majestic Idol, Nev	Dec 15	Jul. 20	0.005
Manhattan Con., Nev	Feb 30	Mar. 1	0.01
Moonlight, Ida	Dec 30	Jan. 28	0.005
Nabob, Ida	Dec. 31	Jan 25	0.005
Nat'l Copper, Ida (post.)		Jan 29	0.002
Nor. Bnkr. Hill, Ida	Jan 30	Mar 6	0.002
Oreano, Ida	Dec 26	Jan 25	0.00075
Phoenix, Ida. (post.)	Dec 26	Jan 26	0.005
Potosi, Nev	Jan. 12	Feb. 4	0.02
Raven, Ida	Dec 30	Jan 30	0.0003
Rescue-Eula, Nev	Feb 11	Mar 22	0.01
Riverside, Ida	Dec 20	Jan 20	0.001
Scranton Ex., Utah	Jan 4	Feb 5	0.00025
Sheba, Utah	Jan 12	Feb 24	0.05
Sierra Nevada, Nev	Feb 8	Mar 2	0.05
Silver Star, Ida	Jan 5	Feb 5	0.002
Sonora, Ida. post	Nov 30	Jan 15	0.002
Sunset Dev., Ida	Jan 18	Feb 18	0.0025
Syndicate, Ida. (post.)		Jan 28	0.001
Tarbox, Ida	Jan 28	Feb. 28	0.0025
Ton. Gap. Qn., Nev	Jan 12	Feb 16	0.01
Umatilla, Nev	Jan. 4	Feb. 8	0.01
Union Con., Nev	Jan 14	Feb 4	0.05
Utah-Yerington, Nev	Jan 2	Jan 23	0.0006
Verde May, Ida	Feb. 1	Mar. 1	0.001

Stock Quotations

COLO. SPRINGS Jan. 19 Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	.01
C. K. & N.	.06¾
Doctor Jack Pot	.10
Elkton Con	.47
El Paso	1.50
Findley	.02
Gold Dollar	.04
Gold Sovereign	.04
Isabella	.18
Jack Pot	.08
Jennie Sample	.03
Jerry Johnson	.04
Lexington	.006
Old Gold	‡.01
Mary McKinney	.54
Pharmacist	.02
Portland	1.11
Raven B. H.	[illegible]
Vindicator	1.27

SALT LAKE Jan. 15 Name of Comp.	Bid
Beck Tunnel	.05¾
Black Jack	.04
Colorado Mining	.07
Crown Point	.01
Daly-Judge	4.87
Gold Chain	.10
Grand Central	.64
Iron Blossom	1.02½
Little Bell	.10
Lower Mammoth	.04
Mason Valley	.75
May Day	.16
Opohongo	.02
Prince Con	.20½
Seven Troughs	.03
Silver King Coal'n	2.2
Silver King Con.	1.90
Sioux Con.	.02½
Uncle Sam	.06
Yankee	.07

TORONTO Jan. 19			
Bailey	.0[illegible]	[illegible] O'Brien	‡.15
City of Cobalt	‡[illegible]	Hollinger	22.25
Coniagas	[illegible].25	Imperial	.01
Peterson Lake	.2[illegible]	Jupiter	.09
Right of Way	.02	McIntyre	.22
T. & Hudson Bay	55.00	Pearl Lake	.03
Timiskaming	.1[illegible]	**Porcu. Gold**	.75
Wettlaufer-Lor.	.0[illegible]	**Preston E. D.**	.01
Big Dome	[illegible]	Rea	[illegible]
Dome Exten.	[illegible]	[illegible]	1.10

SAN FRANCISCO Jan. 19			
Comstock		Misc. Nev. & Cal.	
Alta	.04	Belmont	‡[illegible]
Belcher	.29	Jim Butler	.73
Best & Belcher	.07	[illegible]	[illegible]
Caledonia	[illegible]	[illegible]	[illegible]
Challenge Con	[illegible]	[illegible]	[illegible]
Confidence	‡.30	[illegible]	.33
Con. Virginia	[illegible]	[illegible]	.14
Crown Point (Nev.)	.01	[illegible]	[illegible]
Gould & Curry	[illegible]	[illegible]	[illegible]
Hale & Norcross	[illegible]	[illegible]	[illegible]
Julia	.01	[illegible]	[illegible]
Mexican	.64	[illegible]	[illegible]
Occidental	.85	[illegible]	[illegible]
Ophir	.10	[illegible]	[illegible]
Overman	.16	[illegible]	[illegible]
Potosi	.02	[illegible]	[illegible]
Savage	[illegible]	[illegible]	[illegible]
Sierra Nevada	.10	[illegible]	[illegible]
Union Con.	.2[illegible]	[illegible]	[illegible]
Yellow Jacket	.30	[illegible]	[illegible]

N. Y. EXCH. Jan. 19 Name of Comp.	Clg.
Amalgamated	58
Am. Sm. & Ref., com.	61¾
Am. Sm. & Ref., pf.	101¼
Am. Sm. Sec., pf. B.	78
Anaconda	27¼
Batopilas Min	.75
Bethlehem Steel, pf.	100¼
Chino	35¾
Colo. Fuel & Iron	25¼
Federal M. & S., pf.	28
Great Nor., ore., ctf.	29¾
Guggen. Exp.	50
Homestake	118
Inspiration Con.	19
Mex. Petroleum	60¾
Miami Copper	18¼
Nat'l Lead, com.	47
National Lead, pf.	109¾
Nev. Consol.	13¾
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf.	1½
Ray Con.	17¾
Republic I&S, com.	22
Republic I&S, pf.	78
SlossShefl'd, com.	27
Sloss Sheffield, pf.	‡82
Tennessee Copper	31¼
Utah Copper	54
U. S. Steel, com.	52¾
U. S. Steel, pf.	108¾

N. Y. CURB Jan. 19 Name of Comp.	Clg.
Beaver Con.	.23
Big Four	.08
Blue Bell	.04¼
Braden Copper	7¼
B. C. Copper	‡.50
Buffalo Mines	.75
Can. Cop. Corpn	1¼
Can. G. & S.	.05
Caribou	‡.58
Chambers Ferland	.11
Con. Ariz. Sm.	7/16
Coppermines Cons.	1⅛
Davis-Daly	1⅛
Diam'field-Daisy	.09
Dia. Black B.	.05½
Ely Con	‡.01
Florence	.54
Goldfield Con.	1¼
Goldfield Merger	.33
Greene Cananea	25
Kerr Lake	4¼
La Rose	.80
McKinley-Dar-Sa	.53
Mines of Am.	2¼
Mutual Min., pf.	‡3
Nevada Hills	.29
New Utah Bingham	‡7/16
Nipissing Mines	5.70
Ohio Copper	.10
Oro	.12
Pacific Smelt	‡1/16
Stand'd Oil of N.J.	401
Standard S. L.	1¼
Stewart	1 11/16
Tonopah	[illegible] 11/16
Tonopah Ex.	2 9/16
Tonopah Merger	.30
Tularosa	5/16
West End Ex.	.03¼
Yukon Gold	2¼

LONDON Jan. 7 Name of Comp.	Clg.
Alaska Tredwell	£8 0 0
Camp Bird	0 6 6
El Oro	0 10 0
Esperanza	0 8 9
Mexico Mines	4 0 0
Oroville	0 10 3
Santa Gert'dis	0 8 9
Tomboy	1 2 6

BOSTON EXCH. Jan. 19 Name of Comp.	Clg.
Adventure	1¼
Ahmeek	245
Alaska Gold M.	28¾
Algomah	.50
Allouez	37
Am. Zinc	18¼
Ariz. Com., ctfs.	4 1/16
Bonanza	‡.41
Butte-Ballaklava	.2
Butte & Superior	43¼
Calumet & Ariz.	55
Calumet & Hecla	360
Centennial	15¼
Cliff	‡1
Copper Range	32
Daly West	1¼
East Butte	8¼
Franklin	4¼
Granby	62½
Hancock	11¼
Helvetia	.25
Indiana	3½
Island Cr'k, com.	45½
Island Cr'k, pfd.	87
Isle Royale	19½
Keweenaw	2¼
Lake	6¼
La Salle	3½
Mass	3¼
Mayflower	5¼
Michigan	.50
Mohawk	48½
New Arcadian	6¾
New Idria Quick	‡3½
North Butte	23½
North Lake	1¼
Ojibway	.75
Old Colony	4¼
Old Dominion	43
Osceola	68½
Quincy	50
Santa Fe	1¾
Shannon	4¾
Shattuck-Ariz.	24
Superior	25¼
Superior & Bost.	1½
Tamarack	27¼
Trinity	‡3
Tuolumne	.19
U. S. Smelting	20½
U. S. Smelt'g, pf.	39
Utah Apex	2¼
Utah Con	10¼
Victoria	1¾
Winona	1
Wolverine	37
Wyandot	.50

BOSTON CURB Jan. 19 Name of Comp.	Bid.
Alvarado	.60
Bingham Mines	‡3½
Boston Ely	.15
Butte & Lon'n Dev	.23
Calaveras	.95
Calumet-Corbin	.17
Chief Con	.80
Corbin	‡1
Cortez	.15
Crown Reserve	.76
Eagle & Blue Bell	.95
First Nat. Cop.	1 1/16
Houghton Copper	1½
Iron Cap Cop., pf.	‡5
Majestic	.13
Mexican Metals	.14
Nevada-Douglas	.63
New Baltic	1
Onero	.75
Raven Copper	.05
Smokey Dev.	.10
So. Lake	.04½
Tonopah Victor	‡.17
Trethewey	.14
United Verde Ext	1.2

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1912	New York 1913	New York 1914	London 1912	London 1913	London 1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	24.979
September	63.078	60.640	53.290	29.088	27.986	[illegible]
October	63.471	60.793	50.654	29.299	28.083	23.149
November	62.792	58.995	49.082	29.012	27.263	22.703
December	63.365	57.760	49.375	29.320	26.720	22.900
Year	60.835	59.791	54.811	28.042	27.576	25.314

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1913	New York Electrolytic 1914	London Standard 1913	London Standard 1914	London Best Selected 1913	London Best Selected 1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	13.223	64.166	60.540	69.446	64.955
August	15.400	*	69.200	‡	74.313	‡
September	16.328	*	73.125	‡	78.614	‡
October	16.337	*	73.383	‡	79.250	‡
November	15.182	11.739	68.275	53.227	73.825	*
December	14.224	12.801	65.223	56.841	69.583	*
Year	15.269	13.602	68.335	61.524	73.740	68.168

TIN

Month	New York 1913	New York 1914	London 1913	London 1914
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41.582	*	188.731	‡
September	42.410	32.675	193.074	‡
October	40.462	30.284	184.837	‡
November	39.810	33.304	180.869	139.391
December	37.635	33.601	171.786	147.102
Av. year	44.252	34.301	206.279	156.564

LEAD

Month	New York 1913	New York 1914	St. Louis 1913	St. Louis 1914	London 1913	London 1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	3.891	4.223	3.738	20.038	19.051
August	4.624	3.875	4.550	3.715	20.406	‡
September	4.698	3.828	4.579	3.658	20.648	‡
October	4.402	3.528	4.253	3.384	20.302	‡
November	4.293	3.683	4.146	3.585	19.334	18.500
December	4.047	3.800	3.929	3.662	17.798	19.097
Year	4.370	3.862	4.238	3.737	18.743	19.079

SPELTER

Month	New York 1913	New York 1914	St. Louis 1913	St. Louis 1914	London 1913	London 1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	4.920	5.128	4.770	20.592	21.568
August	5.658	5.568	5.508	5.418	20.706	‡
September	5.694	5.380	5.544	5.230	21.148	‡
October	5.340	4.909	5.188	4.750	20.614	‡
November	5.229	5.112	5.083	4.962	20.581	25.016
December	5.156	5.592	5.004	5.430	21.214	27.369
Year	5.648	5.213	5.504	5.061	22.746	22.544

PIG IRON IN PITTSBURGH

Month	Bessemer 1913	Bessemer 1914	Basic 1913	Basic 1914	No. 2 Foundry 1913	No. 2 Foundry 1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.99
February	18.15	15.06	17.22	14.12	18.13	14.08
March	18.15	15.07	16.96	13.94	17.53	14.10
April	17.90	14.90	16.71	13.90	16.40	14.13
May	17.68	14.90	15.80	13.90	15.40	14.27
June	17.14	14.90	15.40	13.90	15.10	13.96
July	16.31	14.90	15.13	13.90	14.74	13.90
August	16.63	14.90	15.00	13.90	14.88	14.08
September	16.65	14.90	15.04	13.90	14.93	14.03
October	16.60	14.84	14.61	13.75	14.80	13.97
November	16.03	14.59	13.91	13.43	14.40	13.83
December	15.71	14.70	13.71	13.45	14.28	13.8[illegible]
Year	$17.09	$14.88	$15.57	$13.78	$15.77	$14.01

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

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Goldfield and Its Present Boom

By H. C. Cutler*

SYNOPSIS—The prediction of optimists that a second boom, of greater force than the first, was sure to occur, now seems about to be fulfilled. Based on the strike of high-grade ore in the Jumbo Extension mine, the camp is expecting more discoveries in other properties. Stocks are experiencing sudden inflation in value, and the beginning of an excitement appears to be at hand. The present article reviews the established theories of the Goldfield geology, correlating it with more recent studies and the new ore discovery.

The long-expected has happened. For a number of years, in fact ever since the decline of the last boom, optimists have been predicting a second boom for Goldfield. They based this prediction on nothing more tangible than the fact that some of the other great gold camps, particularly Cripple Creek, had a second boom of greater intensity than the first. The recent strike of high-grade ore in large quantities in the now famous Jumbo Extension property furnished the necessary incentive for the present excitement.

At first it was quite hard for those who had stuck in Goldfield, in spite of their slogan "If you stick you will win in Goldfield," to realize that the present discovery was anything more than a small bunch of ore, and they believed it was only a question of a short time when it would "peter" out. But as the orebody continued to increase in size and value, it gradually dawned on them that here was the material to start the long-looked-for revival. The discovery was in new ground, apparently not connected with the known system of oreshoots, and it gave prospective value to a large amount of territory hitherto not deeply prospected. When the orebody passed from the latite to the latite-shale contact and was larger and richer than above, the news was spread broadcast and a large number of the "oldtimers" who had left the camp when it declined and spent their money in other places, began to return to share in the golden harvest about to begin.

A New Period of Activity

At the time of writing the boom is on full blast, and people are coming in from all over the country. The stock market, with Jumbo Extension as a leader, is in a furor. Old stocks, hidden away in trunks and pigeonholes and long forgotten, have been resurrected and in many instances turned into money at the present market prices. Various tales are told of persons who have dug up these stocks and turned them over for amounts of money sufficient to last them for the remainder of their lives. Of course, these tales grow with repetition and the effect is to excite the public. Maps of the Goldfield district, which have received but scant attention during the past few years as they hung on the walls, are now at a premium. The large one that hangs on the wall at the Goldfield Hotel is constantly surrounded by crowds eager to find open ground or trace the course of the new oreshoot. Copies of Ransome's report on the Goldfield dis-

Town of Goldfield and the Surrounding Country trict, now out of print, are eagerly sought by visiting engineers, and geological papers and articles published in the past are carefully read for some clew to present conditions. Is there after all a substantial basis for all this excitement? I believe there is, at least for a part of it.

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F. L. Ransome's report, "The Geology and Ore Deposits of Goldfield, Nev.," issued by the U. S. Geological Survey, is excellent. It is the result of a careful study of the district, and his geological conclusions have been borne out to a great degree. I believe that the development work done in the past few years on the lower levels of the various mines has made clear some of the puzzling problems which Ransome encountered, and that it is now possible to formulate a theory supported by facts that will give a clear idea of the formation of the ore deposits. I do not intend to go into a technical discussion of the various rock flows, the geological sequences, or the processes of alteration and ore deposition with all the attending features, since this has been thoroughly covered by Ransome's report and other articles in the past few years. I intend merely to give a broad outline covering the structural features: the formation of the fissures now occupied by the ore deposits, and to correlate the facts already ascertained by Ransome, Locke, Byler and others.

RECENT STUDY OF GEOLOGICAL FEATURES

E. A. Byler has been in Goldfield continuously since its discovery and has studied the various features of the geology carefully. By means of a glass model, constructed by himself, he has noted the detail features of the geology as they were developed by the numerous shafts and other openings, and his ideas have already been expressed.[1] All of the geologists who have studied the problem suggest a relation between Columbia Mountain fault and the mineralization. Ransome, in his report, terminates this so called Columbia Mountain fault at the Conqueror mine on the north and the Red Top mine on the south. Byler has extended it beyond the Florence on the south and to an east and west fault, extending westerly from Diamondfield on the north. The different dips of this fault, varying from 20° to 55°, have been puzzling and this in itself suggests that there have been several different movements.

Ransome concludes that the greater part of the total movement was prior to the dacite intrusion while Locke, touching lightly on this faulting, concludes that the main part of the movement was later. Byler agrees with Ransome. Correlating the known facts concerning the dip, we find that, in the immediate vicinity of Columbia Mountain, and where it is contiguous with it, the fault has an easterly dip varying from 50° to 60°. Toward the west, in the vicinity of the Conqueror mine, it flattens to 20° to 25°, still dipping to the east. Through the dacitic area south of the mountain the fault is irregular both in strike and dip, and has apparently dissipated itself into innumerable fractures which in the main dip easterly, from 30° to 55°, and even steeper. Upon passing into the latite, a general dip of 30° to the east is encountered and this seems to persist to depth.

Byler says: "The fault zone, shown in this section on its dip, corresponds approximately to sloping fault-contacts of dacite with latite, and latite and shale, and at deeper workings probably the fault contact of shale with alaskite. The downward throw on the east side of the fault has not been sufficient in amount to allow the approximately horizontal layers of latite and shale entirely to pass their corresponding layers on the west side. Therefore, the fault zone in places passes through latite upon both sides, and similarly through shale. In consequence of the dacite intrusion across this fault along a portion of its length, which practically obliterated it to a depth of about 300 ft., it follows that the relative position of the geological formations caused by the fault do not properly show above or at this intrusion, though they do below it.

After the dacite intrusion there has been a further small movement along this fault zone, and where the intruded dacite lies across the upward extension of the zone, no preëxisting fracture is present, and the movement, while following the extension in general, has been recorded in irregular fractures extending up to the surface having a steeper dip, and connecting below with the fault as shown in Fig. 6. The mass of eruptives and solidified dacite intrusion has settled irregularly, due to the additional movement of the fault in its original position below, and we consequently find many irregular fractures extending from this fault zone to the surface. These fractures connect below and finally merge with the original fault zone, the foot wall of which in effect forms the foot wall of the mineralization."

RANSOME'S DESCRIPTION OF GENERAL GEOLOGY

We find that no matter what dip these various fractures have at or near the surface, at a depth of about 300 ft. they merge into the main fissure, with an easterly dip of 25° to 30°. This at least is true of the places exposed by the workings in the productive area. It is hard to conceive of an upthrust, or block fault, showing a slipping of the rock layers on the fault plane having such a flat dip as 25°. This movement has more of the appearance of faulting under a tension, a pulling apart of the rocks, rather than a shearing, such as we would have with an upthrust. This part of the faulting movement seems to be entirely separate from the movements caused by Columbia Mountain. Ransome's description of the general geology of the district suggests a solution of the question. Quoting from his report: "The structure of the Goldfield district, as previously stated, is broadly simple. A Tertiary volcanic series resting upon the worn surface of much older rocks has been elevated into a dome of gentle curvature, and this after some modification by faulting and igneous intrusion has been truncated by erosion so as to denude patches of the fundamental formations. This structure was afterward covered, at least in part, by flows of lava which have in their turn been eroded from all but the outlying parts of the district. Banner Mountain may be taken as the approximate center of the uplifted area. The uplift, however, is not symmetrical, and Vindicator Mountain appears to correspond structurally to a local protuberance on the dome. . . . The symmetry of the dome is further modified, as will later be shown, by irregular intrusions of the dacite and by the Columbia Mountain fault."

The consensus of opinion, deduced from a correlation of the facts, is that this uplift occurred some time after the out-pour of the Milltown andesite and before the intrusion of the dacite. The effect of this uplift would be twofold. It would tend to break up and disrupt the flows directly over the highest point of uplift, and, producing a tension at a certain radial distance from the center, cause a breaking and in many places a slipping of the rocks, or in other words, an approximately circular tension fault. This line of faulting corresponds closely with a circular line drawn through Ransome's area of alunitic alteration as shown in Fig. 1 (after Ransome). I do not believe that there was actual faulting around the entire circumference, but in the absence of faulting, there would be a crushing and fissuring of the rocks sufficient to produce a condition favorable to ore deposition. This faulting and breaking probably extend to great depths and connect with the source of the mineralizing solutions, furnishing a path of easy access to the surface. It is entirely probable, judging from the character of the ore deposits, that at this time and before the intrusion of the dacite, the formation of the orebodies began, and as a result we have those of the Black Butte, McMahon Ridge, Sandstorm and Kendall and possibly the lower end of the Mohawk series and the large orebody recently discovered in the ground of the Jumbo Extension company.

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[1] "Min. and Sci. Press," July [illegible], 1912, p. 959.

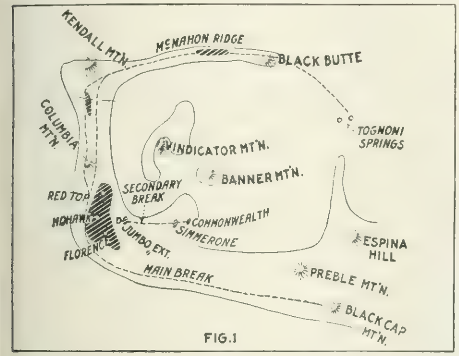


FIG. 1

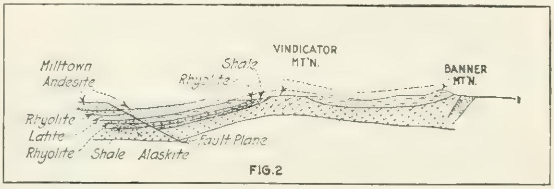


FIG. 2

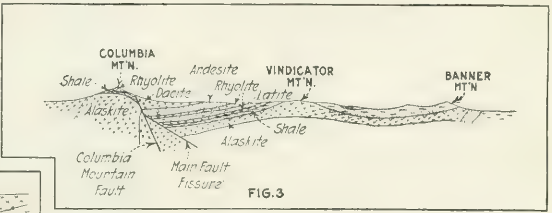


FIG. 3

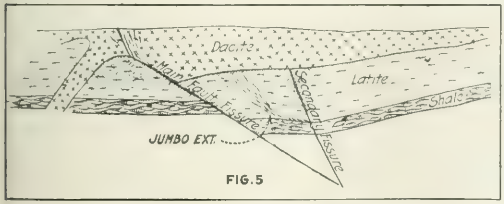


FIG. 5

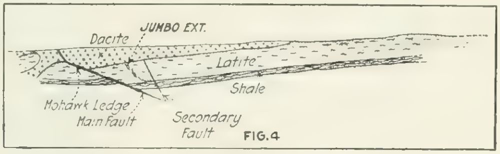


FIG. 4

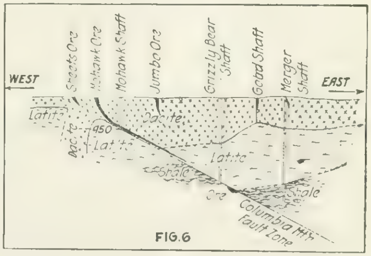


FIG. 6

ILLUSTRATIONS OF GOLDFIELD GEOLOGY

In a disturbance of such magnitude as this it is inconceivable that there resulted just one distinct fissure plane. During the time of formation of this one main fissure there must have been formed innumerable smaller fissures and cracks, some superficial and of no great extent, others larger and connecting in depth with the main mineralizing break. This latter condition, I believe, is what exists on the Jumbo Extension ground. The orebody is largely confined to the latite and the latite-shale contact. The dacite coming later over the latite practically sealed this surface and arrested the free flow of the solutions and stopping the ore deposition at this time.

SEQUENCE OF CORRELATED EVENTS

The general sequence of events which bests correlates with the facts as ascertained is as follows: (1) The deposition of the Tertiary rocks up to and including the Milltown andesite, on the old pre-Tertiary floor; (2) the domical uplift, with Vindicator and Banner mountains as the center of the dome, and the formation of the main fault fissure around the circular edge of the dome corresponding to a circular line through Ransome's area of alunitic alteration; (3) the first era of mineralization, aided by more or less continuous movement along fault plane, caused by readjustment; (4) the intrusion of the dacite, following the structural line of weakness, extending around the edge of the dome from Columbia Mountain to Black Butte. According to Byler there seems to be considerable evidence that the dacite exists as a dike, at least for a large part of this distance, and that the dacite now exposed is partially intrusive and partially effusive (this, I believe, is also Ransome's idea); (5) the upthrust of Columbia Mountain, causing the Columbia Mountain fault. This fault is clearly defined and has a steep dip to the east where it is in immediate contact with the mountain. South of the mountain and through the known main productive area of the camp, the movement of the faulting dissipated itself in breaking and fissuring the body of dacite. The fault connects in depth with the main fault fissure caused by the domical uplift. The surface breaks in the dacite were irregular both in dip and strike, and extended into the Milltown andesite beyond the Florence. This breaking of the dacite, together with the breaking caused by the cooling of the mass, made of the dacite along this line of movement a porous mass, the so called sponge described by Ransome; (6) the resumption of the flow of the mineralizing solutions. With the dacite covering shattered and broken over the area outlined above, the mineralizing solutions from the main fault fissure found ready access to the surface and circulation was renewed. The large dacitic orebodies of the Red Top, Mohawk and Combination and the andesite orebodies of the Florence were formed. Some slight postmineral faulting occurred later which modified the position of the orebodies somewhat. In general, the ore deposits formed in this part of the district have followed down the breaks in the dacite to the main fissure, down this fissure through dacite and latite to the latite-shale contact, then down the trough formed by the fissure and shale into Atlanta ground, and no doubt at some point still deeper they will pass into the alaskite.

It is impossible to correlate the new orebody of the Jumbo Extension in its upward extremities with the main ore-zone of the Mohawk and Florence group. The bunches of ore occurring in the dacite above the main orebody are disconnected and do not coincide with any extensions of orebodies to the west. Upon entering the latite the vein or orebody becomes better defined with a northwest and southeast strike and a dip to the northeast. Down through the latite to the shale the deposit increases in size and distinctiveness until at the latite-shale contact its proportions are large and the value of the ore in gold, silver and copper high. The contact dips slightly to the northeast and the rake of the oreshoot is to the east.

Secondary Break as Mineral Resource

As stated before, I believe the immediate source of this mineral is a secondary break striking nearly east and west and extending from at least as far west as the Clermont claim and to the Commonwealth mine on the east, and connecting in depth with the main mineralizing break. I have indicated this break in Fig. 1, which is taken from Fig. 19 of Ransome's report. The evidence that this break exists is deduced from superficial examination. Its course is indicated on the surface by a gulch following quite closely the course shown on sketch. In addition to this we find small surface exposures of ore in the dacite following this gulch line, the significance of which will be explained later. Near the western end was the bunch of high-grade oxidized ore found on the Velvet claim almost directly above the present orebody, which yielded about $11,000 in 1907. Some ore was found on the Spearhead claim east of this point. Still farther east and on the Cimarron claim a small pocket of oxidized ore yielded between $5000 and $10,000. East of the Cimarron on the Commonwealth property, bunches of rich ore were found on the surface and to a depth of 100 ft. Across the gulch, on the Lone Star property from $15,000 to $20,000 of ore was extracted at or near the surface.

In the mining of this ore, it was impossible to follow the downward extension of the "pay crack." The reasonable explanation of this seems simple. The larger part of the mineralization from this secondary break took place before the intrusion of the dacite, in the latite and on the latite-shale contact. After the intrusion of the dacite the latite surface was sealed and the circulation of the mineral solutions stopped. As this part of the district was too far away to be affected by the Columbia Mountain uplift and not in line with the faulting, the breaking up of the dacite was slight. The porous mass, likened to a sponge, was missing, and ore deposition slight. The small ore deposits enumerated above were formed in small cooling cracks in the dacite, which connected through small seams with the break in the latite below. These small seams as they were formed allowed a very slight resumption of circulation of the mineral solutions. I believe that intelligent prospecting along the line of this indicated secondary break will very likely be rewarded by the exposure of other oreshoots. I also do not believe that this is the only secondary break connecting in depth with the source of the solutions. Prospecting will probably disclose others.

With the discovery of the large body of ore on the latite-shale contact, this contact has assumed too great importance in the public eye. It must be remembered that ore occurs in a very small portion of the dacite, latite and andesite formations, and that other conditions are necessary for its deposition. This is just as true of the latite-shale contact. This contact has been exposed in a number of places in the district and no ore found on it, and great care must be exercised by the investing public in placing their money where they at least have a chance.

I believe that the chances of discovering further ore in depth in the andesitic areas of McMahon Ridge and Black Butte are good, and it is quite possible that there are other places along the circular break that are mineralized and will stand intelligent prospecting. The effect of the present discoveries will be to stimulate work along these lines.

More or less familiarity with the geology of the Goldfield district as described by Ransome, Locke, Byler and others is necessary to understand the outline of the above theory as I have gone into but little detail. Fig. 1, after Ransome, gives an idea of the general circular break with Banner and Vindicator mountains as approximate center. The dotted circular line is only an approximation of the course of the main break and follows closely Ransome's area of alunitic alteration. Its actual course is masked to a large degree by the dacite intrusion. This area is no doubt the result of the circulation of waters through the main fissure, both from above and below. The secondary break is shown by a dotted line extending from a point east of the Mohawk shaft to the Commonwealth mine. The strike of this is assumed along the gulch line connecting the two points. The dip is problematic. Fig. 2 is a section through Vindicator and Banner mountains and represents the approximate position of the various rocks after the domical uplift and erosion at the highest point, and shows the faulting plane on the western edge.

Fig. 3 shows how this was further modified by the intrusion of the dacite and the upthrust of Columbia Mountain. The main fault fissure, instead of extending to the surface, is cut off by the dacite and the Columbia Mountain fault, as indicated in the sketch.

Fig. 4 after Ransome, is a cross-section through the Mohawk shaft showing the Mohawk ledge and the approximate position of the secondary break with reference to the main fault fissure and the Jumbo Extension ledge. The dip of the secondary break is entirely assumed. Fig. 5 is a portion of 4 enlarged. Fig. 6 is a copy of Byler's Sketch 1.

Designing Small Copper Smelting Plants

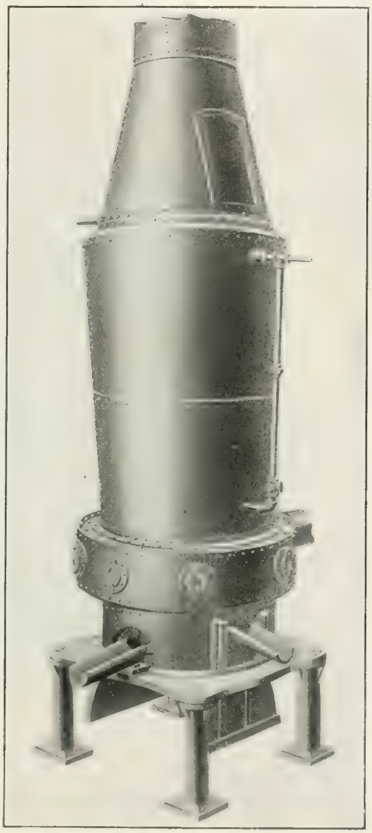
By Charles C. Christensen*

SYNOPSIS—Small smelting plants have been the means of developing important mines. The design of copper-smelting plants, ranging in capacity from 30 to 200 tons, is considered in this article.

The rôle of the small smelting plant has been an important one in the development of some of our great mines. While times have changed its importance in certain parts of this country, the small furnace is still accomplishing excellent results in the developing of small but rich properties, especially in countries where the transportation facilities are meager, as in certain parts of Mexico, Peru, Chile, and other Latin-American republics. The assistance of a consulting engineer or metallurgist is not always sought in the installation of small smelting works. A few remarks covering the main features of these small plants may therefore be of interest.

Experience in copper smelting has taught that 1 sq.ft. of area at the tuyere line of a furnace will smelt from four to six or seven tons of charge per day; about four tons for small circular furnaces, five tons for small rectangular furnaces, six tons for the larger rectangular furnaces, and up to seven tons for the extremely long furnaces. Of course, the nature of the slag made and the character of the ore might be such that a greater or less amount would be smelted, but under ordinary conditions the foregoing figures may be taken as representative.

In the design of small works, the distance from transportation and manufacturing centers must determine the number of spare parts to be ordered at the time of preliminary installation. The size of plant will also determine, to a great extent, whether assaying and sampling equipments are to be provided. At some properties assay equipment will have been installed before a smelting furnace is considered. Probably not many properties will have sampling equipment, but in this department the equipment is largely determined by the individual preference of the superintendent, so that aside from the mention of the standard Snyder, Vezin and Brunton samplers, it is hardly worth while to discuss in detail the sampling equipment. Frequently, the metallurgist in charge has to improvise a sampler; or it may be that the mine ore is sufficiently regular to depend on the mine sampling, or as frequently happens in emergencies, sampling must be dispensed with and the furnace run entirely on physical criteria.



Small Circular Water-Jacketed Furnace

The plants to be considered in the succeeding remarks range from a daily capacity of 30 to 200 tons, and as these small installations are usually in isolated places where electric or water power may be developed, no description will be given of steam power plants. The plants under consideration will be beltless plants, electrically or water-power driven.

Design of a 30-Ton Plant

A plant of 30-ton capacity naturally predicates a rich ore, as the expense of operation will be much higher per ton than in a larger plant. The operation of a small furnace also means more "grief" for the operator in keeping his furnace going than probably occurs in the running of a well regulated plant of 1000-ton or even 10,000-ton capacity.

Following the rule already mentioned in regard to the tuyere-line area necessary for a given capacity, we have for a 30-ton charge per day the following calculation: $\frac{30}{4}$ = 7.5 sq.ft. The desired hearth area would thus be found in a standard 36-in. round furnace such as shown in the accompanying illustration. Its capacity is likely to be lower than the amount mentioned, as small furnaces will only develop this speed when smelting a very favorable charge. It should also be noted that capacities mentioned refer to tons of charge, not ore; the ore smelted by a given furnace must be calculated with reference to the amount of flux necessary to make a charge that will produce a readily fusible slag.

A blower having a capacity of 1950 cu.ft. per min. at 16-oz. pressure would be required, and to operate the blower, a 12½-hp. electric motor. A 40-hp. generator would be provided to run the motor, and a dynamo for electric lighting. A 24-in. Pelton waterwheel would develop about 45 hp. with say 100 cu.ft. of water per minute under a 330-ft. head. A 10-in. pipe line would supply the power plant. If an electric-light plant is not desired, a 12½-hp. generator and a 15-hp. Pelton would suffice.

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Blast Furnace—All iron and steelwork for one round, steel water-jacketed blast furnace, measuring 36 in. in diameter at the tuyere line, complete in details as follows. The bottom of the furnace shall consist of a heavy cast-iron plate resting on four short cast-iron columns; under the bottom of the furnace shaft there shall be hinged drop doors. The water jackets shall be of steel plates with riveted and welded joints, the outside sheet of the jacket shall be $\frac{5}{16}$ in. thick and shall extend down to the bottom plate to form the curb of the furnace; the inside sheet of the jacket shall be $\frac{3}{8}$ in. thick. A sheet-steel windbox encircling the outside jacket shall have six tuyere openings into the interior of the furnace. Above the jacket shall be a $\frac{3}{16}$-in. sheet-steel hood of conical shape provided at the feed-floor level with an opening for charging the furnace. The hood is to terminate in a sheet-steel stack passing up through the roof of the building.

Forehearth—There shall be provided a matte-settling pot, 36 in. in diameter, mounted on wheels, to act as forehearth.

Slag Pots—Six cast-iron 2-cu.ft. mounted slag pots, the wheels of which shall be provided with roller bearings.

Furnace Tools—There shall be provided four standard steel-charging barrows with roller-bearing wheels; four No. 7 wheelbarrows; four No. 2 scoop shovels; four long-handled square-point shovels; four sledges with handles, two each 6-, 8- and 10-lb., respectively; 600 lb. assorted sizes of furnace bars; one six-beam charging scale; six 24x24-in. cast-iron doors and frames (in case a brick dust chamber is deemed desirable); a four-section matte pan, each section to be 4 ft. 6 in. wide by 2 ft., by $3\frac{1}{4}$ in. deep.

A 50-TON SMELTING PLANT

For smelting 50 tons of charge per day, the hearth area required would be as follows: $\frac{50}{4} = 12\frac{1}{2}$ sq.ft.; thus a 48-in. round furnace would meet the requirements. The amount of air required by the blast furnace may be found by the following rule: 260 × hearth area in square feet = cubic feet of air needed per minute. Applying the rule: $260 \times 12\frac{1}{2} = 3250$ cu.ft. of air per minute, for which a standard 13-cu.ft. positive-pressure rotary blower would be ordered; this would be operated at 250 r.p.m. and deliver air at 16-oz. pressure.

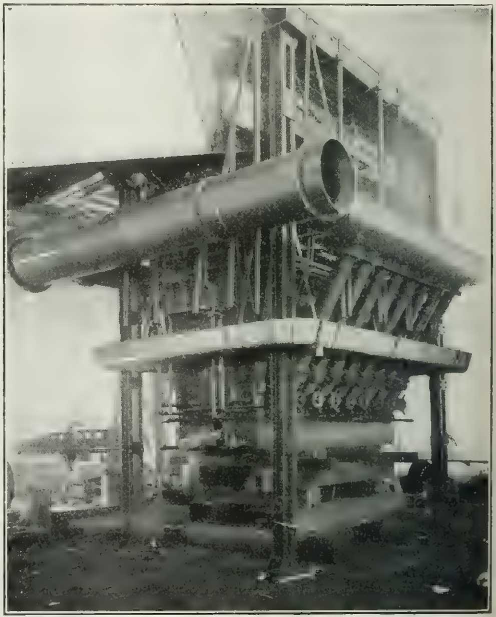
Power to run the blower for the 50-ton furnace would be figured as follows: $\frac{3250}{1000} = 3.25 \times 5 + 10\% = 18$ hp., for which a 25-hp. electric motor would be provided. The dynamo for an electric-light plant, with transmission losses added, would bring the power requirements up to $62\frac{1}{2}$ hp., say a 65-hp. generator. Adding for loss in the generator and gear friction, 77 effective horsepower must be delivered by the waterwheel. Assuming a 320-ft. head, 650 ft. of No. 12 steel pipe, 12 in. in diameter, and 200 cu.ft. of water per minute, a 3-ft. single-nozzle Pelton wheel would be required; this would deliver about 96 hp. with 187 cu.ft. of water when running at 120 revolutions.

The specifications for the blast furnace and for the accessories would be similar to those for the 36-in. furnace (except that a portable rectangular forehearth, made of 36x18x24x1-in. cast-iron plates might be provided).

THE 100-TON PLANT

To smelt 100 tons of charge per day, a furnace having the requisite hearth area would be $\frac{100}{5} = 20$ sq.ft. A standard furnace 36x84 in. at the tuyere line would have a hearth area of 21 sq.ft. and would be selected for this capacity. Applying the rule to determine the air requirements, we have: 260 × 21 sq.ft. = 5460 cu.ft. of air per minute. One of the standard positive-pressure rotary blowers delivering 33 cu.ft. per revolution and running 180 r.p.m. should deliver 5940 cu.ft. of free air per minute at 32-oz. pressure. About 5 hp. is usually figured for 1000 cu.ft. of blast for each pound of pressure; therefore, allowing 10% for friction losses, $\frac{5940}{1000} = 5.9 \times 10 + 10\% = 65$ hp. To drive this blower an 85-hp. electric motor would be connected by a cut gear and pinion.

To run the blower motor and a dynamo for an electric-light plant, embracing one hundred 16-cp. incandescent lights and four arc lights, 110 hp. will be required; but 15% should be added for loss in motor and dynamo, and 10% for loss in transmission, hence the generator should be capable of developing $137\frac{1}{2}$ hp.; say 140 hp. is needed. Allowing 15% for loss in generator and 3% loss for transmitting power by gear from waterwheel to generator, gives a total of 165 hp. to be delivered by the waterwheel. Assume 360 cu.ft. of water available per minute under 375-ft. head and 650 ft. of 16-in. steel pipe. A 4-ft. single-nozzle Pelton waterwheel, figuring 80% efficiency, would deliver 213 hp. with 358 cu.ft. of water at 370-ft. head. Using a 16-in. pipe line 650 ft. in length, the loss of head by friction would be 4 ft., leaving an effective head of 371-ft., which will give 213 hp. with 358 cu.ft. of water per minute, running the waterwheel 339 r.p.m. The maximum pressure in the pipe line will be 370 × 0.433 = 160 lb. Figuring a tensile strength of 60,000 lb. for the steel plate, a factor of safety of $3\frac{3}{4}$ and for



A 100-TON COPPER-MATTING FURNACE ASSEMBLED AT FACTORY double-riveted lap joints 0.7 efficiency, the following rule will give the thickness of plate required for the pipe line:

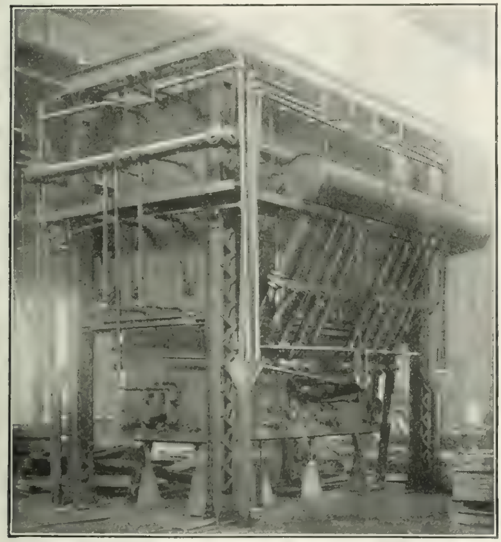
$$\frac{8\text{-}in.\ radius\ of\ pipe \times 160\text{-}lb.\ pressure}{16{,}000 \times 0.7\ efficiency} = 0.114$$

Therefore, No. 10 B.W.G. steel plate would be used for this pipe line. The waterwheel should be supplied complete with nozzle, gate, shaft, bearings and bolts for timber frame. The pipe should have double-riveted lap joints and at the intake end a cone to fit the flume and a long curve to connect with the waterwheel. The pipe should be shipped rolled, punched and nested, with necessary rivets (+ 10%) and riveting tools.

SPECIFICATIONS FOR 100-TON BLAST FURNACE

Blast Furnace—All iron and steelwork for one rectangular steel water-jacketed blast furnace, measuring 36x84 in. at the tuyere line, for matte smelting, complete in details, as follows:

The curb shall consist of a heavy cast-iron bottom plate 1 in. thick, supported by six jackscrews and stands. Resting upon the curb plate will be the steel water jackets; there shall be eight side jackets, each 21 in. wide, and four end jackets, so assembled that there shall be a smelting space of 36x84 in. at the tuyere level. The side jackets only shall be boshed, departing from the vertical 12 in. in 12 ft. The end jackets shall be provided at the bottom with a cut-out to accommodate a steel tapping jacket at the front and a cast-iron tapping block and spout at the back. (A copper water jacket or a water-cooled cast-copper block will be provided for the front end, when desired.) A water-jacketed steel-plate spout trapping the blast is usually furnished, but a trough-shaped spout, either cast iron or water jacketed, may be specified.



A 200-TON COPPER-MATTING FURNACE WITH WATER-JACKETED STEEL SPOUT

Each side jacket shall have two 4-in. diameter tuyeres, making 16 tuyeres in all; each tuyere to be provided with an independent tuyere box, air valve and connection to the bustle pipe. All jackets shall be of the best flange steel, the inside plate shall be $\frac{3}{8}$ in. thick and the outside plate $\frac{5}{16}$ in. thick; all joints shall be welded. Jackets shall be provided with handholes, flanges for inlet and outlet water connections, binder lugs, hanger and spacer brackets. The water space for all jackets shall be 5 in. The binders for the jackets shall be of the trussed vertical type, two for each jacket, allowing the removal and replacing of any single jacket without disturbing the other jackets or their binders.

A complete set of water piping, valves and fittings shall be provided for supplying cooling water and for conducting discharge water to the pockets attached to the supporting columns of the furnace. The bustle pipe shall be 14 in. in diameter, extending on both sides the whole length of the furnace, and around one end where there shall be a 20-in. inlet to which is attached a 20-in. air gate with flange ready for connection to the 20-in. blast main; the blast main shall be made of No. 14 steel and shall have a 20-in. valve at its connection with the blower.

The mantel frame will be made up of three 8-in.x18-lb. I-beams at the sides and two at the ends. This mantel frame will be supported by four trussed-steel columns 17 ft. 7 in. high. The steel columns shall be provided with face- and cap-plates, connected to the column channels by heavy angles and gussets. The I-beams shall be connected at the corner of the mantel frame by steel angles and shall be provided with cast-iron spacers between the beams, which shall be bolted together.

The charging-floor plates shall be of cast iron, 1 in. thick, and shall extend for 2 ft. on each side of the furnace. On each side of the furnace there shall be dumping plates, 1 in. thick and reinforced by ribs; these shall extend inside the charge openings and down to the top of the jackets. Above the charging floor will be erected four cast-iron corner columns and two center columns with cast-iron lintels, forming four openings for charging. A sheet-steel hood and downtake with four sheet-steel charging doors, provided with chains, wire ropes, and sheaves, will complete the superstructure. The furnace shall be erected in the shops of the contractor, and all parts fitted into place and properly marked, so that the same may be easily assembled at destination. All drawings necessary for the erection of the furnace to be furnished by the contractor.

Forehearth—The forehearth shall be 12 ft. in diameter, made of heavy steel plate with angles top and bottom and cast-iron spout; the forehearth shall be lined with firebrick (silica, magnesite, or chrome brick when low-grade fiery mattes are to be made; a portable rectangular forehearth mounted on wheels might also be used; this may be arranged for either intermittent or continuous tapping of the matte)..

Slag Cars—Two 25-cu.ft. round tilting-bowl slag cars shall be provided. The frame of the car shall be built up of steel and extended at one end to carry a platform. The axles shall run in brass journals and the wheels shall be provided with a brake. The bowl shall be readily removable from the trunnion rings and capable of being tipped by means of a screw and wormwheel at one end.

Matte Pans—A sectional matte pan, 4 ft. 6 in. wide by 20 ft. long by 3¼ in. deep shall be provided. This shall be shipped in 10 sections—two end and eight middle sections—with 1¼-in. bolts for connection. Each section shall have two pointed ribs cast in the bottom, 1½ in. high, and all corners shall be round, 3 in. radius. Molds shall be cast smooth with cored holes for bolts.

Furnace Tools—Six standard steel charging barrows with roller-bearing wheels; two 2-wheel coke-charging barrows with roller-bearing wheels; six No. 7 steel wheelbarrows; six coke forks; six No. 2 scoop shovels; six long-handled square-point shovels; six sledges with handles, two each 10, 12 and 14 lb.; 1000 lb. of assorted furnace bars; one 6-beam charging scale. For the dust chamber there shall be provided eight cast-iron 24x24-in. doors and frames. A brick or steel stack should be provided at the end of the dust chamber, the height and material depending upon local conditions.

THE 200-TON SMELTING PLANT

For the 200-ton plant, the desired tuyere area would be $\frac{200}{5} = 40$ sq.ft., which would be provided in a 42x140-in. furnace. The specifications for this furnace would be similar to those for the 100-ton furnace; a 14-ft. circular forehearth would be used, and three slag cars would be required. The air requirements per minute for the 200-ton furnace would be $260 \times 40 = 10{,}400$ cu.ft.; this volume would be supplied by a positive-pressure rotary blower, delivering 57 cu.ft. of air per revolution when operating at 185 r.p.m. under 2-lb. pressure. The horsepower required to run the blower would be $\frac{10{,}400}{1000} \times 10 + 10\% = 114$ hp., for which a 125-hp. electric motor would be provided; using the same electric-light plant as the 100-ton plant, a generator of 190 hp. will be needed, and 225 hp. must be delivered by the waterwheel. A 4-ft. single-nozzle Pelton waterwheel will develop 231 hp. with 368 cu.ft. of water per min. and 390-ft. head; a 20-in. No. 8 B.W.G. steel pipe would bring the water to the wheel. The furnace tools for the 200-ton plant would be the same as specified for the 100-ton furnace, but the quantities should be doubled.

Dredging in Philippine Islands

Dredging in the Philippines was active in 1914. The most successful company was the Gumaos, which averaged about 65,000 cu.yd. per month. The cleanups during the first half of the year were about 18,000 pesos per month, but later the cleanups increased to $30,000 and $35,000 per month. This company's dredge has operated almost uninterruptedly since its installation, about 23 months ago. It operates under rather severe conditions, on account of the clay and buried timbers contained in the gravel. While the company's dredge operated without interruption or breakdowns of any consequence, the corporate management developed friction which resulted in changes in the personnel of the board. Philippine Dredges, an Australian company, operated its dredges more or less continuously during 1914. In October, the yield for two dredges was 736 oz. of gold, and for the third, 39 oz., the last having been stopped for repairs to boiler. No. 1 dredge was started in October. The November cleanup was 701 oz.; two dredges were undergoing repairs. The Malaguit Dredging Co. operated in 1914, but was closed down for a period for repairs and changes to the boilers, screens and tables. Some important dredging interests sent drillers to the islands during the year, but the results of this exploration are not known. The gold output of the Philippines from lode and placer mining increased to $1,060,100 in 1914, an increase of about $300,000 over the production of previous year.

Copper in Germany

The following is a translation of a communication received recently by the New York office of Siemens & Halske A. G., Berlin, from Director R. Werner:

As you know, England has cut off the importation of copper by Germany and, besides, is putting pressure on the neutral countries by allowing the importation of copper by these countries only in case they pledge themselves not to reëxport it to Germany. Since the outbreak of the war England has seized every copper shipment, destined for Germany and the neutral countries of Europe, which she could get a hold of, detaining them at Gibraltar or in home ports. As a result, great economy of copper is being practiced in all branches of German industry, wherever possible, and copper is replaced by other metals, wherever that can be done.

There is enough copper in Germany to insure the manufacture of the necessary ammunition for a long time, certainly for a longer time than this war is going to last, so far as anybody can foresee. However, even the army is curtailing the use of copper. The principal consumption of copper for military purposes is brass, which is being manufactured into fuses for grenades and shrapnel. These two kinds of shells are already being manufactured with fuses made of other metals, particularly iron and steel.

A further demand for copper for military purposes is for buttons, cartridges, shellbands, facings for helmets, belt buckles, etc., which are now being manufactured of other metals, and experiments are going on all the time in this direction.

The industries engaged in the peaceful arts, naturally refusing to be brought to a standstill, have ever since been looking for ways out of this difficulty, and especially the electrical industry has already achieved the following:

(1) Standards have been established for insulated iron wire, which is already being manufactured in large quantities.

(2) Long-distance electric power transmissions are being conducted over steel cables.

(3) Cables are being manufactured of aluminum and steel instead of copper.

(4) Brass is being replaced in machinery construction to a great extent by steel and iron. Formerly, brass had been largely used in the German industry, because it can be worked better and easier, but not on account of the necessity of construction, as a great many parts can be just as well made out of iron. The same holds true for journal bearings.

(5) In the shipbuilding industry it had been a practice and tradition to make a good many parts out of massive bronze. This has been changed, and these parts are being replaced either by hollow castings of bronze or by iron or steel castings which are being coated or covered with bronze.

I could mention a good many other instances, but will restrict myself to those above to show that German industry is not at a loss for expedients, but is daily more successful in considerably reducing the consumption of copper and thus raising itself to independence from the importation of foreign copper. In this connection I wish to point out that there is a constant effort being made to increase the output of copper from our domestic mines, for instance on the part of the Mansfeld mines. In a short time those mines will certainly be in a position to meet the demand, reduced by the above mentioned substitutes, on the part of the military authorities.

As a matter of course, under the present pressure of the circumstances, the different methods of replacing copper by iron, which are rendering Germany forever independent from the importation of copper or at least considerably more independent than she has so far been, are more and more perfected, and most of them, once in vogue, will also be retained in times of peace. Thus the goal will ultimately have been reached that the consumption of copper in Germany and also in other countries, which doubtless will also adopt the new working methods, will permanently decrease so considerably that in future times of peace it will represent only a small percentage of the former consumption. Then the United States, the greatest copper-producing country, will encounter great difficulties in disposing of her large production. The German demand for copper will certainly decrease to but a small percentage of what it has been before, so that the market for an important export article of the United States will be greatly restricted.

Toward this obvious injury of her commercial interests the United States is now drifting, unless she hurries to secure by political pressure upon England the unconditional right of exporting copper to Germany or at least to neutral countries, and, therefore, she has a deep interest in exercising this political pressure, in order to obtain from England a strict guaranty that no shipment of copper destined for Europe will be seized or detained, as has been done heretofore.

* * *

The following is a German view of the copper situation, expressed in a recent issue (Dec. 19, 1914) of the weekly report of the American Association of Commerce and Trade in Berlin:

> It has been frequently said that the interruption of the copper import into Germany is a serious menace to her industries. Notwithstanding the fact that Germany produces only 2.4% of the world's copper production, which has a volume of one million tons per year, no conclusion should be formed upon the resources of copper for Germany. In the first instance, with the interruption of the import the exports also ceased, and, therefore, all the copper formerly used for exports in manufactured form is available. Furthermore, it is almost an impossibility to prevent the importation of copper entirely.
>
> The following industries have the greatest interest in the pending copper question; manufacturers of ammunition, vessels of all sorts, apparatus for breweries and distilleries, plates for copper printing, manufacturers of bronze and brass ware, electrical industries, parts for the chemical industry, etc. A distinction should be made as to the uses of copper for these various industries, referring to refined copper of the best quality and ordinary copper as is utilized in many instances for various purposes.
>
> In order to insure the supply for the army and navy, the authorities have taken the supervision into their hands in regard to the trade in refined copper. There are large quantities on hand of ordinary copper in the form of scrap copper, sufficient for the yearly demand of 8 lb. per capita, which is the same amount that is used, as per statistics, in times of peace. The German copper coins alone represent a weight of approximately 8000 tons; many copper products becoming unserviceable are being remelted and the copper used over again. It was these reserves that caused the failure of the copper corner in 1889.
>
> Germany can be considered a vast copper mine from the fact that it has been imported in enormous quantities and retained in the country in many forms of manufactured goods. According to official data, the import of copper into Germany in 1913 amounted to 220,892 tons and the German copper production to 40,278 tons in the same year[1]. The yearly copper import into Germany represents a quarter of the entire world's production and within the last 10 years nearly two million tons have been imported.
>
> In view of these facts it is not surprising that Germany, after four months of war, is in a position not only to satisfy all demands of her army and navy, but largely those of her industries.
>
> The German production of electrolytic and blister copper has multiplied in comparison with former years, and is steadily growing even during the present war. Existing plants for the production of refined and blister copper are being enlarged, as large quantities of scrap copper, filings, residues containing copper, are being delivered, attracted by good prices, material which in time of peace was largely sent to Belgium, England and France. On the other hand, copper is being replaced wherever possible by other suitable material, as for instance copper covered material is now used for many purposes, where formerly pure copper was used.

* * *

Another view is given by a correspondent of the London *Daily Chronicle* at Basel, Switzerland, who says:

> Without suggesting that the war will resolve itself into an ammunition supply duel, in which the Allies would easily win, one can conclude that the German famine in war materials will play an important part in the destinies of Europe. If the Krupps are obliged to make use of kitchen utensils and old cartridge sockets after four months of war, what will happen if peace remains hidden for another two or three years?

A Zurich journal announces, the article says, that copper for bullet and shell manufacture is so scarce that the German soldiers get rewards in the following scale for objects found on the battlefield: 2s. 6d. for a kilogram of cartridge sockets, 1s. for a shell and 1½d. for each cartridge.

All the cartridges used for rifles and quick-firing guns have copper sockets. The tremendous quantity used in the last four months has caused the issuance of an order to German soldiers to guard against any excessive use of ammunition. Some of the means taken to secure supplies of copper in Germany are related in the article. In large towns patriotic merchants are offering to the army the copper fittings on shop fronts, plates, pillars and supports; three-quarters of the cartridges supplied to the police have been commandeered by the military; kitchen utensils have been requisitioned throughout Belgium and householders are being urged to give or sell to the army everything made of copper.

One of the military branches hardest hit by the scarcity of aluminum is that of manufacturing Zeppelins, for which huge sheets of the metal are required. The ban on the exportation of aluminum by Switzerland is said to have caused the abandonment of the Zeppelin factories at Schaffhausen and Friedrichshafen.

* * *

Tungsten Ores in 1914

The production of tungsten ores in the United States during 1914 is estimated as equivalent to about 990 short tons carrying 60% of WO_3, according to the U. S. Geological Survey. This output is the smallest since 1908, when only 671 tons was produced. In 1913 the production was 1537 tons, of which 953 tons was ferberite from the Boulder field in Colorado, a quantity almost equal to that of the whole country in 1914, but the production of the Boulder field in 1914 was only 466 tons.

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[1] The discrepancy in the statistics of copper production in Germany is due to the different bases of computation. The mines of Germany produce normally about 25,000 metric tons of copper per annum. The smelters of Germany produce a further quantity of copper that is derived from imported ore. Presumably ore supplies are now cut off just as that of refined copper is. The recovery of copper from scrap and junk is, of course, limited. A more important consideration is perhaps the extent to which other metals are being used in Germany as substitutes for copper. We have heard of steel wire being put up for long distance telephone lines.—EDITOR

Prices ranged from $6.50 to $9 a "unit."

Of the various tungsten minerals, the one produced in largest quantity was sheelite, from the Atolia district, in the Mohave Desert, Calif. A little sheelite was also mined in the Deep Creek Mountains, Utah. Small quantities of both wolframite and hübnerite were shipped from Arizona, and hübnerite was produced on Patterson Creek, in the Blue Wing district, Idaho. Some wolframite was produced near Penasco, N. M., and in the Clark Mountain district, near Ivanpah, Calif.

During the year 267 tons of tungsten ore were imported, against 401 tons in 1913. During 1913 there were 661 tons of tungsten metal and ferrotungsten imported. In 1914 these imports dropped to 192 tons.

Katanga Operating Three Furnaces

After the occupation of Brussels by the Germans, part of the executive staff of the Union Minière du Haut Katanga, including Secretary Velge, was transferred from Brussels to the office of the Tanganyika Concessions, Ltd., in London, where legally constituted board meetings are now regularly held. A circular recently issued by the Union Minière du Haut Katanga states:

> The company's smelting operations in Katanga have been kept running without interruption, although copper fell rapidly from £60 to £48 per ton, but has risen since to over £56 per ton. During the period that has elapsed since war broke out, although considerable difficulties have been caused directly by the war, two furnaces have been kept running, producing 3750 tons of copper up to the end of November. The third furnace was blown in at the beginning of December in order to increase the output of copper, and in view of the rising price of the metal, it is estimated that the total production for the year will therefore not be far short of the 12,000 tons anticipated in Mr. Williams' speech to the shareholders referred to above. The copper produced from the beginning of the year up to the commencement of the war was realized at a price which shows a profit of approximately £20 per ton over the cost delivered in England. In spite of the adverse conditions affecting the metal market since the beginning of the war, the copper produced and landed in England since then has been sold at a price which shows a profit of over £10 per ton over the cost delivered in London. The company is considering the immediate erection of two further blast furnaces which have already arrived at Beira.

The directors of Tanganyika Concessions, Ltd., have announced, according to the *Financial Times,* that the company is for the time being unable to pay the debenture interest coupon due on Jan. 1; arrangements had been made with the Société Générale de Belgique in Brussels to provide the amount required, but in consequence of the war and the occupation of Brussels by the German troops, the Société Générale is at present unable to remit any funds.

Aërial Ship-Loading System at Ellamar, Alaska

Owing to a long stretch of shallow water at its shipping point, the Ellamar Mining Co. found it necessary to arrange some rapid and economical method for loading its copper ore on ships. The ore is high-grade, and is shipped to the smeltery at Tacoma, Wash.

After a study of the problem it was decided to install an aërial ropeway leading out to a loading dock at which the steamers could tie up and load easily. The tramway is of the friction-grip type, and connects the shaft with the loading dock, 2200 ft. out in the bay. It has a capacity of 200 tons an hour, the idea being to delay the ships as little as possible for loading. The buckets have a capacity of 2000 tons of ore.

Shore Station and Seaward View of the Ellamar Loading System

There are six towers of wood, five of them in shallow water, and properly protected against attacks of teredo. The track cables are 1 in. and 1⅝ in. in diameter, and of the lock-coil type. The pulling rope is ⅝-in. special steel. Six steel chutes are being installed in the loading bins, these having undercut, air-operated gates. The tramway was supplied by the Broderick & Bascom Rope Co., of St. Louis. The accompanying photographs show part of the installation.

Radium-Uranium Ratio in Carnotites

S. C. Lind and C. F. Whittemore in *Journ. Amer. Chem. Soc.,* 1914, XXXVI, 2066-2082, report that samples of carnotite representing large quantities (a few hundred pounds to several tons) of ore showed a Ra : U ratio identical with that of pitchblende, 3.33×10^{-7}, whereas those from a few pounds of ore tended to exhibit abnormal (high or low) ratios. This is explained by supposing that "transposition" of radium has occurred within the ore bed, producing local differences which are equalized in mixing large quantities of ore.

Pato Property of Oroville Dredging Company

SYNOPSIS—This South American dredging property has rejuvenated Oroville and with an adjacent area, also controlled by the Oroville company, is estimated to contain over $12,000,000 in gold. W. A. Prichard recently completed an extended investigation of these properties situated in the Nechí River valley, Colombia. He estimates a profit on present showings of over $5,000,000 for Pato, and of over $4,000,000 for the Nechí property across the river. Pato's drilled area is estimated to contain 22,419,490 cu.yd., having an average recovery value of 31.6c., and Nechí is estimated to have 6,855,900 cu.yd., averaging 71.86c. per cu.yd. Dredging costs on Pato have been reduced to about 11c. per cu.yd., and when a second dredge is added and the Nechí dredge also operated from the Pato power plant, operating costs are expected to be 7½c. per cu.yd. for Pato, and 8c for Nechí. Mr. Prichard's interesting report on the Pato property is reproduced herewith nearly in full.

As a result of 12 months' examination of the Pato property, during which time 291 Empire hand-drill prospect holes and six shafts were sunk with the object of extending and checking the prospected areas, the prospected area undredged at Oct. 1, 1914, is estimated at 528¾ acres of an average depth of 26.3 ft., and of an average recovery value of 31.6c. per cu.yd. This area is calculated to contain 22,419,490 cu.yd. of a gross value of $7,092,100. The field operating cost of dredging, on the basis of one dredge on Pato and one on Nechí, after 12 months from Oct. 1, 1914, and two on Pato after 18 months from that date, is $1,744,462; estimated net returns, $5,347,638, or £1,100,000, approximately.

Prospect of Additional Areas

Outside of the prospected areas small extensions can be expected beyond the outlined boundaries. Between the estimated area and the Nechí River there is a fair amount of low river bottom that will probably prove payable as indicated by isolated holes of payable value and by the results of the dredge which, although not reaching bedrock, returned from 15c. to 33c. per cu.yd. for a considerable stretch in its hurried progress from the point of its construction to the tested area. There are a few acres of this ground along the river too deep for the Pato dredge, for which the Nechí dredge could be utilized after exhaustion of the Nechí ground. The future dredging prospects of Pato, therefore, outside of the tested areas, while indefinite, are by no means negligible. Aside from these exceptions, no important asset has been discovered.

Gold-bearing gravel benches have at one time covered several square miles of the Pato property, but these are now much cut up and depleted by ancient workings. Only detached areas of the poorest gravel have been left. By drilling scattered prospect holes over these areas it appears that they are too small or not of sufficient value to be profitably worked on a large scale. Some of them can probably be worked at a profit on a small scale, perhaps, best by systematic tributing or leasing.

California Hill with an area of 13¾ acres and an average depth of 45½ ft. is the largest and richest of these deposits. Eight drill holes and two shafts sunk on this area give it a total of 1,008,200 cu.yd., with an average value of 19.7c. per cu.yd., making a gross value of $198,970. To work this deposit, it would be necessary to pump the water from the Nechí River, necessitating a mile of pipe line, electric driven pumps and hydraulicking equipment.

I understand that on a hydraulic property being operated higher up the river, it requires 17c. ground to pay operating expenses, although that property has a water supply under gravity head. It is obvious on this basis that the margin of profit, if any, to be obtained from California Hill is small.

However, as there appears to be a small hydraulicking deposit on the Nechí property across the river, the Pato management may later on have an opportunity to obtain figures from local operations that would justify the equipment of California Hill and the working of it as a small side issue. At present California Hill is used for camp purposes and is occupied by about $25,000 worth of buildings.

Present High Yields

The average yield of the material handled from the time the dredge reached the prospected area up to the present has been more than double the estimated average value of the dredging area.

In the drilling of this ground the drill holes were not sufficiently close together to indicate more than that the gravel was payable. In this part of the property there was only about one drill hole to each 10 acres. The richest gravel formed a strip of only about 500 ft. in width and was only penetrated by two or three holes.

That the dredge struck the richest ground first was due to the accidental lay of the land. There was no other approach to the prospected area from the river when the boat was erected. The dredge has been kept in this best portion for systematic working as well as for sound financial reasons. Higher than average yields are expected to continue until in the spring of 1915, when lower average yields may be expected.

The yardage that has been dredged since Oct. 1, 1914, and what will be dredged in the coming months, of this high value is such a small part of the total prospected area that the general average of the remainder will not be greatly reduced as might be feared. Wide variations in the yield may always be expected and no individual prospect hole must be taken as the average of any particular piece of gravel. It is only in the aggregate that drilling may approximate the average of an area.

Dredge-Operating Costs

The yardage capacity of the Pato dredge varies with the amount of clay in the material handled and the depth and character of the gravel. During the months of July and August, 1914, the material handled was 128,488 and 139, 547 cu.yd., respectively. The dredge was working under fairly normal conditions. These were the first months of operation with the dredge-pond water in a condition of positive control by means of a dam across Pato Creek, completed in July, 1914. Prior to this time the dredge depended upon the elements, resulting in muddy pond water during the rainy periods and a total stoppage in the dry periods. The muddy water caused enormous wear on pumps, etc., with heavy losses of running time and heavy cost for renewals and repairs.

The high average operating cost of 17.71c. per cu.yd. for the 11 months, from Oct. 1, 1913, to Aug. 31, 1914, was due chiefly to this cause. For July and August the cost per cubic yard was 10.25 and 11.52c., respectively, including some extraordinary expenses.

In addition to the diverting dam across Pato Creek for supplying pond water to the low ground, a pumping plant is being installed to aid in dredging the higher ground. With proper engineering care there should never again be serious trouble or stoppage on account of muddy pond water.

It appears from recent operations that the average dredge capacity is over 125,000 cu.yd. per month, but to be conservative I have estimated the operating cost on the basis of an average monthly yardage of 100,000 cu.yd. With one dredge bearing all of the overhead expense of management, power, etc., the field operating costs should never exceed 11c. per cu.yd., exclusive of bullion realization. After the Nechí dredge begins operating, bearing its proportion of the overhead expenses, the costs for Pato should not exceed 8c. per yd., exclusive of bullion expense. With two dredges on Pato, and one on Nechí the cost for Pato should be about 7½c. per yd., inclusive of bullion realization, which amounts to about 0.7c. per yd. on a yield of 32c., or 1.5c. on a yield of 70c. per cubic yard.

In computing the net returns, the cost inclusive of bullion expenses, is taken at 12c. up to the period when the Nechí dredge should be running; 9c. thenceforward to the probable beginning of operations of a second dredge on Pato, which I am assuming will be ordered, and 7½c. per cu.yd. during the remaining life of the property. I believe these figures are conservative, and give some leeway for accidents, changes of management, etc., incidental to operating in the tropics. This estimated cost is built up in the following manner: Running expense, $3600 per month; current repairs, $3600; clearing 4.8 acres at $250, $1200; water supply and pond expenses, $1500; electric power, $800; general expense, $2900; bullion expense at 0.7c. per yd., $1400. Two dredges would therefore dig 200,000 cu.yd. for a cost of $15,000 per month, or 7½c. per cubic yard.

Another Dredge Recommended

It would require 20 years, more or less, for the present dredge to exhaust the estimated area of dredging ground on the Pato property. It is not likely that the dredge will last that long, even without taking into account the probable additional ground. Aside from this, I believe that a direct saving of 1½c. per yd. to Pato and 1c. per yd. to Nechí could be made by distributing the fixed expenses over three dredges instead of two. This would mean on 20,000,000 yd. $300,000 to Pato, and on 6,500,000 yd., $65,000 to Nechí.

If we compute the interest at 5%, say on $2,000,000 profit, which with one dredge would probably be the minimum remaining in the Pato property at the end of 10 years, and if we reduce the principal 10% each year, we shall have $500,000 in interest. It appears from these figures that a new dredge that would cost erected not over $250,000 would bring an added return of about $850,000 to the Pato and Nechí companies.

An advantage can be gained by adding a dredge at this particular time in that the construction could follow upon the heels of the Nechí dredge. This would make a considerable saving in being able to continue the employment of the skilled mechanics now on the ground who were taken down at considerable expense and in the use of the building arrangements, etc., prepared at considerable expense for the erection of the Nechí dredge. I therefore recommend you to add another dredge to the Pato property as soon as possible. The new dredge should be of the same capacity as the present Pato dredge with interchangeable parts, as much as possible, to avoid carrying two different sets of spares.

Particulars of Prospecting

Where gravel deposits extend several feet below the permanent water level, as those of the dredging areas of Pato, there is no method commercially available for accurately determining their gold contents. Drilling, which under these circumstances is the most accurate, gives only approximate results that are subject to wide variations owing to the personal variation of method, carelessness in drilling and panning, varying physical properties of the deposit, and to the economic impracticability of drilling holes sufficiently close together.

Having driven a tube and pumped the gravel out of it foot by foot to bedrock and panned the gravel so extracted and weighed its gold contents, we desire to know just what proportion of the displaced gravel and gold entered the tube and subsequently the pump, and what proportion was pushed aside by the tube in entering the ground and how much was pushed out of the tube in pumping. This proportion varies in different sections of the hole and also in the different holes, more especially where the physical character of the deposit is different. Many other variable quantities common to all types of drills enter into the process, but suffice it to say that we can only assume an average factor or proportion which is reliable to within perhaps 50% of the true average figure on any individual drillhole.

Drilling Factor

In the early drilling of the Pato property a theoretical factor arrived at in an entirely different field was necessarily used. For this examination, we had the advantage of a dredge in operation and under our own direction dredged over an area where we had previously drilled 17 holes. Carefully calculating the area and cubic yards represented by each hole and knowing the actual yardage and gold yield by the dredge, we determined mathematically the factor for the drill holes which would give the actual value recovered by the dredge. This factor works out at 387 ft. of hole for 1 cu.yd. of gravel removed.

This factor or proportion was then used for all of the holes drilled under my supervision on the Pato property. I further checked six of my drill holes by sinking shafts alongside. In this checking I compared the dry weight of the gravel from both the shaft and drill holes and determined the drill factor for each case on that basis. In those shafts where there were no water difficulties, the factor obtained in this way checked up closely with the factor obtained by dredging. In consequence, the drill results that have been obtained on the Pato ground during this examination are figured more scientifically than is usually possible or considered necessary.

In calculating the present dredging area of Pato, I have used the results of 89 holes drilled under my supervision, 33 drilled under C. H. Munro, six drilled by A. P. Rogers and one drilled by E. B. Kimball.

In estimating the yardage, a circle of uniform size was drawn on the map about each hole, and the area included in the polygon formed by joining the points of intersection of the circles was taken as the area corresponding to that hole. That area and the depth and value of that hole were used for determining the cubic yardage and gross corresponding to the hole. These figures thus obtained separately for each hole were then summed up to obtain the total area, yardage and value. In this manner, errors of calculating results are not introduced by varying distances between drill holes of widely different values and depths.

Fineness of Gold

By assay of the gold recovered from the drillholes we found that the bullion fineness varied from 848 to 937. The gold of greatest fineness is the thin, flaky gold from California Hill, while the gold of lowest fineness is from certain parts of the low ground in the dredging area where the grains are coarser. I have used an average fineness for Pato of 871 or $18 per oz., which corresponds to the usual fineness of the bullion recovered by the dredge and is about the average of several assays of drill samples. Mr. Munro used a fineness of 897 in his calculations, and Mr. Rogers used 850. These figures are all within the range of accuracy in drilling, and within the range of bullion variation, as determined by dredging and by assay.

Former Reports

Previous to the purchase of the Pato property several years ago A. P. Rogers drilled with a Cyclone steam drill 16 holes and sunk four shafts and made a report for the vendors. Later, C. H. Munro drilled 45 holes with a Keystone steam drill and 37 holes with the Cyclone drill. Afterwards E. B. Kimball drilled two holes checking Mr. Roger's holes and two holes to check Mr. Munro's holes.

With an Empire drill, I checked fairly closely, but with slightly higher results, two of the Munro Keystone holes, one of which was also a Kimball check hole. The Empire drill, however, gave much higher results in four holes drilled to check four of the Cyclone drill holes. I believe, therefore, that in using the Cyclone holes in my estimate as reported by Munro I have introduced an added factor of conservatism. Considering the circumstances under which they were made and in the light of recent and more exhaustive examination, I consider that the early prospecting reports on the property are very creditable. The errors in estimating the ground were made on the safe side and their prophecies as to future extensions of the dredgeable areas have been borne out by further examination.

The most serious criticism that has been aimed at the early reports is with reference to the free washing of the ground. With regard to this point, the dredge difficulties that have been attributed to clay were mostly due to the lack of provision for sufficient pond water. There are some clay difficulties, but they are not so serious as has been thought. By light digging in the clay beds, frequently encountered, the present dredge crew is successfully getting through the bad places without clogging the buckets. It is, however, always necessary to have a negro at the hopper with a bar to assist the material out of the buckets.

Geology and Character of Ground

The Pato and Nechí properties lie in an oval basin surrounded by crystalline rocks. This basin has been cut through by the Nechí River, which separates the two properties. Within this basin are flat tables of gravel deposits whose edges form terraces. The bedrock of each of these gravel benches is clay, either red or blue, according to exposure, in which are included beds of peat or brown coal. Each of these gravel benches is a reconcentration of the bench above it and represents a former stationary level of the river.

California Hill is a remnant of the upper bench. Below this was a lower bench the bedrock of which stood above water level. These two benches have been nearly removed by erosion and ancient workings. The third bench partly submerged forms the greater portion of the higher dredging ground. The fourth bench is that being dredged now and is nearly submerged. The fifth bench, wholly submerged and covered with recent river sand, is the dredging area of the Nechí and some of the Pato not thoroughly prospected. Below this on the Nechí River bank we know from Mr. Rogers' drill hole No. 1 that there is still a sixth layer of gold-bearing gravel between the depths of 66 and 74 ft. We know nothing yet about what lies below this.

The outer and higher bench gravel lies on the clay which lies directly upon the rim rock; but toward the center of the basin, where we encounter the lower layers of gravel, we know nothing about what lies under the clay which we assume for dredging purposes to be bedrock. In this connection I would recommend that the management dig into the bedrock from time to time with the dredge on the chance that the supposed bedrock may be in places only an intermediate thin seam of clay.

Since each successive gravel bench as we go downward is richer, it is possible that deep drilling may disclose ground rich enough for successful drift mining. I do not, however, attach much importance to this possibility.

The gold of the Pato property has originally been brought in from the surrounding hills, all of which are auriferous, by the small storm streams. By the successive concentration described above, we now have the deposits of economic value.

In each concentration, part of the finer grained gold has been floated away so that the average grain of the lower deposits is fairly coarse, although nuggets or rounded grains are seldom dug up. The gold is of fairly uniform-sized thin flakes. It is easily saved by amalgamation. There is but little black sand, of which the most valuable portion is caught by the dredge and saved for further treatment.

Equipment

The Pato property is equipped with its own hydro-electric power plant, one 8½-cu.ft. dredge, an ice plant, and a complete repair shop.

The power plant consists of a dam built of 17,000 cu.yd. of concrete which supplies water under a head of 87 ft. to three 600-hp. Pelton-Francis turbines which drive three separate electrical generators of 300 kw. each.

I have made a graphical chart of the daily records of power used and of the power unused over the period from Oct. 1, 1913, to Oct. 1, 1914, which is the driest 12 months in the last six years of which a rainfall record has been kept. These calculations indicate that without allowing for reservoir storage, there was always sufficient power to operate one dredge; that for 36 days out of the year the power would have fallen short of supplying two dredges, and for 86 days it would have fallen short of supplying three dredges. Such shortages would, no doubt, have been wholly or nearly made up by reservoir storage repleted by the occasional rains, so that one may count on at least two dredges and possibly three running continuously during average years. With three dredges in operation, it may be necessary to close each one in turn from two weeks to a month. Such a stoppage, moreover, would be advantageous for general repairs.

The Pato dredge is an all-steel, close-connected, 8½-cu.ft. bucket dredge. Aside from an obvious mistake in design of the hull, which has caused it to sink twice, the dredge has proved satisfactory. The mistake in the hull is being remedied by the addition of pontoons.

REPAIR SHOPS

Provision has been made on the property for repairing the largest parts of the dredge. The large tools in the machine shop are:

1 20-in., 16-ft. lathe.
1 3-in. radial drill.
1 16-in. shaper.
1 600-lb. steam hammer.
1 250-ton hydraulic press.
1 50x25-in. 2-chuck, 16-ft. lathe.
1 36-in. punch and shears.
1 36-in., 10-ft. heavy planer.
1 Acetylene welding-and-cutting outfit.

The woodworking shops contain:

1 50-in. portable sawmill.
1 54-in. sawmill.
1 7/8-in. band saw.
1 20-in. double-surface planer.

The property is well equipped with construction tools such as derricks, rockbreaker, cement mixers, air compressors, winches, etc. There is also a large gasoline launch, tram lines, warehouses, bullion laboratory, etc.

The skilled dredge laborers are mostly drawn from the dredging fields of America, and come out under contract of one or two years, while the mechanics and clerical staff are of several nationalities including a number of Colombians. The common laborers are mostly natives from the lowlands of Colombia and negroes from the British Islands off the coast. These laborers are very inefficient and independent, and considerable skill is required in handling them. They are worked on contract as far as possible.

CLIMATIC AND LIVING CONDITIONS

The days are disagreeably hot and steamy, the temperature ranging between 70 and 90° F. It rarely rains in the daytime. The nights and early mornings are cool and pleasant, except for parasitic and insect pests of many descriptions. During nine months of the year it rains nearly every night and at times as much as 9½ in. in a few hours.

The camps for the white men are made comfortable by means of mosquito-proof houses, electric fans and ice water. Owing to the necessity for careful and sanitary living, the percentage of sickness among the white employees is lower than in some of the ideal climates of the world. Typhoid and dysentery, so deadly in Colombian towns, are unknown at Pato.

The company has a resident physician who looks after the health of employees and the sanitation of the camp. Good living quarters and food are provided for the white employees. The natives suffer a great deal from malaria, blackwater fever and skin diseases, owing to their insanitary mode of living, poor food and excessive use of rum.

GOVERNMENTAL RELATIONS

The Colombian government, both state and national, is making a laudable effort to promote and foster the development of its natural resources by foreign capital. However, a peculiarity in its laws gives almost sovereign power to the municipalities in the matter of local administration and taxation. Much of the good intent of the government is thereby undone through the tendency of the municipality to fatten on the industry that is unfortunate enough to become established within its jurisdiction. The Pato property is continually persecuted by the municipality of Zaragoza by the levy of exorbitant duties both legal and illegal so that it is necessary to keep a salaried native lawyer on the property, another at Remedios, the head of the district, and another at Medellin, the state capital.

* * *

Ninth Perkin Medal Presentation

On Jan. 22, Dr. Edward Weston, of Newark, N. J., was presented with the ninth impression of the Perkin medal, given for distinguished service in chemistry and electrochemistry. The ceremony took place at the Chemists' Club, Dr. G. W. Thompson presiding. In his introductory speech he stated that progress in electrochemistry is dependent on the ability to measure current, and in general, "efficiency" means efficiency in the use of power, which can only be obtained by convenient methods of measurement. These Doctor Weston had made possible. However, his claim on them was more direct, being based on his chemical work itself, as would be shown later.

Doctor Chandler, as senior past-president of the Society of Chemical Industry, then spoke, giving a brief biography of Doctor Weston, of whom his parents had vainly attempted to make either a dentist or a physician, but who, following his own inclinations, came to America at the age of 20 to practice as a chemist.

In his first weeks here, Doctor Weston visited him, Doctor Chandler, in search of a position, but he was unable to do more than to give letters of introduction, one of which got Weston work manufacturing photographic chemicals, chiefly pyroxylin. While in this position he saw an advertisement for a man having some knowledge of chemistry and electricity, particularly electroplating. He applied for and was offered this position, his new employer wishing him to come immediately. He was unwilling to leave his then employer in the lurch, so offered temporarily to work making photographic chemicals by day and electroplating by night. [This habit of a 20-hr. working day he still continues.—EDITOR.]

The plating establishment was soon straightened out. To eliminate plating by electricity from batteries, Weston developed the plater's dynamo, went into dynamo building generally, electric lighting and at length into the building of electrical measuring instruments. Having briefly reviewed his career, Doctor Chandler then presented the medal.

Doctor Weston spoke briefly in reply, thanking Doctor Chandler and the Society, and saying that although he had apparently wandered far from chemical realms, yet he felt that his work had been rendered possible by the application to all subjects of the analytical reasoning and the breadth of view engendered by chemical training, and that he felt he had always been a chemist at heart. He also again thanked Doctor Chandler for his letter of introduction of 45 years before. L. H. Baekland followed him, giving some of the features of the chemical work in the old wet-plate days, discussing the chemistry of electroplating, the development of resistance alloys of no or minus temperature coefficient, the flaming arc, the hydrocarbon filament-flashing process, the structureless carbon filament, the Weston standard cell and others of Doctor Weston's inventions.

Doctor Weston then spoke again, giving at greater length the details of the inventions, and of some of the steps leading to them. The hydrocarbon filament-flashing process was developed in the early days of the electric light. No mechanical process could manufacture a filament approximately 6 in. long, weighing about 7200 to the ounce, of uniform resistance. The weak spots broke first. On heating these in an atmosphere of hydrocarbon vapor, the vapor was decomposed and carbon deposited. The weak spots, which were hottest, got the most carbon until uniform resistance was obtained.

In attempting to obtain a uniform pyroxylin film to make the structureless carbon filament, a still further advance, the solvents were ether and alcohol, and when these were allowed to evaporate in air the film always "checked" and pitted. This was finally avoided by lowering the speed of evaporation by keeping the plates in an atmosphere of air mixed with the fumes of the solvent which were made to escape very slowly. From these nitrocellulose films the nitro-group was eliminated by ammonium sulph-hydrate, the film cut to filaments, which were then heated to form the carbon filaments. These filaments were almost uniform in their own length when produced, but were subjected to the flashing process, partly to equalize small differences between different filaments, partly to produce a graphite coating on the carbon. But space forbids describing at length the many chemical and physical-chemical problems here encountered.

He also spoke of the importance of examining even fundamental definitions. Thus in our boyhood textbooks one of the properties by which metals and mixtures of metals could be told was by the rise in their electric resistance upon heating. Nevertheless he had developed alloys which had no temperature coefficient, and others which had a minus coefficient, i.e., the resistance fell with increase of temperature.

Another case was even more amusing, for several years after he had actually begun running his first dynamos, lighting a number of arc lights in series, several distinguished physicists proved that it was *impossible* of accomplishment. One of them gave an absolute mathematical demonstration of this. But as Doctor Weston remarked, "What are textbook theories when confronted with facts?"

The chemistry of the flaming-arc lamp, the cored electrode for arc lights, the Weston cell, and of electroplating and electrolytic refining were also touched on. In the last he had also had to work against an established belief, as it was held a kilowatt-hour could only deposit so much metal, regardless of electrode spacing, composition of electrolyte, or any other factors. Yet the efficiency of electrodeposition had been enormously improved in spite of the theorists. In short, it could be easily seen that one of earlier speakers was well within bounds in saying that the medal was equally deserved for services to chemistry, to electricity, or to electrochemistry.

A. L. Queneau

The war looks nearer to us Americans when we know that some of our own folks are at the front. Mr. Queneau lived so long with us that we claim him as one of us, though he never relinquished his French citizenship. After completing his courses at home he studied at Columbia and then became connected with the New Jersey Zinc Co., by which he was employed several years. He went to Broken Hill for the Zinc Corporation, and returning to the United States, became manager of the Bartlesville Zinc Co., in Oklahoma. Resigning from that position he resided for several years in Philadelphia, became interested in electric zinc smelting and went to Belgium to develop his process. There he was when the war broke out and he had to drop everything to rejoin his regiment.

A. L. Queneau

Up to November he was with the heavy artillery at Soissons. Then he was detailed to act as interpreter with the British forces, a useful employment of him inasmuch as he speaks English better than most of us, besides which he is a brilliant engineer. The accompanying photograph was taken of him at the British base at Havre at about Christmas. He wrote that he was about to leave for the front again.

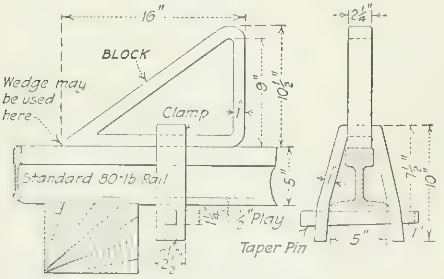
Details of Practical Mining

Steam-Shovel Block

By L. B. Pringle*

The block-and-clamp device herein described was developed and adopted for its steam shovels by the Oliver Iron Mining Co. ,Hibbing, Minn. It is of simple construction, is quickly and cheaply made, is easy to handle, and has proved a success. The block is placed against the hind wheel of the shovel and prevents any backward movement of the machine as the dipper gouges into the dirt, or when the shovel is working on an up-grade.

The material for block, clamp and pin is wrought iron. The block is made from 1x2¼-in. stock bent into a right-angled triangle with dimensions as shown. The clamp is of 1x2½-in. stock, made to fit snug over the rail and through the block. The holes in the sides of the clamp are cut to fit a pin 1x1¼-in. tapered to 1x1 in. and 10 in. long. The distance from the top of the clamp to the upper edge of the holes is 7½ in., thus allowing ½-in. play beneath the bottom of the rail.



Assembled Parts of Steam Shovel Block

There is approximately 10 in. of longitudinal play between the clamp and the inner edges of the block. This permits the clamp to be placed against a tie, and the block so adjusted as to have its working face over the tie or beyond it.

If the block is inclined to slip, a small iron or wooden wedge inserted between the block and rail at the rear end will make it secure. Unless the shovel is unusually large or is working in extremely hard ground or is on a maximum up-grade, one block and clamp will be sufficient.

First-Aid Jar

A new first-aid package has been brought out by the National Affiliated Safety Organizations. It is a glass jar protected on the outside by a wire cage and made tight by clipping the glass cover down against a rubber gasket. The jar is 9½ in. in diameter and 6 in. high. The handle is molded in the cover. The first-aid materials are arranged in the jar so as to be quickly accessible and always visible. The chief advantages claimed for the jar are its convenience and its cleanliness. Undoubtedly for most industries the device is highly serviceable. It is questionable whether it is available for underground use, inasmuch as it is about impossible to keep glass from breaking underground and the protection used in this instance is quite inadequate, although the protection together with the fact that the glass is annealed, probably renders the jar safe against breaking on the surface. It would appear that the same design worked out in enameled ware of some sort would make an excellent container for an underground first-aid outfit. It might be, however, that this would prove too expensive. The jar is described in *N. F. A. Safety Bulletin,* of Nov. 1, 1913.

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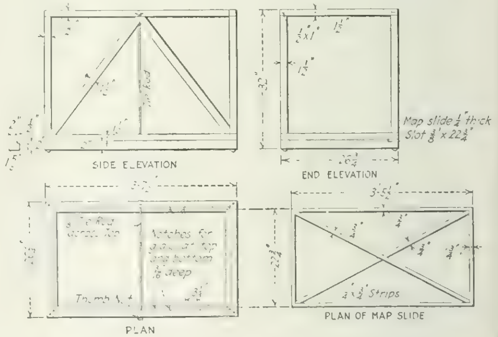
Mine Model of Vertical Glass Plates

A mine model to be of the greatest value must be simple in construction, so that it can be easily taken apart to make additions, easily movable, and so designed that the greatest possible amount of information can be placed upon it, both in plan and section, and this information seen as a whole without removing any portion of the model. Such a model is here described.



Framework of Model and Slide

The illustration shows the frame. The bottom pieces are 2x2½-in. and the others are 1½x1½-in. wood strips. The upper pieces are mortised together and secured by screws, as shown, also braced by 1½x1½-in. pieces and held by tie-rods. Vertical slots, cut on the inside of the upper and lower horizontal 1½-in. side pieces hold panes of glass, upon which sections of the mine workings are drawn. The upper side of one bottom end piece is cut out to permit the passage of the map slide, and the other bottom pieces are grooved, as shown in section, to support the slide. This map slide is made of ¾x¼-in. wood strips, light to handle but strong enough to permit tacking the mine map upon it. A handle aids in drawing the slide out. Casters on the bottom of the frame facilitate the moving of the model about; with all its glass sections in place, two men can easily lift it. The slots to hold the glass are shallow, in order that as little area of glass and map may be wasted as possible, and since the frame will naturally spring a little with the weight of glass and from weathering, the tie-rod at the top is threaded at one end and a thumbnut placed on it to take up any slack between glass and frame.

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*Formerly engineer with Oliver Iron Mining Co., Hibbing, Minn.

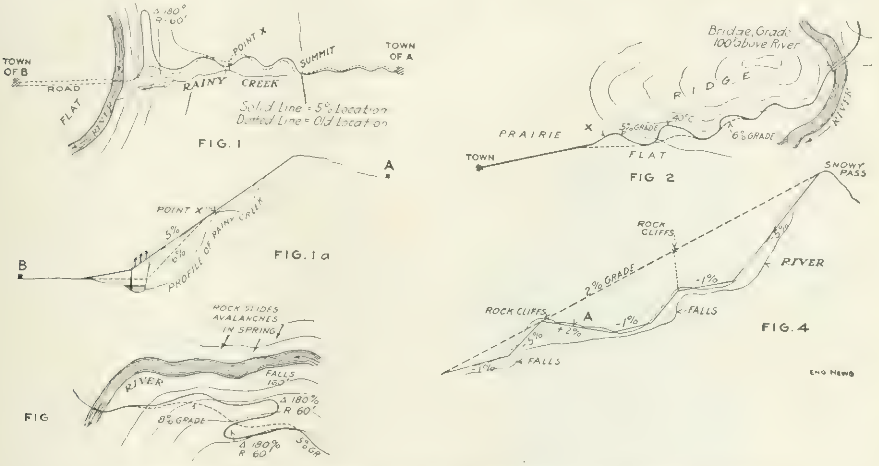
The model itself consists of a series of parallel, vertical glass plates, upon which the various mine workings, geological features, etc., are drawn. These plates should be of the best grade of window glass. If the regularly spaced vertical sections do not include all the workings, such as important raises, etc., these may be projected to the nearest section, always projecting in one direction to avoid confusion; the projections may be drawn in dotted or broken lines to distinguish them. In special cases, as for a working shaft, it may be desirable to add an extra section even if irregularly spaced. The mine workings, rocks, ore (broken or in place), faults, dikes, surface, etc., can be shown by lines, conventional designs and colors. Sections are first made on detail paper, the glass plates laid over these and the work traced. In this way the work is easily kept uptodate, and, if a slide is accidentally broken, a new one is easily traced. The marking on the glass may be done with colored picture varnish and linseed oil, oil colors, water colors, or, if the glass is first cleaned with alcohol, lines may be ruled with pen and drawing ink. If a crow quill pen is used for the ruling, the ink is less liable to run. Black waterproof drawing ink for the outlines of mine workings and water colors and conventional designs in ink for geological features make an effective combination; they are also easily applied and removed. The mine map on tracing cloth fastened to the slide with thumb-tacks is as easily removed and corrected as one of the sections.

The dimensions given in the illustration are for a model made to the scale of 1 in. equals 30 ft., and will include a block of ground 1200 ft. long, 700 ft. wide and 900 ft. deep vertically. These dimensions may be varied to suit different conditions and scales; intermediate sections are easily added. When not in use, the model should be covered by a black-cloth hood to keep it clean and protect it from flies.

"Dont's" in Mountain Road Location

In *Engineering News*, F. W. Harris, recently locating engineer for the Washington state highway commission, gives some illustrations of mistakes made in locating highways in mountain country. He argues against the attempt to maintain a uniform 5% grade.

In Fig. 1 the old road, dotted, is on a varying grade of 6% and 7%. The new road is located on a 5% grade. The loop shown was necessary to develop down to the bridge site, for the other side of the river was flat. Poor alignment was not the worst feature, however, for at the point *x* the road was almost in the creek, and at the bottom of a narrow ravine, where in November conditions bade fair to rival the Grand Canal. Had a 5% grade been used at the point *x*, and a thousand feet of slack grade used there, thence descending on a maximum 6% grade, the loop would have been eliminated and the quantities on the trestle approach to the bridge across the flat would have been cut in half.



Examples of Uneconomical Highway Location in Mountain Country

In Fig. 2 the elevation at the bridge site was fixed and the ridge across was followed down to the flat. The heavy curvature was used to develop distance as the support ended at *x*. Here one-half mile of 6% grade on the ridge would have eliminated 180° of central angle and two 40° curves.

Fig. 3 shows a double-loop development on a steep mountain side to maintain a 5% grade. The development is roughly three miles in length. Two miles of 8% would have cut out the loops. One fall of 160 ft. in the river shows how steep the descent is. To cut out the loops a line was run on the other side of the river, but this was only jumping from the frying pan into the fire, for that side was bare and rock slides and avalanches came down in the months of March and April.

Fig. 4 shows an approach to a typical mountain pass.

By breaking grade and following the benches, the cheapest and straightest line is secured. Frequently these benches ascend in elevation and an adverse grade at point *A* is used. It is better to use an adverse grade than to continue on a straight descending grade and develop around those points. Adverse grades should be frequently used to secure a tangent on the ground. It will be found rarely necessary to exceed rising 20 ft. above the original surface under such conditions. Grade should be broken every 300 or 400 ft. if necessary.

One of the great advantages of a broken grade with an 8% maximum is that it enables the locating engineer to dodge costly construction work such as rock cliffs, bad slides and swamps. A road surveyed on a 2% maximum grade in Fig. 4 would allow the locating engineer no opportunity to avoid costly construction. Even in the roughest mountain country half the highway will probably have less than 3% grades.

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Rock-Dust Sampler

By Otto Ruhl*

The U. S. Bureau of Mines in its investigation of the rock-dust problem in metal mines has found the devices hitherto used in sampling the mine air for dust to be not wholly satisfactory. To remedy this, Edwin Higgins has devised an apparatus which seems to offer a satisfactory solution to the problem.

The Dust Sampler in Operation

The device was first used by him in his examination of the mines in the Joplin district. It consists of the following essential parts: (1) A glass bulb for catching the dust. This bulb is partially filled with graulated sugar. George A. Burrell, after considerable investigation and research, agrees with the South African authorities that granulated sugar is the most satisfactory medium for intercepting rock dust. The granulated sugar is prevented from passing into the sampling device by means of a perforated glass plate inserted in the bottom of the glass bulb. (2) A mouthpiece of an oxygen-breathing apparatus, with inhalation and exhalation tubes attached and including the valves which cause the air to flow in the proper direction. The mouthpiece is kept in place by the regulation cap, to which straps are attached. (3) A nose clip to prevent air from passing in or out of the nostrils. (4) A Draeger liter-bag, having a capacity of 35 liters.

The purpose of the device is to determine what weight of rock dust may be contained in a given volume of air. To take a sample, the apparatus is adjusted in the mouth with bulb and liter-bag attached; the nose clip is made tight on the nose and the sampler breathes naturally, the inhaled air passing through the sample bulb, where the dust is extracted, and the exhaled air passing into the liter-bag where it may be measured. After the sample is taken the sugar is removed from the bulb, dissolved, and the remaining dust collected and weighed. Thus the weight of dust contained in a measured volume of air is obtainable. The photograph shows the apparatus in use.

As to the accuracy of this device, it is probable that the exhaled air from the lungs occupies about $^1/_{50}$ less volume than the air that is inhaled. This is not an appreciable error. While the fact that from 35 to 40 liters of air may be taken at one sampling makes for greater accuracy, there is a small source of error in determining at just what point the liter-bag may be considered full of air. This is probably the most serious source of error, but it may be reduced to the minimum by practice in using the device. On the whole, it is believed that the device on account of the large volume of the sample it will take is accurate to within 2 or 3% under any conditions.

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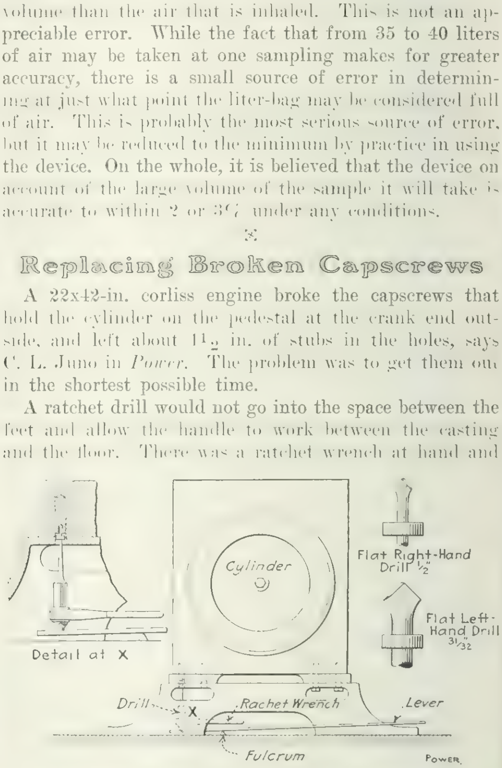
Replacing Broken Capscrews

A 22x42-in. corliss engine broke the capscrews that hold the cylinder on the pedestal at the crank end outside, and left about $1\frac{1}{2}$ in. of stubs in the holes, says C. L. Juno in *Power*. The problem was to get them out in the shortest possible time.

A ratchet drill would not go into the space between the feet and allow the handle to work between the casting and the floor. There was a ratchet wrench at hand and two drills were forged with square shanks to fit it. One drill was $\frac{1}{2}$ in. and the other $\frac{31}{32}$ in. (the bolts were $1\frac{1}{8}$ in.). The $\frac{1}{2}$-in. drill was used first, then the $\frac{31}{32}$-in., which was ground to turn to the left. The object was to have the drill tend to loosen the stubs instead of tightening them.



Power.

Drill in a Close Place

After about an inch had been drilled with the $\frac{31}{32}$-in. drill, the stub backed out, leaving a nice, clean thread. A long bar and fulcrum were used for the drill feed. The illustration shows the layout.

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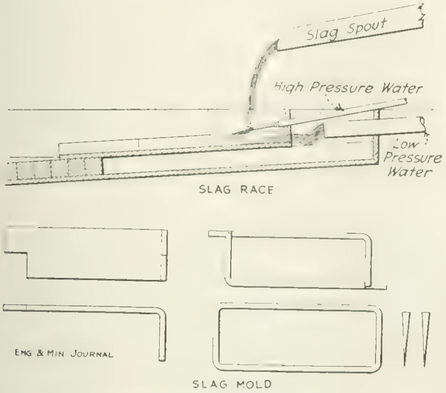
*Ruhl & Shanklin, mining and civil engineers, Joplin, Mo.

Details of Milling and Smelting

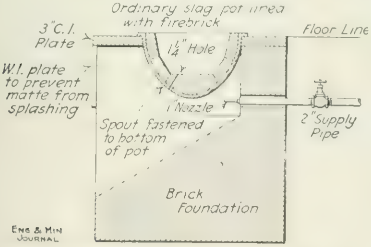
Slag- and Matte-Granulating Devices

By Percy E. Barbour*

Two granulating devices are shown herewith, both of which have worked satisfactorily at a small smelting plant. The first was used for slag and the second for matte. The slag race is lined with slag blocks made with the molds shown. The slag spout, nozzle and flushing launder and their functions are clearly indicated in the accompanying sketch. The matte granulator uses an old slag pot lined with firebrick and set in a brick foundation. There is a hole in the bottom of the pot through which the matte flows and a nozzle directs the stream of water into it as it falls. The deflecting apron of the foundation diverts the granulated matte to the receiving car.



Slag Race Made of Slag Blocks


Ordinary slag pot lined with firebrick
3" C.I. Plate
Floor Line
1¼" Hole
W.I. plate to prevent matte from splashing
Nozzle
2" Supply Pipe
Spout fastened to bottom of pot
Brick Foundation
ENG & MIN JOURNAL

Arrangement for Matte Granulation

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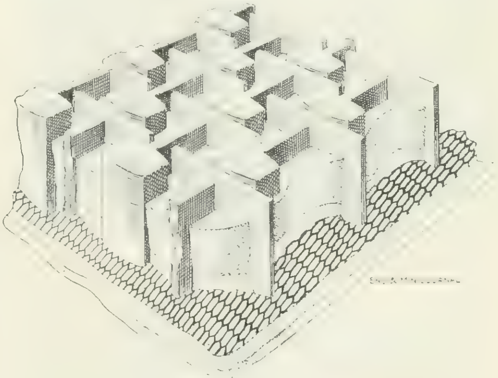
The Use of Lime Water for Precipitating Copper from Leaching Solutions has been patented by George B. Chittenden, of Chilito, Ariz. (U. S. pat. 1,104,110). This is claimed to be a great improvement on precipitation by milk of lime, iron, or similar reagents.

Britannia Tube-Mill Lining

A novel use of rails, so often useless adjuncts to a mine and mill scrap heap, has been suggested in a form of tube mill lining, invented by Henry Berquist, of Britannia Beach, B. C. The Hardinge Conical Mill Co. is bringing out this lining, crediting the form to the inventor mentioned. The photograph on p. 240 was taken after one of the linings had been in use for about six months, and the report is that it would have at least another six months of life. It will be noticed that the open spaces between the rail sections are filled with an agglomeration of pebbles and other material. These have a tendency to hold the sections more firmly in place than when originally embedded in the cement.

The accompanying drawing shows the method of embedding the rail sections in the mill, the directions being furnished by the Hardinge Conical Mill Co. They are as follows:



Britannia Tube-Mill Lining

The interior of the mill must be thoroughly cleansed, especially from all traces of grease and oil. The mill shell should be absolutely clean, not merely wiped. A small quantity of cement mortar is mixed up, using one part of good portland cement and two parts of clean sharp sand, worked up to the consistency of thick paste. The cement is spread over a portion of the mill shell to a depth of about 1 in. The mill should be lined in sections running from feed to discharge openings. On top of the cement, place some type of wire screen, cut up in small sections, not to exceed 1x2 ft. Any flexible wire screen between 8 and 4 mesh will answer. That shown in the illustration is expanded metal lath, No. H, gage 27, unpainted. Press this wire cushion as deeply into the cement layer as possible. It is not necessary that the pieces of wire overlap, but the joints should be fairly close. The screen is desirable to distribute internal forces.

Over this a second layer of cement, approximately 1 in. thick, is spread on top of the wire. Then the rail ends are forced down into the cement as far as possible, using even a light blow, if necessary, thus forcing the metal cushion still further into the cement bed. The rail ends should be arranged as nearly as possible in the order shown in the illustration, using 3½-in. or 2½-in. lengths. The 3½-in. length is better in a cylindrical mill. When half the mill is finished, another layer of cement is put in up to about 1 in. of the top of the rails. This is allowed to set and the lining of the other half of the mill finished in the same way.

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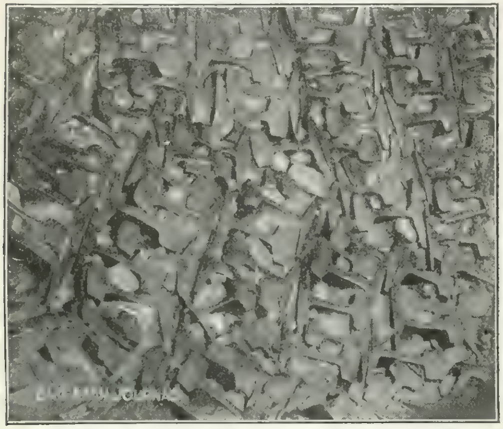
*Mining engineer, 887 Middle St., Bath, Me.

The principal points in setting this lining are the care that the mill shell is clean, that the cement does not take any set before being used, that the rails once embedded are not disturbed in any manner, that the rails are forced into the cement bed as deeply as possible, that all crevices between the rails are well filled within 1 in. of the top, and that the lining is well set before the mill is put into operation. Mills equipped with this lining should be operated for several hours with half a charge of lump ore before any balls or pebbles are put in, in order to fill the remaining crevices, thus forming a cushion.



Brittannia Tube-Mill Lining

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A New Process for Heating Blast-Furnace Stoves

The Pfoser-Strack-Stumm system for heating Cowper stoves was first described in November, 1913 (*Stahl und Eisen,* 1914, p. 305). Further notes were given in a paper by A. Spannagel in an Iron and Steel Institute paper, Autumn session, 1914.

If the flow of gas through a blast-furnace stove be increased beyond the normal, the temperature of the waste gas rises, and though the stove is heated more quickly, the efficiency falls. This, however, is true only up to a certain gas velocity. Beyond that critical point, the stove heats still more quickly, but the temperature of the exhaust gas falls, i.e., the efficiency is greatly increased.

The explanation seems to be that as stoves have ordinarily been run, the gas has flowed quietly through the channels in the checker work, only the outer layer of gas giving up its heat to the bricks by conduction, while the inner layers have had to get rid of their heat by radiation. If the velocity of the heating mixture be now increased, an eddying is caused in the gas current and more heat is conveyed by conduction, but since the quantity of gas is greater, a larger proportion of the heat is unused. But if the velocity be increased still more, the gas molecules are driven about so violently that in a short time all come in contact with the brick and give up their heat. As a result the temperature of the waste gas falls. At the same time the heating period is shortened.

In the original installation, the velocity of the gas was heightened by using an air blast at 12-in. water pressure as an aspirator. Just enough air was used to leave no excess of either oxygen or carbon monoxide. Using rough-cleaned gas (0.5 gram dust per cu.m. of gas) the heating period was shortened from 4½-5 hr. to 1½ hr., and the exhaust-gas temperature dropped from 700 to 350° for a blast temperature of 800° C. By using highly cleaned gas, the size of the passages in the checker work was reduced, and the exhaust-gas temperature was reduced to 90°-116° C., using air at 16-in. water pressure to aspirate the heating gas. At Neunkirchen, six blast furnaces will hereafter be worked with 15 stoves, of which not over 12 will be running continuously. The method is also applicable to Cornish boilers.

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Fume Precipitation by Electrostatic Discharge

The use of a wire coaxial with a metal cylinder as electrode in the Cottrell process of fume precipitation has been known for some time. The active agent is the luminous corona surrounding the wire, which does not extend far. However, a method of extending this influence has been patented by W. W. Strong and A. F. Nesbit (U. S. pat. 1,120,561), assignors to R. B. Mellon, of Pittsburgh. This they describe as follows:

In the use of an ordinary high-tension alternating-current corona discharge, we have found that under certain conditions the luminous region about the active electrode may be greatly extended by the introduction of a spark gap in series with the active or grounded electrode. The effect of the introduction of such a spark gap is used in wireless telegraph practice for the purpose of introducing high-frequency oscillations upon antennae circuits. It is well known that the frequency and damping factor of these oscillations depend upon various characteristics of the circuit including the momentary values of the resistance, the capacity and the self induction. It is therefore seen that the secondary ionization and the ionic currents of the corona may be increased by the use of a spark gap in the high-tension circuit and the aggregating action of the discharge is also increased. The insertion of even a single spark gap in series with the high-voltage circuit gives a very appreciable effect upon the precipitation produced. The length of the gaps and their positions relatively to circuits shunting them are factors which enable a nicety of adjustment of the electrical circuits for the purpose of controlling the precipitation. These facts have been determined by actual experiment. We have also found that, contrary to the usual view, iron-cored inductances may be used to exert a very noticeable adjustment of the circuits.

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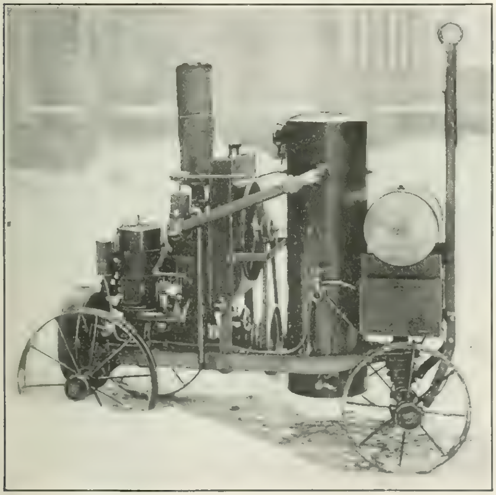
Ferrosilicon Production should be at a minimum of 1 kg of the compound per kilowatt-day, according to Keller in "L'Eclarage Electrique."

Mining & Metallurgical Machinery

Portable Gasoline-Driven Compressor

The small gasoline-engine-driven air compressor here illustrated has been developed by the Ingersoll-Rand Co., particularly to meet the needs of the contractor doing work of a temporary character requiring compressed air in small quantities.

The compressor is operated by a simple single-cylinder gasoline engine, coupled directly to the compressor, both pistons working on the same crankshaft. The engine is of the single-acting two-cycle type, closely following well known marine designs. The compressor is one of the company's standard types, Imperial XII, with a capacity of 45 cu.ft. per min. at a pressure of 90 lb. It is fitted with an air unloader and the engine with a centrifugal governor.



Portable Air Compressor

Cooling is provided for by a gear-driven pump and an automobile-type radiator with large tank capacity, serving both the compressor and engine. The radiator is assisted by a large fan.

The frame, axles and wheels are of steel; the front axle is arranged with a swivel connection to the frame, permitting horizontal rotation and sufficient vertical movement to accommodate the wheels to inequalities of the road without strain on the frame.

An air receiver fitted with safety valve, pressure gage, necessary piping, outlets, etc., is hung at one end of the frame and a gasoline tank of 15 gal. capacity is supported on a large tool box, as shown in the illustration.

The outfit complete weighs 1600 lb.; it is designed for hand transportation, but can be fitted with tongue and singletree if desired. The company rates this outfit as equivalent in capacity to one Jackhamer.

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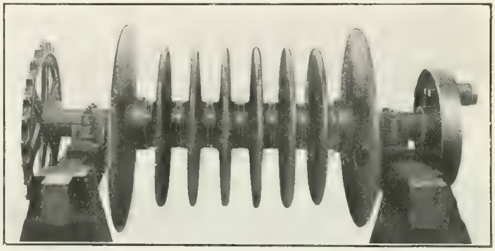
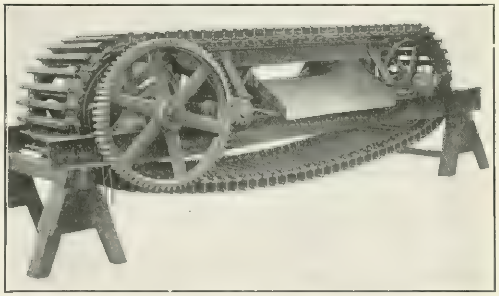
New Types of Grizzlies

The capacity of a crusher operating on run-of-mine ore is frequently reduced by the amount of fines in the feed. If it is possible to bypass these fines, a saving in power and wear is effected, delays are reduced and the use of a smaller crusher is sometimes made feasible. If an automatic feeder is used the crusher can also work to capacity. A frequent arrangement of grizzlies and feeder is one in which the latter delivers over a 45° grizzly into the crusher, but this arrangement requires considerable headroom. To meet feeding conditions and overcome the headroom difficulty, two new types of grizzlies have recently been designed by the Stephens-Adamson Mfg. Co., of Aurora, Ill., and installed at the properties of the Hercules Mining Co., Kellogg, Idaho, and the Magma Copper Co., Superior, Arizona.



Disk Type of Grizzly and Feeder



Traveling-Belt Type of Grizzly

Those in use at the Hercules are the traveling grizzly bar feeders shown in Fig. 1. If any pieces become wedged between the bars, they are automatically released as the bars open up over the sprockets. The feeder is placed directly beneath the hopper opening so that the material rests upon the bars and its flow to the crusher is controlled by the motion of the feeder.

The situation at the Magma Copper Co. was somewhat similar to that at the Hercules, with the difference that there was no room for the traveling type of feeder. The rotary feeder and screen, Fig. 2, were designed for this case. It requires more headroom but less room horizontally than the traveling feeder. The larger rocks are held on the circumference of the disks and delivered into the crusher, while the fines pass down between the disks. The distance between the disks may be changed by adding or removing washers on the shaft between the disks. Lumps lodging between the disks are freed by stationary steel fingers dovetailing with the disks.

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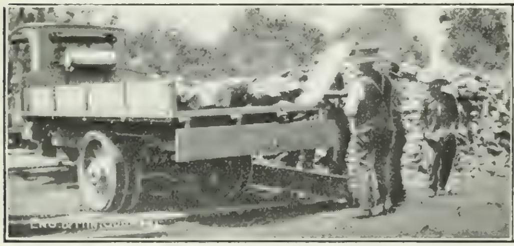
Motor Trucking Iron Ore*

Pierce-Arrow trucks are being used to haul the iron ore which the McIntyre Iron Co. is using in its experiment of smelting titaniferous ores at the Port Henry blast furnace. The mines are at Tahawas, in the Adirondacks, about 30 miles from North Creek, the nearest railroad station. At first it was attempted to transport the mining equipment by teams. One two-horse team carried two tons, and as it took three days to make the round trip, the cost was high. Two Pierce-Arrow five-ton trucks were purchased, and it was found that these two trucks could make two round trips per day carrying five tons of equipment at a much lower cost.



Loading Ore on Trucks

Loading Ore into Railway Cars

The next problem was to get the ore down to the railroad. A plan involving the use of three large traction engines with trains of snowsleds, carrying 250 tons per trip, was evolved. The plan called for a snow leveler going over the ground to the station, followed by a water wagon sprinkling on the softer parts of the snow, so that the road would freeze and allow the heavy traction engines and sleighs to travel over it with ease. This scheme was an utter failure; only 10 miles was actually traversed from the mine to the nearest point on the state highway; the traction engines were practically scrapped. It was found that they would carry only 10 tons per trip instead of the 250 tons originally expected.

George H. Pride then obtained a contract to haul the ore the remaining 22½ miles. He purchased seven five-ton Pierce-Arrow trucks fitted with shallow wood bodies having removable sides and tail gates. These trucks are now operated night and day. There is a mechanic in charge of the equipment, [illegible] drivers and 21 laborers for loading and unloading. The road is [illegible], with a surface which is good, but which is cut up by small waves said to cause a synchronic vibration on the truck springs.

The total drop is about 1000 ft. The complete round trip of 45 miles takes 5¼ hr. Four trips per day seem to be about the maximum that can be secured with safety.

It has been found advisable to take off each truck in rotation and give it a complete examination by the mechanic in charge, to insure its working up to its highest capacity all the time. At the beginning, the use of trailers was attempted. It was found that they cut down the speed to about three miles per hour, and they were also extremely troublesome on grades, because they could not be braked satisfactorily. For these reasons, and also because of complaints that the highway was being cut up, it was decided to abandon the trailers entirely.

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Hardening Salts and Pastes

What are termed "sentinel" pyrometers, in the form of paste and metallic salts made into molecular mixtures that will melt down at different temperatures throughout the range from 220 to 1330°, have been developed recently by the Carl Nehls Alloy Co., Detroit, Mich. They are described in *American Machinist*, Jan. 7, 1915. One form of application is to cast the mixtures into solid cylinders, $\frac{7}{16}$ in. diameter and ¾ in. long.

Each one is wrapped in a paper on which is printed its correct melting temperature in degrees Centigrade. For all temperatures below 932° F., these salts can be used in air-tight glass tubes. The salts can then be used over and over again. By using small porcelain saucers the salts do not run to waste and litter up the place. This also enables them to be used several times, as the salt melts each time the temperature rises above the one marked on the cylinder, and becomes solid again the moment the temperature falls below this degree.

These salts are also made up in the form of paste. Enough to make several hundred determinations is packed in a tin. Pastes with various melting temperatures can be daubed along a steel bar and inserted into furnaces, ovens, retorts, flues, gas mains, steam pipes, and the like. The salts that melt and those that remain solid will indicate the temperature, which would be between the two.

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The Manufacture of the Symons Disk Crusher has been taken over by the Chalmers & Williams Co., Chicago Heights, Ill., in addition to its former line of crushing machinery.

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*An abstract from an article by John Younger, mechanical engineer, truck department, [illegible] Motor Car Co., Buffalo, N. Y., appearing in the [illegible] issue of "The Pierce-Arrow Sales[illegible]

Herbert Clark Hoover

To the New York *World* of Jan. 17, 1915, Will Irwin, the well known writer, contributed an article about Herbert Clark Hoover, who needs no introduction to mining engineers and metallurgists. However, Mr. Hoover is as famous for his modesty and reticence as he is for his practical achievements, and consequently some of the personal touches of Mr. Irwin are interesting. In making some excerpts from his article, which we do with the courteous permission of the *World,* we have discarded some inaccuracies of his story and have limited ourselves to those things that are correct or those that look probable. Not included among the latter is the portrait of Mr. Hoover, with which the original article was adorned. That portrait did not look like Mr. Hoover at any time during our acquaintance with him in the last 10 years or so. Mr. Hoover is in fact quite averse to having his picture taken. At the time last year when he was presented with the gold medal of the Mining and Metallurgical Society of America, we were extremely desirous of publishing his picture, but no photograph was to be obtained, notwithstanding the considerable influence that we were able to exert in quarters near at home. So then, let us turn to Mr. Irwin's story:

We had in Stanford University, during the earlier, livelier days of that institution, a working student who found time not only to make his own living and to keep his scholarship high, but to run student-body politics, which were in those days complicated and ardent. As one looks back over his college days, he finds himself surprised not only at the college "phenoms" now occupying humble niches in life, but at the unconsidered individuals who have made names for themselves. That, I believe, is an academic platitude. But sometimes your college man runs true to early form; and I think most of us expected something from that quiet, grave and wise young man whom we knew as "Bert" Hoover.

His record in Australia came to the attention of those Europeans who were working with the Chinese in that brief dawn of progress which preceded the Boxer uprising. They made Hoover, at the age of 26, the expert of the North China Government. He was far in the interior, prospecting, when the rebellion broke. By good fortune he got to Peking alive, gathered up Mrs. Hoover and took her to Tientsin just as the Boxers laid siege to that town. For six weeks Hoover, Mrs. Hoover and a half dozen other Americans lived beneath a barricade of rice bags and sugar barrels, rather expecting death any day. Once, when the supply of defenders fell short, Hoover was enlisted to help man a machine gun, and daily Mrs. Hoover served tea at 4 o'clock to the foreign colony, sweetening the brew from the sugar that protected them from Boxer bullets.

The siege was lifted at last. But the Chinese Reform Government was gone, and with it went Hoover's worldly fortunes. That, his friends have remarked since, was as it should be. It was not fair that any man of 26 should be so successful as Hoover, before the Boxers flattened him out. Having nothing else to do for the time, Hoover joined the correspondents, and followed the allied armies into Peking. He helped for a few months in the reconstruction of the Chinese railroads, and when things straightened themselves out managed to get a coal concession. He took this to London, raised capital, and presently found himself established in the heart of the commercial world as a mining engineer and promoter.

From this point, his fortunes, through all those vicissitudes which always mark the mining business, have gone on and up, until now his interests are as wide as the world. He presses one button and it rings and starts a new shaft in Burma; another, and it shifts a gang in Australia; another, and it sets the wheels going in Mexico or China or California. One of his companies would doubtless be called "the Zinc Trust" in America; another involves the management of a principality in Russia. He is a specialist on organization. The best thing he does is to take a rundown property, below the line of dividends, and make it pay. Certain mining engineers have told me that Hoover is probably the most powerful and influential mining engineer in the world—and he is only 40 years old!

Whenever we write a European biography of these times, we must hereafter insert this line: "And then the war broke!" It broke in the mining business, as that business is run from London, with a deafening crash. It involved, it complicated, it ruined things to an extent which would have been ridiculous had it not also been so tragic. And just then, when such a man as Hoover needed all his brains and faculties for his own business life thrust a new responsibility upon him. The Americans were pouring out of the Continent to get home any way they could. Half of them were panic-stricken; half of them, in the first confusion, were practically without funds. Some one must straighten things out. A hastily-formed American committee began this work. But its chief executives had to go home in order to attend to their own affairs. Hoover found himself at the head of this committee, doing three men's work in getting 92,000 of his countrymen home to safety.

The full history of the American committee cannot be written as yet; it involves too many delicate considerations of diplomacy. But it was a whale of a job, take the word of one who listened to its troubles. Forty-two thousand of our refugees passed through its hands. Ten per cent. of them had to be helped financially. They came in irregular rushes, which must be distributed somehow among the steamship lines. No sooner was the delegation from the British Isles despatched than the crowd from Paris, ordered out when the Germans came to the height of their rush, arrived. No sooner were these distributed than the Americans began piling out of Germany.

The American Committee had to make itself a kind of regulator of popular desires. There were two classes of Americans in Europe last fall—those overeager to get away from trouble, and those who wanted to overstay their welcome. To the former class belonged that old lady who would not sail until Hoover gave his guarantee in writing that the Germans would not sink her ship. In this class too was the old negro who, when asked why he wanted a ticket home, wrote, "I take a great interest in my own country just now." To the latter class belong those women who, when the Germans came near to Paris, had to be forced into the train by their friends. Sometimes one class was in the ascendant, and sometimes the other; sometimes there was a rush for steamers, and sometimes steamers sailed with empty cabins. The committee was always soothing Americans or "throwing a scare into them," as the situation demanded. But by the middle of October, the American tourists had been cleaned out of Europe, and the transatlantic lines had begun to withdraw steamers. Not an American remained in Europe for want of passage money. Two unfortunate American children, who wandered with their mother into the Russian trenches in East Poland, died of exposure. Otherwise, no American lost his life as a result of the war.

That did not end the work of the committee, however. The European Governments found use for this neutral body. Thousands of German schoolgirls were shut up in England, thousands of English schoolgirls in Germany. The Governments agreed to exchange these prisoners; and the American committee took charge of this work. American women chaperoned and escorted the girls back and forth. Before December Miss Daisy Polk, of San Francisco, made six such round trips. Then, too, after the fall of Antwerp and Ostend, the Belgian refugees began pouring into London. The English were not yet ready for them, and the advance guard was received and relieved by the Americans.

Here Hoover should have returned to his business. But immediately life walked up and handed him another responsibility of charity. Belgium, as all the world knows now, is starving, and America alone can feed her. The Americans in London, occupying a strategic position as "neutral citizens" on the border of the trouble, are the logical persons to handle the transmission of supplies. They formed the Commission for Relief in Belgium—and again Hoover, with his executive ability and his creed of efficiency, was the logical man for active Chairman. He settled down to that job, and he is at it on this date of writing. Within three weeks after he settled down to work, Hoover, with one set of associates in New York, another in Rotterdam and another in Belgium, had perfected a system of shipping, checking and distribution which is a model of its kind. Men of other races might have built up such a system, give them time, but only an American, working with Americans, could have done it in so short a time. It is the old story: If you want a thing well done, pick the busiest man you know. Presently the work of the commission grew until it became the largest commissary undertaking the world ever saw—feeding nearly 7,000,000 people from supplies three to five thousand miles away.

Being an American, Hoover has the sense of humor common to us all, but he still hides it under that grave exterior of his college days. He talks little, but he thinks much, and straight to the point. Efficiency is his hobby and work his recreation. But he has found leisure for friends; and no man on earth has a more interesting assortment. The Hoovers live at Red House, an old manorial establishment, built in Georgian days when Kensington was open country. Now it lies behind a wall, which conceals its English garden and its antique gables from the crowds of Greater London. Thither, in old times, before this war, came these friends, world-wanderers all, as to a harbor in their wanderings. They ranged from Alaskan "mushers" to Chinese mandarins, and the conversation at Red House made a story book seem thin and commonplace.

There is little of such life for any one in darkened, anxious London nowadays; and least of all for the group of Americans who are feeding Belgium. Twice since November Hoover has taken the trip to Brussels, which involves, nowadays, a deal of hardship and some peril. The rest of his nights and days he is struggling with shipments and food purchases. Social, diplomatic, governmental notables crowd the anterooms of the Commission's offices. A thousand schemes to raise enthusiasm and subscriptions are being conducted under his supervision. The last heard from him in New York, he was thinking of going into Belgium again.

"And I'm frank to say I dread it," he said. "I can't convey the things you have to see."

Nechi Mines (Colombia) Ltd.

In connection with his report on Pato Mines (Colombia) Ltd., W. A. Prichard also reported on the property of Nechí Mines (Colombia), Ltd., to the directors of the parent company, Oroville Dredging Co., Ltd. The Nechí, or San Francisco, dredging ground is across the Nechí River from the Pato mine. The Nechí property will be operated by the Pato company's managerial staff and supplied with power by that company. The ground has been prospected by 41 drill holes, the first of which were sunk under the direction of the Pato management while the last few holes were drilled under the supervision of Mr. Prichard.

The dredgeable area as prospected to date is estimated to be 89¼ acres of an average depth of 47.6 ft. and an average value of 71.86c. per cu.yd., or a total of 6,855,900 cu.yd., having a gross value of $4,926,600; the field operating cost of dredging, on the basis of one dredge operating on Pato for six months, and two dredges on Pato after that period, is estimated by Mr. Prichard at $554,472, showing a net return of $4,372,128 or £900,000, approximately.

In estimating the drill-hole results on the Nechí property a theoretical drill factor of 238 ft. of hole to the cubic yard was used, a lower value than was taken in the Pato estimate where there was an opportunity to obtain corroborative results with the dredge. The fineness of the gold on the Nechí property was determined at 860, by assay.

South of the drilled ground there is a swampy area that has not been sufficiently drilled to determine its value. A few holes that were put down indicate the probable existence of a few acres of dredgeable ground. The tested ground of the Nechí property lies along the south side of the river and on the opposite bank in the Pato property, three drill holes have indicated a similar gold content. Hence, it is suggested that the auriferous gravel, which lies at considerable depth, extends right across under the bed of the river. As there are upward of 40 acres of river bed at this point Mr. Prichard recommends that a test therefore be made. The Nechi company's title, originally issued in 1858, is said to antedate that of the French concession covering the river channel.

Up to the time of the purchase of the property by the Nechí company the native owner was working the bench-gravel deposits in a small way. These bench gravels have the appearance of being of sufficient size and value for profitable working by hydraulic methods. Mr. Prichard recommended that the mine staff investigate the bench gravels at a favorable time.

The Nechí dredge will have a steel hull, and was ordered in England from Fraser & Chalmers; it will be a close-connected 7½-cu.ft. bucket dredge. The hull arrived in Colombia in November, 1914, and is being assembled near the Pato machine shop. The machinery for the dredge was delayed by the war, but at the recent meeting, Chairman F. W. Baker announced that, unless unforeseen contingencies arose, the dredge was expected to be completed by July, 1915. The hull was being constructed above ground and will be launched into the Nechí river before the machinery is placed upon it. It will only have to cross the river when completed to reach the dredging ground. The dredge is designed to dig to a depth of 55 ft. below water level and to handle a 10-ft bank.

The Nechí dredging ground contains less clay than Pato, and, being deeper, the buckets will average fuller than on the Pato dredge. The buckets on the Nechí dredge, while of only 7½-cu.ft. capacity, as against 8½-cu. ft. on the Pato dredge, are expected to handle as much or more yardage than the Pato. The Nechí dredging area is agricultural land with few trees and the cost of clearing should therefore not exceed $100 per acre. Pond water will be obtained by connection with the Nechí river, thus avoiding the cost of pumping pond water as at Pato. Mr. Prichard estimates that the Nechí operating costs on a basis of 100,000 cu.yd. per month, will average not over 9c. per cu.yd. for the period during which one dredge is working in Pato, and 8c. when two dredges are operating in Pato; these estimates include 2c. per yd. for bullion-realization expense, or more than double the Pato expense for this item.

The chairman stated that the estimated earning capacity of the Nechí property, based on the treatment of 100,000 cu.yd. of gravel per month, estimated to yield 71c., and allowing for an operating cost of 10c., would be £146,000 per annum. The property was purchased for £10,000 and other expenses incident to purchase and examination amounted to about £4000, while £50,000 were provided for working capital and equipping the property. The funds necessary to acquire and equip the Nechí property were effected by the formation of a company with a capital of £140,000; it is consequently estimated that the dredge will be earning 100% or more, every year, on the capitalization.

California Mineral Exhibit, Panama-Pacific Exposition

The California State Mining Bureau will exhibit at the Panama-Pacific International Exposition. About 400 sq.ft. of floor space in the Mines and Metallurgy Building will be devoted to case exhibits of California's mineral products. All mineral producers wishing to exhibit are invited to communicate with the State Mineralogist, Ferry Building, San Francisco.

The Engineering Foundation

The establishment of a fund to be devoted to the advancement of engineering arts and sciences was mentioned in the JOURNAL of Jan. 23, 1915, p. 200. The engineer who gave the initial gift is Ambrose Swasey, of Cleveland, Ohio, who devotes $250,000 to this purpose. This was announced at a meeting on Jan. 27.

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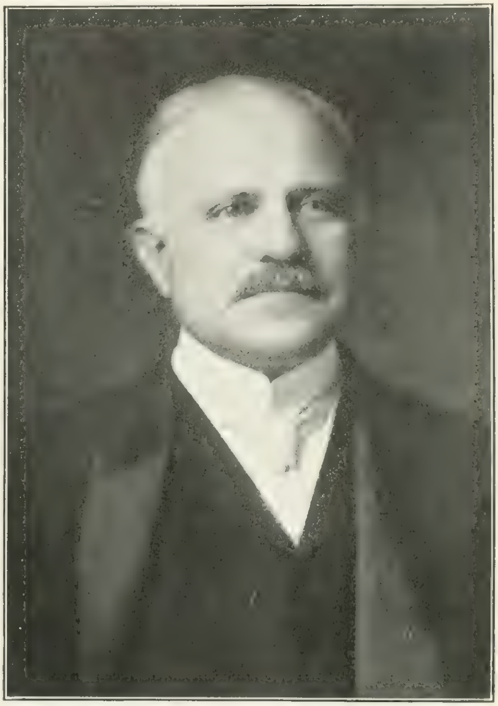
A New Allotropic Modification of Sulphur is suspected by A. H. W. Aten, who reports in "Zeit. physik. Chem.," 1913, LXXXIII, 442, that the enhanced solubility in sulphur monochloride of sulphur previously heated to 170° C points to the presence of a maximum of 5% of a new allotrope, which, however, has not been isolated. Similar solubility relationships hold for carbon bisulphide and toluene; and all the solutions are yellow.

Daniel Guggenheim's Testimony

The testimony of Daniel Guggenheim to the U. S. Industrial Relations Commission, sitting in New York on Jan. 21, attracted a great deal of attention. It was given in the presence of a large audience.

Mr. Guggenheim was asked by Chairman Frank P. Walsh to give a list of the corporations in which he and his brothers, Murray and Solomon, are directors. Mr. Guggenheim mentioned the American Smelting & Refining Co., the Chile Copper Co., American Smelters Securities Co., Nevada Northern Ry., Yukon Gold Co., Mexican Union Ry., the Guaranty Trust Co., and the Guggenheim Exploration Co., as some of the concerns in which he is personally a director. Murray Guggenheim is a director in the New River Collieries Co. and the United States Zinc Co.; Solomon Guggenheim in the Braden Copper Co., Electric Boat Co., Electric-Dynamic Co., Industrial Oxygen Co. and Interborough-Metropolitan company.


DANIEL GUGGENHEIM

"The laborers of each plant are under the direct control of the general manager," testified Mr. Guggenheim in speaking of the plants of the American Smelting & Refining Co.

Up to 1912, when his health became somewhat impaired, he himself visited the numerous plants of the companies in this country, getting to each one about twice a year. He kept posted on labor conditions in each mine and smelter. His associates on the board of directors and in the executive committee were similarly well informed respecting what was going on, the executive committees meeting at least once a week and the sub-committees almost daily.

"All the members of the executive committee," he said, "are thoroughly familiar with the business and in thorough sympathy and in touch with the men. When I became ill, other directors went to our plants, getting to each one about every 30 or 60 days. The directors are responsible for labor conditions on our properties. Our directors are somewhat different from those of most other corporations, especially those on the executive committee. They have been brought up in the business and are thoroughly acquainted with it technically. In the event of labor difficulties the general manager of the plant communicates with the officers here, stating the conditions."

"What have you done to help your employees?" asked Mr. Walsh.

"Up to a year and a half ago," Mr. Guggenheim replied, "we did what we could to remedy conditions and make improvements. I told the members of the executive committee and board of directors that we should do more than we had done—we should see to housing the men better, relieve the conditions under which they worked, establish a pension fund—try to throw a helpful, encouraging light into their lives. It meant better business—a higher efficiency.

"We wanted a man who could take full charge and who understood labor thoroughly, and go about to see that what was needed. We engaged Dr. C. P. Neill, U. S. Commissioner of Labor. We wanted suggestions from him. We had elected to adopt the compensation acts in all places where we have works and the elective laws have been enacted."

"Did your company oppose the passage of any of them?" asked Mr. Walsh.

"We did not," answered Mr. Guggenheim.

"We have been experimenting in our Perth Amboy plant on insuring our workers, single and married, so that from $500 to $1000 is paid in the event of death. We have also improved the housing of the men and their sanitary conditions.

"My province in the company as president is to suggest its policy," said Mr. Guggenheim. "Our directors are in sympathy with improving the working conditions wherever possible and within reason.

"I am a member of the labor committee of the A. S. & R. Co. When we hear that conditions are bad in this or that plant the matter is brought to the attention of the executive committee and an investigation ordered, and if the conditions are found to be bad, the conditions are changed."

"Do you recall what your men in the Perth Amboy plant were paid when they went on strike, in 1912?"

"I do not. It may have been $1.60 a day or $1.80. As soon as the trouble arose I directed Willard S. Morse, a director, to go to Perth Amboy and study conditions and try to remedy them and do all he could. Our efforts in that were rewarded. Mr. Wilson, then Governor of New Jersey, sent a member of his staff to Perth Amboy, who telephoned me when the difficulty was settled that he was highly pleased, not only with Mr. Morse's work, but with the spirit of the company.

"The directors of our company do not shirk the responsibility they feel is theirs. Whenever any of our directors go to the plants they talk with the workers. At Perth Amboy Mr. Morse discussed the questions with many of the men. Some of them with whom he talked were unable to make clear what they wanted, as they didn't seem to know.

"I would not say we have frequent strikes. You must consider that the men are restless because of the high cost of living. I sympathize with the men affected by the increased cost of necessities and I do what I can to help them."

"Do you oppose the policy of organized labor?"

"Employees are fully justified in organizing. Often the capitalist is arbitrary—just as the laborer is, at times. I have no objection to what our employees do outside the plant. They are human."

"Do you think industrial discontent is increasing?"

"I think it is on the increase and fear it will continue to increase unless something is done to prevent it. The high cost of living is partly responsible for that, but the greatest canker known to the world is envy. A man these days sees so many things to invite his envy. But envy is a pretty well distributed trait.

"I think we are getting to a higher standard in dealing with labor, just as I think the world today believes it is no longer necessary to kill off your competitor to get along; or grind down your fellow man.

"There is not enough legislation. I am not one of those who complain that our statute books are cluttered up with useless laws for changing this and that. We are many years behind England and Germany in legislation which helps the workingman—the poor man.

"There is today too great a difference between the rich man and the poor man. To remedy this is too big a job for the state or the employer to tackle single-handed. There should be a combination in this work between the Federal Government, the State, the employer and the employee. The men want more comforts—more of the luxuries of life. They are entitled to them. I say this because humanity owes it to them."

"Do you think the workingman should have a voice in the arrangement of the conditions under which he labors?"

"The workingman should have not only a voice—he should have a compelling voice. The workmen's compensation act was won by the workingman. He will win more legislative victories. And legislation that will benefit the many is desirable, no matter what that legislation is."

"I think the state should furnish work for the men who lack employment. You may call me socialistic, if you like, but it is a job of the United States to look after its people. Were it not for philanthropic work there would be a revolution here.

"But sufficient is not given in this case. People won't give up money they make easily, even though they have more than they need.

"So the government must raise the money—raise it by taxing the estates of the rich, if you will—but the United States must raise it some way.

"An evil of philanthropy lies in the fact that its proposed beneficiaries feel themselves placed in the light of paupers. Thousands of persons are too proud to accept help unless they can give something in return. Many of them prefer to starve. They want help—money—but they want to work for it.

"In the scheme of uplift in which we are all interested.

I think, I believe the workers are entitled to share in the profits in all industries. This should be so arranged that the money could be taken in bulk at the end of the year and deposited to their account in a banking institution. If that were done it would change conditions in thousands and thousands of homes.

"Workers, in the mass, do not understand how to save. My method would teach them. It would be the same as teaching a child to read and write. The people in this country who have built up fortunes in the last 10 or 15 years have done it because they have been thrifty. Many are poor because they did not save. Sometimes, of course, fortunes come without thrift, as in the case of the son of a worthy or unworthy sire. The sons of the rich, in many cases, are entitled to sympathy, though I would not say as much sympathy as the poor.

"I prefer conciliation instead of arbitration. Labor and capital will never get together when there is trouble if both sides are equally strong. I have always felt that conciliation can do more than compulsory arbitration, but legislation would do away with both. The laborers must organize to accomplish this object.

"We have in our plant the so called 'open shop.' Every man has a right to be heard as an individual or as the representative of an organization. We do not discriminate. A man may belong to a union or not as he pleases. Of course, we will not let any union organization walk into our plants and tell us what we shall do. We have to use reason. We have the interests of our shareholders to consider.

"We do not think we have a right to control a man any more than we have a right to say what he shall eat or drink.

"I believe we get better results from the big organizations than from the small corporations, because there is a better chance to eliminate incompetency and arbitrary methods."

Chairman Walsh tried to draw out Mr. Guggenheim on the nature and extent of the philanthropic work he supported, but Mr. Guggenheim modestly avoided pursuit of the inquiry in that direction, saying, "Oh, I do not want to advertise."

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Colorado Metal Mining Association

The second annual convention of the Colorado Metal Mining Association was held at the Brown Palace Hotel, Denver, on Jan. 11, 12 and 13, with President Bulkeley Wells in the chair. The session opened with the reading of the reports of the president, secretary and treasurer, which were ordered published for distribution. Governor Ammons addressed the meeting and in the course of his remarks said he believed mining was destined to retake the high place it formerly occupied in the state and become of even greater importance. Governor-elect Carlson then addressed the association and urged the mining men of the state to unite in opposing measures of national conservation which would tend to thwart the best interests of the state. He advocated a greater degree of coöperation between the State Geological Survey, the Bureau of Mines, the Colorado School of Mines, and the members of the mining fraternity, to insure the rapid growth of the mining industry. Special attention was called to the bill before Congress for the adoption of a leasehold system for mining property, and the people of Colorado were urged to stand together in suppressing such legislation. It was the unanimous opinion of the association that a leasehold system would repel capital and retard mining development indefinitely.

Resolutions were adopted protesting against the leasing of public lands and demanding a more equitable system of taxing mining properties. Numerous other resolutions were adopted and committees were appointed to draft suitable bills and confer with the governor thereon.

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Carl Schnabel

Prof. Carl Schnabel died recently at his home in Berlin, in the 71st year of his age. Schnabel was one of the most distinguished of German metallurgists. Of his early life we know relatively little. In 1877 he was assistant superintendent of the silver-lead smelting works at Lautenthal in the Harz. In that capacity he developed his well known process of treating with carbonate of ammonia the zinc-lead oxides obtained by steaming liquated silver-lead crusts. A plant for this process was erected at the works, and for a time Prof. H. O. Hofman, now professor of metallurgy in Massachusetts Institute of Technology, was in charge of it. This process was in operation for several years, but it was found to be too expensive and had to yield to the distillation process that is now in use everywhere. If my recollection be correct, Schnabel's process was also used at the great silver-lead refinery at Hoboken near Antwerp.

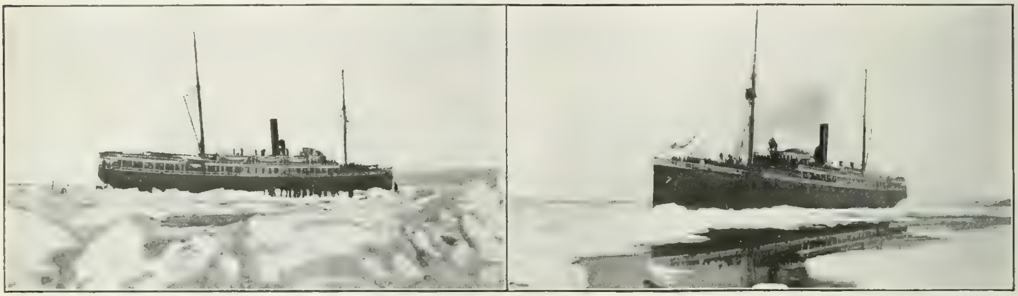
While at Lautenthal Schnabel obtained his degree of doctor of philosophy from Jena. From Lautenthal he was called to Clausthal to fill the chair of professor of nonferrous metallurgy. He remained at Clausthal a great many years, and while there wrote his well known treatises, especially his "Handbuch der Metallhüttenkunde," which became one of our metallurgical classics and has been translated into English. During his vacations Schnabel also did professional work, his most famous commission being in the early '90s when he was called to Broken Hill, New South Wales, to make a report upon the treatment of mixed sulphide ores.

As a teacher at Clausthal, Schnabel was a great success. He was a man of fine appearance and magnetic personality, a fluent and lucid lecturer, and professionally a master of his subject. He was popular among his students with whom he fraternized, and for whom he was the leader, not merely from the lecture platform, but on the ground among them. Schnabel was a very human man. The pilgrimages to Lautenthal, Langelsheim, Oker, and the other metallurgical points of interest in the Harz, followed by a social gathering in some congenial place, are events that are fondly remembered by old Clausthalers.

Upon the death of Bruno Kerl, the dean of German metallurgists, Schnabel was called to the technical school to Berlin to take his chair, which he occupied until he was obliged to retire, on account of poor health, when he was pensioned by the government. Schnabel was a big minded generous man, and to the writer of this note he gave examples of his fine professional spirit that are warmly remembered.

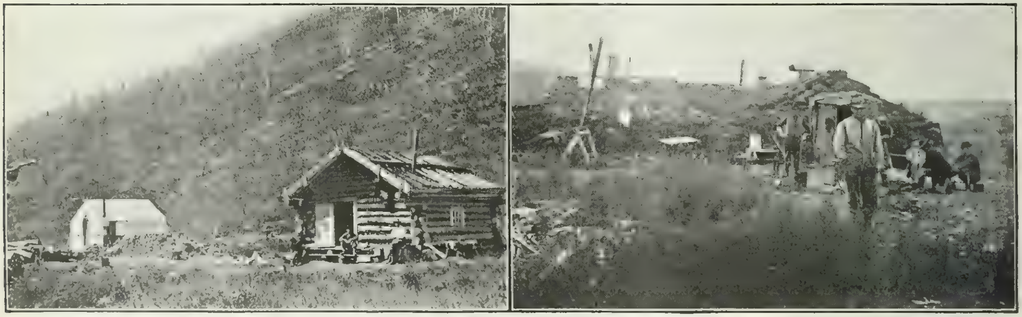
W. R. I.

Photographs from the Field



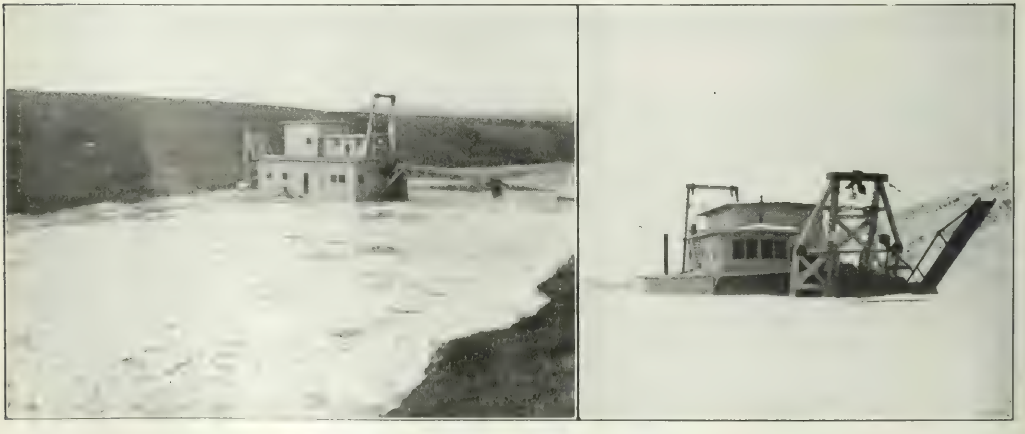
APPROACHING NOME, ALASKA, IN MIDSUMMER

Steamship "Senator" standing in the ice off Nome on June 10, 1914. The ship brings passengers and freight for the dredging fields and mining districts



DREDGE MINERS' CABINS IN ALASKA

The log cabin is in the Innoko district, and the stone and sod cabin is on the Inmachuck River



[illegible] DREDGE IN THE CASADEPAGA RIVER, ALASKA

The dredge is shown operating in the late fall when the ice is closing in, and shut down in winter, completely frozen in

Plant of the Socorro Mining & Milling Co., Mogollon, N. M.
This company is now spending a large sum of money in the development of hydro-electric power for operating mine and mill

Loading Dock and Ropeway of the Ellamar Mining Co., Ellamar, Alaska
2200-ft. transportation system to facilitate loading of deep-water vessels

Concentrator of the Kennecott Mines Co., Kennecott, Alaska
Not at present in operation. Company is shipping high-grade ore. Aerial tramways connect the mill with Jumbo and Bonanza mines. The company owns what is probably the largest existing body of high-grade copper ore

Correspondence and Discussion

Why Is the Patent Mania, or Why Is the Patent Office?

When the number of patents issued by the United States passed 1,000,000, the daily press and some scientific periodicals alluded to the fact with considerable pride as indicative of American ingenuity. The number of patents issued by this Government, according to the *Patent Office Gazette*, is now averaging about 700 a week and the total number issued by the end of the year will approximate 1,122,000.

If one will take the trouble to look up the patents on any one subject, he cannot help but be amazed at the duplication and overlapping of claims, and the question at once arises—why do intelligent men rush to the Patent Office with every slight variation in a process or mechanical appliance that they must know cannot be sustained in the courts as an original discovery or invention?

It cannot be for fame or even cheap notoriety, for the *Patent Office Gazette* performs only the function of a dictionary and patents receive but passing notice only in the technical publications devoted to that particular subject. Far greater publicity and credit could be obtained by the publication of such discoveries or inventions in the technical press or society proceedings.

It cannot be for pecuniary gain, for a little experience and no great amount of reasoning will soon destroy any visions of coupons. Germany is credited with the best patent code in the world. Dr. B. C. Hesse[*] in speaking of the coal-tar industry for which Germany is noted, says: "From 1877 down to the close of 1912 there were taken out in Germany 5675 German patents, or 158 per year, dealing with the utilization of coal-tar hydrocarbons and their byproducts; it has been estimated that not more than one out of every hundred has secured financial return for its owners. During the years 1895 to 1903, 382 German patents, or at the rate of 48 per year, were taken out in inorganic chemical industries."

I think it is reasonable to assume that the financial returns from the patents granted by the United States, taken as a whole or on any one subject, will not exceed the percentage obtained from coal-tar products in Germany, and it is doubtful if out of the 1,122,000 issued, 11,000 have been profitable to the patentees. Judging from the character of many patents issued in the metallurgical industry, the chances for reward are infinitely better in lottery tickets.

This desire, then, to obtain a patent on every trivial modification of a process or device seems to be something akin to a mania for an object really unknown, unless it is a personal gratification that may come from the securing of patents, however worthless they may be. Is not this mania producing a foolish and serious obstacle to the progress of metallurgy?

Let us look at the other side. Some years ago I was talking with an engineer who is connected with one of our large metallurgical companies. He told me in detail of a patent he had applied for and later secured on a metallurgical process. I remarked that every step in his process was already covered with patents or had been in common use for a long time. He said, "I know it, but you know it is possible to string together a number of patents or old ideas and secure a patent on the combination. This will have no intrinsic value, but will serve as a club to keep the other fellows off."

Shades of Efficiency and Economy! If patents were really worth anything and royalties collectible, where would be the ultimate consumer? The very multiplicity of patents defeats their object and makes them worthless.

A patent was recently obtained on a furnace by an engineer connected with another metallurgical company. This furnace was already patented as a whole and in detail from feed to discharge and the patents held valid and operative by the furnace company. The "improvement" consisted of a coal-feed hopper attached to the furnace and the use of the furnace for another purpose, neither of which was original with the patentee. The patent could not possibly be sustained by the courts and was probably taken out as a defensive movement on the part of the company.

Just now, in metallurgical lines, copper leaching and flotation processes seem to be rampant. A few years ago the craze was centered on concentrating tables and cyanide filters. A consulting engineer told me a few months ago that he has 20 patents on the use of sulphur dioxide in copper leaching and electrolytic precipitation. He admitted that they are of little value except as a defense. I happen to know of several other metallurgists who hold a number of patents on the same subject respectively. Without taking the trouble to look them up, I would not be surprised to find 50 or 100 patents expired and in force on this one process alone. The same is probably true of flotation processes.

While engaged in professional work, I wished to use granulated pig iron for a certain purpose and had it made at a local foundry. "American Foundry Practice" told us it could be best granulated by a jet of steam, which was found to be very satisfactory. I was afterward told the process was patented. In fact, it seems impossible to take up any line of work nowadays without being surrounded by patents of little or no originality, but which frequently serve as a means of annoying (to say it politely) and expensive litigation to operating companies who are doing a legitimate business and adding knowledge to the art, provided the patentee can secure financial aid to prosecute his claims.

I do not mean by this to defend individuals or corporations who, by their power, are able to take advantage of a financially weak patentee and infringe on a valuable basic patent by securing patents on slightly modified details, but since it seems possible for any number of people to secure a United States patent on substantially the same thing, it is only natural that corporations and individuals have resorted to this method of defense from blackmailing litigation.

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[*] Lecture delivered before the College of the City of New York, May 1, 1914, "Met. and Chem. Eng.," September, 1914.

A number of years ago I had to fight an interference on a basic patent all the way to the Supreme Court. We were sustained in every decision. Within less than six months after our patent was granted, if I remember correctly, the Patent Office had granted our opponent two patents on the same process. It seems to me our patent laws have been reduced to an absurdity and that branch of our government has become what Washington called the Congress of the Federated States, "a nugatory body." If American ingenuity is measured by the number and quality of patents issued, the average value of that ingenuity is very low.

There are countries where patents are easily obtained because there is little native ingenuity and the governments need the money, but that is not the case with us. It is not to be expected that any one man or an average group of government officials can be fully informed on every branch of industrial effort, but the securing of an American patent should be an achievement to be coveted as a mark of ingenuity, and our government can well afford to maintain, at adequate salaries, a sufficient number of expert examiners who are qualified to pass on each industry represented in the Patent Office. The laws should be so revised that only basic principles or radical improvements are patentable. Trifling modifications, grouping of old ideas, and other juvenile features that menace progress of an art, should be eliminated entirely.

Real inventions and improvements are valuable and real inventors should be rewarded. Capital is willing to pay for such at any time. Let the profession coöperate to secure the world's highest standard for American patents.

STUART CROASDALE.

Denver, Colo., Dec. 21, 1914.

Steel Balls vs. Flint Pebbles

The editorial in the JOURNAL of Dec. 26, in regard to the use of steel balls vs. flint pebbles in tube mills, raises an interesting question whether means for the removal of fine iron particles from the ground pulp might not only extend the use of steel balls for crushing pulp intended for cyanidation, but might also permit balls of a less expensive kind of steel to be used than manganese and chrome steel.

I recall that I built a magnetic separator a number of years ago for this purpose for a cyanide mill in Mexico, but as the order was placed through a foreign commission house, and the engineer in charge was, I believe, a Spaniard, I was unable to get in touch with the results obtained. I have, however, felt that this subject is worthy of further study and investigation. It is probable that from $\frac{1}{2}$ to $\frac{3}{4}$ lb. of metallic iron per ton of pulp is added to the ordinary quartzose ore from ball mills, and probably $\frac{1}{4}$ lb. more from the coarse-crushing machinery, such as jaw crushers and rolls.

This fine iron is in the form of minute flakes and scales. Its form makes it peculiarly difficult to separate from wet pulp, but I believe it can be done successfully by means of a type of machine especially designed for the purpose. The successful removal of the fine iron thus holds out promise, both of increasing the capacity and also of reducing the cost of crushing and milling ores intended for cyanidation.

C. Q. PAYNE.

New York, Jan. 8, 1915.

California Redwood for Tanks

We noticed an extract from the JOURNAL of Dec. 19, 1914, in the San Francisco *Chronicle,* referring to California redwood and its uses, particularly in the form of tanks.

Regarding the reason for the resistance of redwood to acid liquors, we have always supposed this was due to the fact that redwood contains an acid itself which neutralizes the other acids. This acid is particularly noticeable in green stock fresh from the saw. When anyone handles this green stock one's hands are stained with black, which is very difficult to get off. This is due to the acid. In the dry stock this does not occur.

The presence of this acid also helps to preserve the wood from decay and from rot influences. This is the reason why it has proved so satisfactory for pipe line, silos, foundation lumber, tunnel timbers, etc. It may interest the JOURNAL to know that we have recently closed a sale for 7½ million feet of redwood ties for India, this wood having been selected because of its long life under trying conditions.

J. H. BROWNE, General Sales Manager,
The Pacific Lumber Co.

San Francisco, Calif., Dec. 29, 1914.

[The idea of an acid neutralizing other acids will probably not appeal forcibly to the chemist. However, this is an interesting problem for anyone objecting to the statement. Why is redwood so resistant?—EDITOR.]

The Utilization of Tin Scrap

I note in the JOURNAL of Dec. 26 the remarks on the utilization of tin scrap. I have acted as chemist to one firm engaged in this industry in England and it may interest the inquirer to know that in London there are at least three firms engaged in "burning" solder off old tin cans and one in completely detinning old tin cans by, I believe, an electro-chemical method.

The chief difficulty in the business appears to be the cost of collecting the old tins and the disposal of the detinned iron, which still contains a trace of tin.

A. H. MAUDE.

Vancouver, B. C., Jan. 4, 1915.

Rapid Discharge for Tube Mills

In the report of the Consolidated Gold Fields of South Africa for the year ended June 30, 1914, I notice the statement that it has been found possible materially to increase the crushing capacity of tube mills by means of a scoop discharge at the outlet end, which lowers the level of the fluid pulp in the mill. The result of such a device seems to me to be similar to the rapid-discharge type of mill known in this country, and not different from the older peripheral-discharge type. If better results are to be secured through such means, our pet theory of the point of "critical moisture" is all upset. What new theory has been formed to take its place?

A. Z. JONES.

Philadelphia, Penn., Jan. 15, 1915.

Editorials

Copper in Germany

The contributions upon the subject of copper in Germany that we published last week and publish this week come from authoritative quarters, and give a correct and complete picture of the position of copper in Germany. Briefly, the situation is this:

Copper is scarce in Germany and but relatively little has been obtained from the outside. The high price, officially 22c. per lb., is sufficient evidence of this. On the other hand, the scarcity is not so great as to attract general public attention. Our own correspondent does not mention it at all, but dwells especially upon the scarcity of gasoline and kerosene, two things that are of more immediate importance to the public generally than is copper. The scarcity of copper is rather adverse in its influence upon the building trades, and is causing remarkable attention to the adoption of substitutes.

It is clear from Mr. Werner's statement that the shortage of copper has not materially affected the military operations. Yet the army, like everybody else, is cautioned to be sparing in the use of copper. It is also clear that the Mansfeld mines have not yet been able materially to increase their production, although it is expected that they will ere long be able to meet the military requirements. We may infer, therefore, that the military requirements are somewhat in excess of 4,000,000 lb. per month, which is about the normal production of the Mansfeld mines.

The argument of Mr. Werner that the adoption of substitutes for copper in Germany is going to have a permanently bad effect upon the copper producers of the world, especially the American, strikes us as disingenuous, and does not leave a very good taste in the mouth. He says in effect to the United States: "Embroil yourself with Great Britain, or Germany will forever afterward be no customer of yours."

We do not believe that permanent substitutes are readily going to be found for what has heretofore been considered the indispensable metal, although temporary substitutes there may be. We have experienced times of destitution in expeditions when we have had to make fire with flint and steel, but we were very glad to revert to the use of lucifer matches when we could get them. The substitution of aluminum wire for copper wire has been talked about during many years, but has failed to make any great headway; and we do not believe that the manufacture of belt buckles out of zinc instead of copper is going to reduce the consumption of copper by anywhere near so much as when the automobile manufacturers discontinued brass trimmings and fittings a few years ago.

Anyway, it seems to us that a condition that prevents American copper from going to Germany is the embargoes on copper shipments that have been decreed by Norway, Sweden, Denmark, Holland, Italy and Switzerland, which comprise all the gateways to Germany. Even if Uncle Sam wanted to twist the [illegible] hand, he would find other barriers to open by persuasion, or break down by force.

An American Metallurgist in the Chile Nitrate Field

Charles Butters is not only one of our most distinguished metallurgists, but is also one of our most enterprising metallurgists. One of the latest examples of his irrepressible activity comes to us in the news that the nitrate industry of Chile is just being awakened by him to the importance and applicability of the vacuum filter in its work. A correspondent in Chile writes to us that this means opportunities later for technical men who have had experience in the handling of sand and slime; and he expresses the opinion that in less than five years after peace is declared, a thousand cyaniders will have found work in the Chilean nitrate business. He adds, that the time might be shortened by about four years and six months if an immediate market could be found for Chile's nitrate product.

Chile is so far away that but few Americans know more than vaguely what is going on there. In fact, the great export business of Chile is in sodium nitrate, about two-thirds of the output of which was taken by Germany. When the German purchasing of sodium nitrate was cut off by the war, the Chilean nitrate producers suffered far more disastrously than did the copper producers. As compared with what the interference in these trades meant to Chile, the experience of the American copper and cotton producers was only a mere taste.

The way to help ourselves in developing a Chilean trade is first to help Chile. There are great possibilities there. Let us consider a modern nitrate plant, as built up to the time when Mr. Butters entered the field. It consists of crushers, conveyors, elevators, cars, rails, locomotives, carts, electrical and steam plants, steel tank work, structural steel by the hundreds of tons, piping (steel, wrought-iron and cast-iron), pipe fittings and valves, shovels by the thousands, mules, harness, lumber, corrugated iron, complete machine shop, foundry and repair equipments, evaporators, wire rope, boilers and steam accessories running into a few thousand horsepower for the treatment tanks, air drills, dynamite and accessory explosives, jute bags (Antofagasta requires 20,000 per day), and so on, for pages. One of the recent plants of a certain large company has twelve 20x12-in. Blake-Marsden crushers. There is not a Gates or any other gyratory crusher in any of the nitrate plants.

However, the nitrate producers of Chile manifestly cannot buy these things unless they are able to sell their nitrate. The United States takes some of the Chilean nitrate for its own agricultural purposes, and ought really to have a larger share in supplying the Chilean producers with what they need than has heretofore been the case. But in order to capture that business fully we ought to use more nitrate of soda in this country; in other words, our farmers ought to be induced to use more. Incidentally, we should then be helping ourselves in another way, inasmuch as if our farmers could be persuaded to use fertilizers more freely, they would not only require nitrate of soda, but also the derivative of phosphate rock, which heretofore we have been exporting so recklessly to Europe, and our producers of which are now suffering because their market is cut off. This seems to be the time of all times when every state agricultural bureau and everybody interested in the development of agricultural resources should unite in a great propaganda to extend the use of commercial fertilizers. In so doing the United States would not only improve its agricultural position, but also would develop a great South American trade for its manufacturers and would open new channels of employment to thousands of its citizens.

The Flotation Process

Everybody has, of course, noticed the dearth of discussion about the flotation process in the current technical literature. The explanation of this is the still unsettled patent litigation and the attitude of Minerals Separation, Ltd., the claimant. That company will neither permit its own employees to talk or write about the process, nor will it permit the employees of its licensees to do so. We do not recollect any metallurgical process of broad application and use respecting which such efforts toward secrecy have been exerted and so far have been successfully maintained. Toward that end no stone is left unturned. For example, a flotation apparatus is introduced somewhere for experimental purposes. The experiments finished, the apparatus, which is essentially a construction of timber, is destroyed with axes. Naturally those concerns which are employing the flotation process without license from Minerals Separation and are liable to be called into court, keep their mouths shut as a matter of policy.

This situation is likely to prevail until a final decision in the Hyde case is rendered by the Supreme Court of the United States. In the meanwhile the suit against the Miami Copper Co. is being prosecuted vigorously and is expected to come up for trial in Delaware this spring. This suit is expected to bring into court review the Callow and the Towne systems of flotation.

The flotation process as practiced is a matter of delicate adjustment. With any given ore experiments may fail to give any promise whatever, simply because of failure to conform to some essential, and usually simple, condition. The size of the ore, the quantity of the feed, the temperature, etc., must all be just right, and especially must regularity of feed be attended to carefully. The fundamental features of the treatment also vary according to different ores. Thus, in floating the blende of Butte the addition of acid is necessary. In floating the copper ore of Miami the presence of acid is fatal. The character of the oil used also varies according to the ore. In the treatment of the zinc-lead ores of Broken Hill eucalyptus oil is commonly employed. In the treatment of the zinc ores of Butte, pine oil, a product of wood distillation (analogous to the eucalyptus oil of Australia) is generally used. Sometimes a little oleic acid is added. In the flotation of copper minerals heavier mineral oils are used. The choice seems to be more or less dependent upon what it is desired to accomplish. In the concentration of copper ore the aim is to extract all the copper possible and if considerable gangue is dragged out with it, no great harm is done. In the concentration of blende, however, the production of a high grade of concentrates is more important than the extraction of the maximum possible percentage of zinc. Therefore a lighter, more delicate oil is favored. In some processes of selective flotation some oils that are very light indeed are used. We have touched upon a few of the important points in connection with this process that ought to be discussed in technical literature, but probably that is not to be expected so long as the shadow of the litigation is over us.

The Pato Report

W. A. Prichard's report on the Pato property of the Oroville Dredging Co., reprinted elsewhere in this issue, will doubtless be read with much interest by those who follow dredging matters. There has been considerable discussion from time to time of this enterprise but much of this was beside the mark, because few data were available upon which intelligent discussion could be based. Pato was in the nature of a pioneer enterprise as most of the dredging operations in Colombia had previously resulted in failure. The Pato management encountered many difficulties, and naturally the first few years were disappointing in actual returns, although the real value of the property was at no time in question.

As a result of Mr. Prichard's drilling, the tested area of the property has been extended from 310 to 528¾ acres, having an average depth of 26.3 ft., an average recoverable value of 31.6c. per cu.yd., and a total yardage of 22,419,490. The tested area is thus nearly doubled, while the average value of the original area is maintained. Mr. Prichard's report is replete with interesting data both of a specific and general character that will be of much assistance to other engineers who may have occasion to investigate or direct the operation of properties in what may be called a virgin field for the dredging operator.

It is pleasant to record that after several trying years, Oroville's Colombian enterprises now promise an ample and satisfactory profit. Mr. Pritchard estimates a net return of over five million dollars for Pato and of over four million dollars for the Nechí property across the river. It is interesting to note that the latter property was purchased by Oroville for £10,000, and that the expenses of examination and equipment will bring the total cost of the property only to about £64,000, whereas the estimated profit from the Nechí dredge is over £140,000 per annum, with a yardage already proved sufficient to last about six years; this does not consider the Nechí River bed, nor the bench gravels that may be amenable to hydraulicking.

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The statement of the United States Steel Corporation for the final quarter of 1914 shows the lightest net earnings ever reported for a single quarter; and completes a year in which the earnings were also the smallest ever made. The only annual statement approaching that for 1914 was in 1904. The dividend on the common stock, which had been reduced previously from 1¼ to ½%, was omitted altogether, and a draft on the accumulated surplus of $5,736,713 was needed to make the payment on the preferred. The result was not unexpected. The reaction from the too heavy buying of 1913 had just begun to pass, when the upset of credit and business due to the war sent down trade to a low point, and low prices failed entirely to stimulate it. The business of the Steel Corporation simply followed the general course of the steel trade, and its losses were probably even greater than those of its independent rivals.

BY THE WAY

A dialogue according to the *Inland Printer*: "How's your latest gold mine panning out?" Fake promoter: "Beyond expectations. Why, old man, it's assaying over a thousand suckers to the ton of literature."

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We have several times remarked how the zinc-smelting works of Belgium and Poland had happened to be in the region of military operations, while those of Silesia and Galicia were in such close proximity to regions of fighting that they also be threatened. We little thought that anything of that sort might happen to a British smeltery, but the works of the Central Zinc Co., at Seaton Carew, near the Hartlepools, were in the zone of the bombardment of the German squadron which recently raided the British coast. Fortunately the works suffered no damage, but an 11-in. shell fell and burst in a field at the back of the manager's house. The incident led to the removal and internment of the German and Austrian workmen who, up to that time, with the sanction of the government, had been kept at work, under strict military control, because the continued production of spelter in England is of importance in the public interest, and there was no sufficiently skilled English labor to take their place. How far it will now be possible for the Central Zinc Co. to continue its operations to the full previous extent is doubtful, but every effort is being made to that end. Meanwhile, the works are being increased as far and as fast as labor conditions allow.

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The valuation of the estate of the late Herman Frasch, as filed in the office of the State Controller, Nov. 18, is $5,261,276. This is a respectable total representing Mr. Frasch's earnings from his two chief accomplishments, the discovery of methods for desulphuring Petrolea and Lima oils; second and chiefly his successful working of the Louisiana sulphur deposits, after a number of others had failed. Indeed it was to his management of the Union Sulphur Co. that most of his fortune was due. It appears from the statement of his property that Mr. Frasch was not a believer in real-estate investments, his entire fortune being in securities and cash. His judgment as to stocks was good, by the way, nearly all of those which he held being of the gilt edge variety. Of those which we would naturally expect to find are American Agricultural Chemical Co., 1000 shares valued at $93,000; Virginia-Carolina Chemical Co., 1485 shares, $46,742; Standard Oil Co. of New Jersey, $700,000; Union Sulphur Co., 505 shares, appraised at $2250 per share. The last item is of interest, as the first valuation we have seen of Union Sulphur stock.

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A great mine that was pronounced a failure but was converted into a great success by the persistence of Grant B. Schley, of New York, who is now the controlling factor, is heard of but little. This is the Britannia, in Howe Sound, British Columbia. At a recent meeting of the Institution of Mining and Metallurgy, Mr. Trewartha-James told briefly of the history of this enterprise. The company had been exploiting this mine for a number of years, and had spent something like $3,000,000 without any profit. Mr. Schley, from long study of the subject in all its details, arrived at the conclusion that before he abandoned the mine he would put in two or three adit levels at considerable depth beneath the great orebodies which they had not been able to work profitably above, and of which large quantities of available tonnage remained. The engineer in charge of the mine, declined to be responsible for driving these deep tunnels, and resigned his post because he saw no prospect of attaining a useful object thereby. The result of that exploitation at depth was to make the Britannia mine one of the most remarkable mines on the West Coast, one of the great profitable producers of copper, and that "forlorn hope" has become of the utmost importance, not only to that company, not only to that district, but to the whole science and art of mining on the Pacific Coast.

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The question of a new property for Stratton's Independence, Ltd., was discussed at the recent annual meeting in London. It is estimated that the company has about two years' ore supply from July 1, 1914; however, some of this ore is so low in grade that it is not practical to determine, except by mill sampling, its value. The company has in hand about £20,000 for the purpose of handling a new property if one of a sufficiently attractive character should be placed before it. The chairman announced that during the last year Consulting Engineer Argall had under consideration from 30 to 40 prospects; 56 mines had received more careful attention, 45 being turned down after examination and casual inquiries; 10 mines had been visited, partially examined and sampled; and one mine fully examined and sampled and a complete report prepared upon it. For this property, Mr. Argall had not been able to negotiate terms which he could recommend to the company for acceptance. He desired an option arranged for a sufficiently long period to enable the proposition to be placed before the shareholders in general meeting. Leopold Salomons, holding nearly 30,000 Stratton shares, wrote to the chairman objecting to the acquisition of another property by the directors, but as the proposition is to be submitted to the shareholders at a general meeting, all will have an opportunity to express their opinion as to the desirability of acquiring another property and continuing in a business for which they are now well equipped.

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David H. Browne, metallurgical engineer with the International Nickel Co., has achieved high distinction as being the successful developer of coal-dust firing applied to reverberatory copper smelting, although Mr. Browne himself properly gives credit to S. S. Sörensen as being the pioneer, and to the late Charles F. Shelby as being the first disciple. The work of Messrs. Sörensen and Shelby paved the way for what Mr. Browne, Mr. Howard and the Anaconda metallurgists have later accomplished. Mr. Browne has the gift of terse and witty expression. There are numerous examples of this in his recent paper in the transactions of the American Institute of Mining Engineers. One of the best is his characterization of the vicious circle of between products in old metallurgical practice. Speaking of the production of flue dust in former times at Copper Cliff, he remarked: "But little flue dust was produced, and this, following the time-honored custom, was wetted down and put back with the charge. Whether the flue dust really smelted, or whether it was worn out by being chased around in a circle, was a problem that troubled no one." Further on in his paper, Mr. Browne suggested that the low temperature of the gas at the throat of the Copper Cliff reverberatory, 922° C., might be criticized by Western smelters who usually have 1200 to 1300° at that point. Mr. Browne explains this, however, by telling that the heat of combustion is well utilized in smelting ore along the side walls, and consequently the escaping gases, having done more work than is usually the case, are relatively cold. "The function of a reverberatory furnace is to melt ore, and not to raise steam," he remarks, "and for this reason the more heat that is absorbed from the coal gases in the furnace, the more efficient the operation and the cooler the escaping gases."

* * *

J. A. Comer & Co. (incorporated), metallurgists of Seattle, have published a pamphlet that we have read with a great deal of interest. The company (capitalization $1,000,000) was organized as a holding company, acquiring stock interests in other companies that may be started to operate with the methods supplied by the holding company. One such subsidiary—the Noble Metals Co.—is installing a plant at Seattle that is expected to turn out 30 tons of concentrates per day. It is said that the metallurgists and chemists connected with J. A. Comer & Co. have given years of study to the special treatment of ores of the entire group of noble metals "and their success in extracting and saving values far in excess of what can be saved by usual methods places them in a class by themselves in the metallurgical world." Yet, J. A. Comer, the chief metallurgist, does not claim to extract larger values from all ores than are extracted by other competent metallurgists. He claims merely that by special treatment he has demonstrated hundreds of times that values from two to 10, and even as high as 20, times that shown by usual methods of assay can be extracted and saved commercially by his process. Supporting this claim some examples are given: Ore from Porcupine gave $20 by the "old fire assay" and $212 by the Comer assay. Ore from Vermont gave $1 and $36 respectively. Alaska ore gave $2.50 by the "old fire assay," $24 by the Comer assay and $11.80 by the Comer commercial treatment. Massachusetts pudding stone gave $1.60 by the "old fire assay" and $24 by the Comer assay. The foregoing data appear on the buff paper of the pamphlet, the prospectus of J. A. Comer & Co. (incorporated). In some following white pages, J. A. Comer becomes personal, thus:

> **Does the Fire Assay Extract the Values from All Ores?**
> **I answer—NO.**
>
> I realize when I make this statement that I am going contrary to all teachings, all practice, and condemning a theory that is accepted the wide world over as being infallible. This is not the first time pet theories have been upset, nor will it be the last.
>
> I may get ridden on a rail
> Or perhaps tarred and feather instead
> **But a principal that is right will prevail**
> No matter what may be said

We must acknowledge that Mr. Comer has thus disarmed criticism, but what gets our goat is that Massachusetts pudding stone.

The Prospector

By Berton Braley

My pick is stuck in my belt loop, my pipe is stuck in my face,
I'm off to the snowy mountains, I'm moving from place to place,
With the clear cool air about me and the chance of a "strike" ahead,
And all of my cares and troubles back in the town I've fled.
Smoking my strong tobacco, humming my happy song,
I'm off on the search for the gold I've hoped, the gold I have sought for long;
But whether I find it or fail once more, whatever my fate deems best,
At least I'll have been on the hike again and sated my deep unrest.

By day in the barren gulches, or up on the snow field's sheen,
Or wandering through the valleys, all quiet and cool and green,
With an ice-cold torrent tumbling over the rocks and sand
And maybe a cordial rancher to shake me by the hand,
With a welcoming, "Howdy, stranger, would you care for a bite with me?"
Then a supper of spuds and bacon whose savor is heavenly,
And night comes over the mountains, and the heights and peaks assume
A dim and a vague translucence, like shadows of stately gloom.

Sometimes with no walls about me, no roof but the sky above,
I lie in my army blanket and—ponder on life and love?
Well, no, I pull on my briar, I'm held by the night in thrall
And I watch the thin smoke melt away and think of nothing at all.
Peace to the wide world's worries, they are millions of miles afar,
They look as distant and small to me as the uttermost tiny star,
And the nightwind brushes my temples and drowsy visions creep,
Into my idle, carefree brain—and then comes a dreamless sleep.

My pick is stuck in my belt loop, my pipe is stuck in my face,
I'm off on another prospect, hoping that I may trace
Some vein of the yellow metal, or even the red or white,
And never was heart more eager, and never were hopes more bright.
What if I never strike it? you ask with a pitying smile
Why, friend, the very searching is many times worth the while,
For it lifts my troubles from me and I know from the very start
That one sort of gold I am sure to gain—the gold of a carefree heart!

PERSONALS

A. Chester Beatty arrived from London on Jan. 23 and will be in New York for a few weeks.

Frederic Kemble Brunton is making an examintaion of the Copper King mine near Clarkdale, Arizona.

Charles M. Schwab, president of the Bethlehem Steel Co., is reported to have secured another large contract for material for export.

Ward Paine, assistant to the president of the Copper Range Consolidated Co., is in the Lake Superior country visiting the property.

Frank McM. Stanton, of the Wolverine and Mohawk mines in Michigan, has returned to New York after a three weeks' inspection of property.

Howland Bancroft has just returned from an extended trip into British Columbia and is now engaged in professional work in Colorado.

N. V. Hansell, of Hamilton & Hansell, New York, sailed on Jan. 23 for Europe. He expects to visit England, Russia, and the Scandinavian countries before returning to New York.

Professor Joseph Daniels, of the Mining Department of the University of Washington at Seattle, has gone to San Francisco to take charge of the state mineral exhibit at the Panama-Pacific Exposition.

O. H. Tittman has been elected president of the National Geographic Society in place of the late Henry Gannett. He is superintendent of the United States Coast and Geodetic Survey, was one of the founders of the society and has been vice-president for five years.

C. A. Filteau, Colorado School of Mines, 1906, who has spent the last two years in the interests of American capitalists in Japan and Korea, has been appointed general manager of the Inca Mining & Development Co., Carabaya, Puno, Peru, and has sailed from New York for his new post.

The City of Philadelphia, acting on the recommendation of the Franklin Institute, has awarded the John Scott Legacy medal and premium to Dr. Charles Edouard Guillaume, of Sevres, France, for his alloy invar. This alloy consists of 63.8% Fe and 36.2% Ni, and has a coefficient of linear expansion of only 0.0000004 per degree centigrade.

Walter Hicks Clingerman, of Scottdale, Penn., has been chosen president of the H. C. Frick Coke Co., to succeed the late Thomas Lynch. He has been general superintendent for 10 years past. Clay F. Lynch, son of the late president, and recently general manager of the Bunsen Coal Co., of Illinois, succeeds Mr. Clingerman as general superintendent.

Walter Harvey Weed is in Butte, Mont., having gone out on professional work. Mr. Weed's offices and those of the "Copper Handbook" have been moved from Houghton, Mich., to 29 Broadway, New York. Mr. Weed contemplates making a "Mines Handbook" out of the "Copper Handbook," including gold, silver, lead, zinc, manganese, tungsten, bismuth and vanadium mines. The new volume will appear sometime during the present year.

Allen L. Burris, president and general manager of El Paso Consolidated Gold Mining Co., Cripple Creek, Colo., has resigned his office, giving as his reason that "at a called meeting of the company's board it developed that the directors did not agree with my policy. Since the burden is too heavy for me with disagreements, I have tendered my resignation as president." The disagreements related to the cause for the depression in the recent price of the company's stock in the markets.

OBITUARY

Henry Gurney Morris died at his home in Philadelphia, Jan. 19, aged 75 years. He was widely known as an engineer and a constructor, especially of motive power. He was born in Philadelphia, and graduated from Harvard University. He became a member of the firm of Morris, Tasker & Co., and later was the founder of the Southwark Foundry. He was one of the first directors of the Pennsylvania Steel Co. He was a member of the American Society of Mechanical Engineers, of which he was a past vice-president, the Engineers' Club, of which he was past president, the American Institute of Mining Engineers, the American Society of Civil Engineers and the Franklin Institute of Philadelphia. A widow and three sons survive him.

SOCIETIES

University of Washington—The "Short Course" in mining opened Jan. 4 with an enrollment of about 30, including a number from Alaska.

American Institute of Mining Engineers—The annual meeting of the Montana Section for the election of officers will be held Feb. 5. The regular informal dinner at the Silver Bow Club, Butte, Mont., will precede the meeting. The business and technical session will be held at 8:30 p.m., in the parlor of the Silver Bow Club. The following papers will be read and discussed: "1. The Concentrator of the Timber Butte Milling Co.," by Theodore Simons. "2. The Boulder Batholith of Montana," by Paul Billingsley.

American Electrochemical Society—The New York Section on Feb. 5, at the Chemists' Club, New York, will hold a joint meeting with the Society of Chemical Industry and the American Chemical Society. Subject of the evening: "The Electrochemical Production of Dye Stuffs and other Organic Products." Speakers: F. A. Lidbury, Oldbury Electrochemical Co., Niagara Falls; Harold Hibbert, Mellon Institute of Industrial Research; Geo. S. Forbes, professor of electrochemistry, Harvard University. The discussion following the reading of the papers will be opened by Dr. Leo Baekeland.

American Institute of Mining Engineers—The annual meeting of the Colorado Local Section was held at the Savoy Hotel, Denver, Jan. 16, following a dinner. Officers were elected for the ensuing year as follows: Chas. A. Chase, chairman; S. A. Ionides, vice-chairman; C. L. Colburn, secretary. Following the business meeting an address was delivered by Dr. R. B. Moore, of the United States Bureau of Mines, on "The Rare Gases of the Atmosphere." Tubes of the rare gases were exhibited and interesting experiments were performed. Interesting facts were related in connection with the discovery of these gases and the development of our knowledge thereof. About 40 members were present.

Canadian Commission of Conservation—The sixth annual meeting of the Canadian Commission of Conservation was held at Ottawa, Jan. 19 and 20, Sir Clifford Sifton, chairman, presiding. His opening address dealt mainly with matters relating to agriculture, forestry and the pollution of streams. Rhys D. Fairbairn, of Toronto, presented a paper on "Technical Education." Dr. Frank D. Adams, of McGill University, Montreal, in a paper dealing with the "Conservation of Mineral Resources," stated that the most serious waste in Canada was in connection with the mining and subsequent treatment of coal and with obtaining supplies of natural gas. Dr. Eugene Haanel, Canadian director of mines, in a report on non-metallic minerals referred to the Alberta oil fields, stating his opinion that the discoveries so far made and the prospects of future finds did not afford any guarantee for investments. A number of other papers were read.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

SULPHATIZING—Process of Sulphatizing Ores. Archibald D. Carmichael, West Norfolk, Va., assignor of one-third to Henry Schuyler Montgomery, Norfolk, Va. (U. S. No. 1,124,696; Jan. 12, 1915.)

SULPHIDE ORES—Process of Treating Sulphide Ores and Other Metallic Sulphides. Kristian Birkeland, Christiania, Norway. (U. S. No. 1,121,606; Dec. 22, 1914.)

TIN—Improvements in and Relating to a Process for the Recovery of Tin by Conversion into Volatile Tin Compounds. A. Richards, London, Eng. (Brit. No. 8611 of 1914.)

TIN—Process for the Production of Tin or Tin Compounds from Pyritic or other Tin Ores, Tin-Ore Concentrates, Tin-Waste, Tin-Plate Waste, Stanniferous Slag, Tin-Slag, and the Like. Jan. Rueb, The Hague, Holland. (U. S. No. 1,124,174; Jan. 5, 1915.)

TUNNELS—Lining for Tunnels and for Shafts. George Henry Dunlop, Brisbane, Queensland, Australia. (U. S. No. 1,125,013; Jan. 12, 1915.)

WELDING—Method of Electric Welding. Charles H. Kicklighter, Atlanta, Ga. (U. S. Nos. 1,123,308; and 1,123,309; Jan. 5, 1915.)

ZINC—Process of Removing Zinc from Zinc-Coated Material. Josef Weber, Essen-on-the-Ruhr, Germany, assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. No. 1,122,340; Dec. 29, 1914.)

ZINC FURNACE. Otto Ernst Ruhoff, Madison, Wis. (U S. No. 1,121,874; Dec. 22, 1914.)

Editorial Correspondence

SAN FRANCISCO—Jan. 20

The State Mining Bureau has concluded to place an exhibit in the mining and metallurgy building of the Panama Pacific Exposition. This would have been done earlier, but as usual the funds of the bureau have not been equal to such extra expenditure as would enhance its usefulness. Mr. Hamilton, state mineralogist, will detail a competent mining engineer from his staff to attend and take charge of the exhibit, and furnish information to visitors. The bureau has a large display of the various ores and minerals produced in California, which has attracted a great many visitors in the past, and which is in fact one of the most complete exhibits in the West. A large part of this collection will be placed in the space provided at the exposition. It will serve the purpose of instruction as to the varied resources of California. It will not be confined to a selection from the mining bureau collection, but will include also exhibits from owners of mines and individual collections. It was at first decided that a special effort would be made to attract visitors to the mining bureau at the Ferry Building, but it would probably have been unsatisfactory to adopt this plan, because people coming to the exposition for the purpose of seeing mining exhibits among other things, are not likely to spend much time looking about San Francisco for other similar displays of the mineral resources of the state.

Protection of Oil Lands menaced by infiltration of water will be undertaken by a bill to be presented in the state legislature. Some time ago representative of men requested State Mineralogist Hamilton to prepare a bill and submit it for their consideration. The oil men were in favor of district control, which is already in force in a voluntary way in the Midway and Coalinga fields. The objection to the law authorizing the formation of districts is, that it does not compel such formation, leaving it to the pleasure of the oil men interested in the districts. Many of the oil men desire legislative compulsion. Mr. McLaughlin, in charge of the petroleum department of the mining bureau, drew a bill for such compulsory district formation and submitted it to a meeting of oil men and representatives of the Senate committee on oil industry, at Sacramento, Jan. 15. Serious objection was made to this bill, although no one representing the oil men or the Senate committee seemed to have any better to offer. A meeting was held at the State Mining Bureau on Jan. 21. This meeting was better attended. The state mineralogist presented an entirely different bill providing for state control. This bill also met with some opposition. Some of the oil men insisted upon the district plan, but as on the previous occasion they seemed to have no definite method to suggest. It was decided that the bill for state control and the bill for district control should both be published for the consideration of oil men all over the state. These two bills will be introduced in the legislature prior to the closing of the present 30-day session, considered in committee, and have a fair hearing by everybody interested with good prospect of passage of one of them, which may be amended to meet the desires and requirements of the oil producers. The bill for state control, drawn by Mr. McLaughlin and presented by the state mineralogist, with possible revision and some moderate amendments, is probably the best and surest solution of the problem that has yet been offered in the legislature or out. There have been bills proposed which practically met with complete endorsement of the majority of oil producers, but they were not such bills as would stand judicial investigation. The present bill for state control contemplates minor changes in the conduct and operation of the state mining bureau and coöperation, so far as the oil industry is concerned, with the U. S. Bureau of Mines.

DENVER—Jan. 21

The Liberty Bell has lost its appeal to the Colorado supreme court in the case of the Moorhead Mining & Milling Co. which won a suit for trespass in a lower court. The decree granted the Moorhead company damages amounting to $46,072, for removal of ore from its property. Some time ago, the Liberty Bell lost a similar suit instituted by the Smuggler-Union.

Carnotite prospecting and mining in the western part of the state is at a standstill. Charges are made by prospectors that there exists a so called radium trust which controls the purchase and marketing of such ores. They contend that the Federal government should establish plants to purchase and treat their ores much upon the plan followed in Austria. The work that has been under way for a year or more by the Denver branch of the U. S. Bureau of Mines is in line with the desires of these complainants. The bureau has a plant in which it can handle reasonable amounts of ore but it was built primarily for research work rather than commercial purposes.

BUTTE—Jan. 21

St. Paul Electrification Contract is one of the most important ever placed, according to reports. The contract which General Electric has taken calls for electric locomotives, substation apparatus and line material. Transmission lines covering 113 miles between Three Forks and Deer Lodge will comprise the initial work. There are to be four divisions to the work, which when finished, will cover 440 miles with approximately 50 miles of track between Harlowton, Mont., and Avery, Ida. Ultimate plans provide for pushing this electrification forward from Harlowton to the coast, a distance of 850 miles. This St. Paul work is the first attempt to install and operate electric locomotives on tracks covering several engine divisions. Power will be supplied by the Montana Power Co., which has at present 68,890 kw. of developed power and further developments under construction of 175,000 kw. The power for electric operation has been contracted for by the railroad at a cost of a trifle over ½c. per kw.-hr. on the basis of a 60% load factor. The contract provides that the 440-mile electrification shall be in operation by Jan. 1, 1918. The system is to be direct current. General Electric figures submitted to the St. Paul show an estimated saving in operation equal to 20% on the total cost of electrification, without allowing for the increased capacity of the lines which electrification makes possible or for improvement of service. The estimated figures provide for an increase of 35% in tonnage per train and a saving of 27% in time per trip. The trolley construction will be of the catenary type similar to that which the New Haven has. Already 30 miles of poles have been set. The electric locomotives will be the most powerful of their kind ever built. They will weigh 260 tons and will have a greater continuous capacity than any steam locomotive now in existence. Nine freight and three passenger locomotives are provided in the initial order. The freight locomotives can handle a 2500-ton trailing load on a 1% grade at a speed of 16 miles and on heavier grades two locomotives will be used. These locomotives will require inspection only after a run of 2000 miles, require no stops for water, coal, dumping ashes, cleaning boilers and other delays demanded by the conventional steam locomotives.

SALT LAKE CITY—Jan. 21

The Keystone Mining Co. of Park City filed suit in the U. S. district court, Jan. 18, against the Kearns-Keith Mining Co., complaining of the removal of ore by alleged trespass. The complaint states that, until 1912, the Kearns-Keith conducted certain operations which resulted in trespass within the Red Fox and U. J. lodes of the Keystone Mining Co. It is stated that ore of an estimated value of $40,000 was removed.

SEATTLE—Jan. 20

The Ruby District business men's drilling campaign is not panning out well. Last summer a drill was purchased by some of the business men of the town who were anxious to have the creeks in the immediate vicinity prospected with the hope that pay would be found close to town. While their intentions were praiseworthy their method of handling the undertaking is said to have been a source of amusement to the old sour-doughs. Since the drill was placed on the ground there has been bickering and quarreling over who should handle it, so that to date nothing has been done and valuable time has been lost; there is still hope, however, of starting work before the winter is over.

In the Shoup Bay district constant mining development will be the order all winter. Reports from the Sealey-Davis mine state that the property is looking well. Good ore is being taken out steadily. The Three-In-One will resume work early in the spring, and the owners expect it to be a mine in a little while. Extensive work will be done on the Gold Bluff, adjoining the Cliff, on the Shoup side of the hill. Little work has been done on this property for two or three years, because of litigation with the Cliff. This was settled a year ago and the Gold Bluff people proceeded with their applications for a patent, which will be issued soon, the final receipt for payment for the land having been received from the land office last fall. Work will be carried on practically all winter by the owners of the Cliff mine which is showing better than it has in some time.

In the Koyukuk, the showing is good in the old creeks and the mining outlook is all that could be expected. Pay has been uncovered on several of the older creeks, while prospects on others are fairly good. With the discovery of good pay on some of the worked-over ground renewed activity in prospecting is in evidence in the whole camp and before summer comes around it is expected something in the nature of a big strike will be made. A rich paystreak has been developed on Wild Creek according to the best information. About 40 men are working on both Wild and Jay Creeks now. On Jay, a tributary of Wild, pay has been located across six claims which average from $200 to $1000 per box-length. Portions of the creeks are difficult for winter mining owing to the fact that water running on bedrock floods the shafts, but the ground is so rich that many of the operators plan to work all winter.

The Tolovana Strike on Livengood Creek continues to attract attention. The scene of discovery is the center of a triangle of which the old camps of Fairbanks, Circle and Rampart (Hot Springs) are vertices. Roadhouses have been built along the trail from Fairbanks and a trading post started on Livengood. Little is known as yet regarding the value of the find, but the outlook is encouraging. The country rock is said to be limestone, gabbro, greenstone and serpentine. The gold is coarse and occurs irregularly in the gravel from top to bottom, the deepest shaft being down about 40 ft. without reaching bedrock. Shallower ground is found in other places. From claim No. 5 Below Livengood Creek, there is reported 5 ft. of gravel running 3c. per pan, $4 per cu.yd. On Ruth Creek, an opencut run 80 ft. into the bank disclosed 15 ft. of gravel at the inner face panning 1 to 3c. Good prospects are also reported from Mike Hess Creek and from all tributaries of Livengood heading in Amy Dome. Many prospectors are at work. Probably ground suitable for dredging, scraping or hydraulicking will be found, even if richer deposits are lacking. Knowles & McCord have leased eight claims on Livengood Creek with option to purchase for $45,000.

JOPLIN—Jan. 23

Better Prices for zinc ores in the Joplin district are leading the mine operators to prepare to take advantage of the high prices; they are rapidly bringing their plants up to full capacity, and as is usual in this district during times of prosperity there are a number of new properties being opened up and a number of drills dot the countryside. Considerable activity is noted within the areas of the sheet-ground deposits, especially around Webb City where a number of new leases have recently been taken on both old leases and new territory. With the coming of better weather these places should get into active operation at once.

An Extensive Pumping campaign is contemplated, involving the pumping out of all of the old ground lying east of Webb City and south of Carterville, covering the Missouri Zinc Fields tract, Homestead tract and a number of smaller tracts of ground; the object in view is that of mining not only the upper levels which have already been mined extensively but of opening up the lower sheet-ground levels which here have been mined only over small areas. The sheet-ground ore was [illegible] when prices for zinc ore were around $30 and $35 per ton—too low for the successful operation of sheet-ground mines, except in a few instances where the orebodies were exceptionally rich, running 4 and 5% blende. With the present high price for zinc ore of $55 to $60, it is an easy matter to make sheet ground pay to operate even where the recovery is as low as [illegible] blende. There are a number of sheet-ground properties throughout the district which will be opened up and operated again while the high prices prevail.

DULUTH—Jan. 23

The Inland Steel Co. has this week taken over the Armour No. 1 and No. 2 mines on the North Range of the Cuyuna, and will assume control Feb. 1. These mines were formerly operated by the Rogers, Brown Ore Co. for the Iroquois Furnace Co. Both are undeveloped properties but estimates are now being prepared for [illegible] which lies immediately east of the Pennington [illegible]. The Inland Steel has heretofore been operating the Thompson [illegible] immediately east of the two Armours. With the ore [illegible] these two properties are the best on the [illegible] to both grade and tonnage, each body being estimated at upward of 7,000,000 tons. The Armour No. 2 has been and is operating steadily but No. 1 has not been producing since 1913. The Rogers, Brown company still controls and operates the Kennedy mine at Cuyuna, the pioneer producer of the range. It is understood that efforts are being made to dispose of this property, as well as the Meacham mine, adjoining the Thompson, which the company has carried for a number of years but which has not produced. Rogers, Brown recently surrendered its lease to the Iroquois mine on the Mesabi range, but still retains some small interests in the Michigan districts. Until recently the organization has suffered severely because of internal friction in the mining end of the operation. Last year President and Gen. Mgr. Chester D. Tripp and Supt. H. J. Kruse resigned. The company's Cuyuna range headquarters have been moved from Crosby to Cuyuna.

ISHPEMING—Jan. 23

The Vanadium Deposit in Baraga County is not highly spoken of in the report made by Assistant State Geologist Hopper. No evidence of the minerals endlichite and carnotite reported were found by him in the specimens collected at the time of his recent visit. No vein over 3 in. wide was seen. Actual conditions do not tally with published accounts.

GREENEVILLE, TENN.—Jan. 23

The New Railroad which is being surveyed to extend from Kingsport on the Clinchfield road to Newport on the Oliver road from Knoxville will make accessible many prospectively important deposits of iron and manganese ores and zinc, lead and barite. The road follows the first great valley west of the Smoky Range and runs generally northeast and southwest across Greene and Cooke Counties. The iron deposits in Cove Creek Basin which will be tapped by the new road were extensively mined in the early half of the last century, furnishing the ore for many charcoal forges, from which the excellent quality of Tennessee iron was made. These have all been idle since the early '70s. The iron deposits are similar genetically to those at Embreeville and in parts of southwestern Virginia. Zinc occurs along the new line with certain iron deposits and as replacement and breccia filling along crushing zones in the Knox dolomite [illegible] as at Mascot, Tennessee, and near Knoxville. There has been practically no exploration or development of the zinc deposits. Formerly the barite deposits in parts of the area were worked but until recently this business has been languishing owing to the competition of the cheaply imported barite in the eastern markets of the United States. Now several local operators are preparing to mine and ship barite and users are offering to take good sized contracts at attractive rates for the best grades of the crude ore.

TORONTO—Jan. 23

Cobalt Output will be considerably curtailed for some time owing to the shortage of power caused by the dryness of the weather last fall. The Northern Ontario Light & Power Co. has notified the mine managers that beginning Jan. 25, every mill in camp must be closed down for one week in every four until the shortage is over. Some of the companies will close down for three weeks continuously so that they will have only one stoppage, others will close for a week at a time. Mining operations will be continued by those companies having auxiliary steam plants capable of supplying the deficiency. At present there is no fear of any power shortage in the Porcupine camp.

PRINCE RUPERT, B. C.—Jan. 18

The Rocher de Boule Copper Co., although closed down at present on account of the market, put in an active year of construction and development. A 250-hp. hydro-electric power plant with pipe line and dam was constructed, and a five-mile transmission line from the power plant to the mine. At the mine there was erected a small portable saw mill with a capacity of 5000 ft. b.m. per 10 hr., a 12-drill compressor, and a Leyner sharpener. The mine is using Leyner machines and did 1200 ft. of development work in 1914. For transportation a 4½-mile aërial tramway was put in, overcoming a difference in vertical elevation of 4500 ft., and a narrow-gage railroad 3000 ft. long was constructed to handle the ore from the mouth of the tunnel to the tramway. In addition there were built six miles of wagon road and three miles of mountain trail. Four sets of ore bins were erected along the tramway, and 25 miles of telephone and telegraph service were completed. At Price Rupert ore bins and a wharf are under construction to permit loading the steamers by gravity. The chalcopyrite and tetrahedrite ore runs about 10% in copper and carries a combined precious metal content of about $4. The veins are fissures in grano-diorite. The property is controlled by Butte interests, and is in charge of Daniel J. Williams. It is hoped to resume operations about April 1.

The Mining News

ALASKA

BEATTIE, BARETTE & HAMILTON, laymen on upper end of Hard Luck claim, upper Vault Creek, have found pay running $5 to $6 per sq.ft. Ground lies above Prest workings of last summer; supposed to be continuation of rich pay worked by Prest.

FRED STRUTHERS AND TONY BOGETTI have proved pay on Palmer Creek, tributary to Chena River, estimated to run over $1 per sq.ft. for width of 126 ft. Ground examined by H. R. Walters last spring for Chicago capitalists, who contemplated putting on scraping plant, but difficulty of transport and other causes led to surrender of options.

KUSKOKWIM RIVER channel through delta, practicable for navigation, announced by Secretary Redfield, as made by Captain Lukens of the Coast and Geodetic Survey. Kuskokwim, second largest river of Alaska, valley offers exceedingly promising field for prospecting. Headwaters tap Innoko-Iditarod district. New steamer lines to be established.

VALDEZ CREEK PLACER MINES reports shipping to property, of Keystone drill and Ingersoll-Rand compressor and drilling outfit. Compressor capacity 310 cu.ft. per min., to be driven by [illegible] hp. Pelton wheel. W. T. Smith, superintendent of transportation for company, to leave Seattle with freight Jan. 30. A. H. Beeson, operating superintendent, is purchasing next season's supplies in Seattle. Expects to start hydraulicking in May, clean up in four months and hydraulic again until freeze up. President [illegible] reports expenditures in 1914 and 1915 to date as follows: Purchasing [illegible] property, $5500, Smith Monahan property, $6,750, sundry property expenses, $770, development, [illegible], equipment, $17,2[illegible], administration and supervision, [illegible], interest, $18,137. Cash in Bank of Cordova is $1,[illegible].

READY BULLION (Treadwell)—Rich pocket of ore reported recently encountered. Stopes have been well lined with rich ore for more than a week, but extent of deposit not yet known.

TEIKHELL GOLD MINING CO. (Valdez)—Several men running tunnel near Teikhell roadhouse. Driven to crosscut three veins. First one at [illegible] ft. from entrance assays showed $109.

CORDOVA MINING & DEVELOPMENT (Cordova)—Company completed 42 ft. of tunnel in December according to report of Superintendent Thomas. Tunnel was started on stringer running diagonally toward main vein at point where it has 3 ft. of width. At face of tunnel stringer shows 8 ft. of good looking quartz.

ROSE GROUP (Valdez)—Development work started by H. James and W. Quitsch, on Mineral Creek. Planned to drive tunnel 20 to 25 ft. and tap lead, which should be reached at depth of 50 ft. Rock from vein brought to Crawford stamp mill gave good returns. Owners intend to push development as fast as possible.

NOS. 1 AND 2 BELOW SUNDAY CREEK (Nome)—Strike of considerable importance reported made on these bench claims by Frank Rice and Charles Haering. Paystreak over 100 ft. in width carrying values of 1 to 25c. from grass roots down, developed and said to extend considerable distance along creek. Rice & Haering extracted $50 in three days with scant supply of water.

ARIZONA

Gila County

STRIKE started Jan. 11 among construction mechanics of Inspiration spread to miners of Inspiration, Miami and Old Dominion, who demanded restoration of wage scale existing before war cut. Latest reports state increase was granted and work was resumed Jan. 23. Strike lasted 12 days, from 1500 to 2000 men being affected. Said to have been one of cleanest and best conducted on record. Strikers provided peace committee, and there was not one quarrel or loud argument on streets of Miami.

CALIFORNIA

Amador County

MOUNTAIN KING AND QUEEN (Pine Grove)—Pine Grove Consolidated Mining Co. operating under purchase option is installing hoisting machinery.

PLYMOUTH CONSOLIDATED (Plymouth)—Average cost of mining and milling reported $2.40 per ton for November. While this is increase of 10c. per ton over October, it is lower than average cost of mining and milling Mother Lode ores, which is said to be $2.80. Modern methods largely accountable for reduction.

Butte County

DOUBLE EAGLE MINING CO. (Chico)—Damage suit for $7500 and restitution of property brought against J. D. Hubbard and others.

DOLLING GOLD MINING CO. (Angels Camp)—Thought mine will be reopened within short time. Development just before closing down disclosed good ore and evidence of persistence of orebodies.

Eldorado County

YELLOW JACKET (Placerville)—Working lease and bond obtained by Burr Evans on this lode claim in Weber Hill district for Judge James Du[illegible], of Brooklyn, N. Y.

Nevada County

KENOSHA MINING CO. (Grass Valley)—Resumption of work contemplated. The 400-ft. shaft will be deepened and levels extended into new ground.

RED LEDGE (Washington)—Strike of ore reported. W. W. Meeks, manager, has done large amount of development work including 1000 ft. of new tunnel.

CHEROKEE (Tuolumne)—Old 400-ft. tunnel cleaned out and will be advanced 100 ft. to connect with old shaft sunk in early days when this gravel mine was producer.

CALIFORNIA (Grass Valley)—J. W. Degelier has taken a bond on this property in Dead Man's Flat district. Reported bond is in interest of George Wingfield, of Nevada. Mine has been producer and it is believed production can be resumed.

Shasta County

RUSSELL PLACERS (Igo)—Prospecting with Keystone drills will be undertaken immediately by F. T. Wiltsee, of New York, who is represented by Fred Grotefend, of Redding. Ground bonded by Wiltsee is same that was worked for a short time with dry-land dredge by Potter and Thompson.

MAMMOTH (Kennett)—Smelter resumed with three furnaces which was closed down at beginning of war. Fifty additional men will be employed and operation of plant, extraction of ore and development will proceed practically on same basis as prior to curtailment of operations.

SUMMIT (French Gulch)—The 600-ft. crosscut tunnel will be completed about Mar. 1. Mine has been producer intermittently during past 20 years. Vein sought is about 2 ft. wide carrying high-grade ore. Ten-stamp mill, electrically driven on adjoining ground will be operated under lease.

Trinity County

TRINITY ASBESTOS MINING CO. (Carrville)—H. T. Mecum, manager, will ask boards of supervisors of Shasta and Trinity Counties for appropriations toward building road from Carrville to Castella, an economic shipping station on Southern Pacific R.R. Distance is 50 miles in direct line, though lesser distance must be covered by wagon road. Such road would provide outlet for entire Carrville district. Freight by wagon must now be hauled from Redding by way of Lewiston at approximate average rate of $2.50 per 100 lb. This company has recently expended $10,000 for machinery and $3000 for development of asbestos and will require short wagon haul to market the product economically.

COLORADO

Lake County

DAVIS (Leadville)—Shaft-sinking stopped at 150 ft. and drifting at 130 ft. developed iron ore carrying 7 oz. silver.

HOPE (Leadville)—W. B. Anderson reopening this old downtown mine and expects to find zinc-carbonate orebodies in 300-ft. level.

San Miguel County

LITTLE DORRITT (Telluride)—Main crosscut tunnel driven to develop this Bridal Basin property has advanced about 2000 ft., recently intersected Sherman vein at depth of about 400 ft. from surface. Vein 6 ft. wide, said to assay $40 a ton. W. Z. Kinney manager.

Teller County

LAST DOLLAR (Victor)—Rapp & Page, working under lease, have reopened this Bull Hill property famous some years ago and are sinking main shaft in good ore below 1250-ft. level.

IDAHO

INTERSTATE CALLAHAN (Sunset)—New concentrator to be erected in spring, on South Fork of Cœur d'Alene River below Wallace. Exact location not yet determined. Survey and plans made for aerial tramway from mine to railroad, two miles distant. Present mill of 300 tons daily capacity not large enough to handle tonnage mine will be capable of producing hereafter. Water supply not sufficient to permit increased concentrating capacity at site of present concentrator.

BLACK BEAR (Frisco)—No. 2 raise has reached 200-ft. level and station cut to hanging wall shows 12 ft. of good concentrating ore. No. 1 raise 900 ft. from No. 2 also in ore and believed ore will be continuous between two raises. No. 1 raise was started directly beneath winze sunk on good ore from upper workings and has depth of 1100 ft. on vein. No. 2 raise has depth of 1500 ft. Plans completed for erection of concentrating mill. Portal of tunnel excellently located only 120 ft. from railroad tracks and high enough to allow erection of mill between it and tracks.

HYPOTHEEK (Kingston)—Regular assessments of 1c. per share will be discontinued, as arrangements have been completed for sale of $200,000 bond issue. New electric station, pump will be paid for out of this money. Pump will arrive in 10 days and will be installed at once on 900-ft. level. This will enable company to develop this level on which rich ore was recently discovered. Crew will be increased to 50 men. Ranch of T. S. Young 3½ miles from mine has been purchased for millsite. Ore will be carried from mine to mill by gravity tramway.

MICHIGAN

Copper

WINONA (Winona)—Daily rock production now 180 tons, handled at Trimountain mill of Copper Range. Change not made to reduce cost to Winona but because Calumet & Hecla subsidiary mill at Point Mills was needed for Isle Royale rock. Change in milling, while it saves in freight, does not in end save anything to Winona tributors, since there is difference of 13c. a ton in price charged for stamping.

TAMARACK (Calumet)—No present intention to resume operations at any shaft and none will be planned until copper reaches 15c., making it possible to operate with profit. Force of miners has started drift to connect No. 3 shaft with slope shaft of Red Jacket branch of Calumet & Hecla at 66 level. This provision necessary to provide proper ventilation for Tamarack when resumption does take place.

KEWEENAW (Calumet)—Shaft down to 1000 ft. and copper showing good at lowest point. Metal appears in form of solid globules. East side openings continue satisfactory. Further financing to continue exploration of Phœnix much mooted question here but New York capitalists are reported willing to assume burden on preferred stock basis. Suggested too that Keweenaw Central may be extended to Copper Harbor, extreme point on Keweenaw Peninsula, to develop Ashbed formation which drills showed to be valuable.

WHITE PINE (Ontonagon)—Prevalence of smallpox will not cause cessation of operations. Only a few cases found, and every precaution taken to prevent further spread of the disease so it will not be found necessary to quarantine camp. Calumet & Hecla has ordered vaccination of all employees at White Pine. Under contract must have things in shape to begin milling rock by May 1. If possible, mill is to start before that time, perhaps as early as Mar. 1, beginning with stamping of about 500 tons of rock daily. Mill will have capacity of 1000 tons, however. White Pine has large amount of rock, rich in copper, in stockpile ready to go to mill. Plant being assembled rapidly and work of installing equipment of electrical power plant which will supply both mill and mine-hoist is proceeding.

QUINCY (Hancock)—Company trying experiments with new drill which will probably bring about greater efficiency in underground work than anything introduced for rock breaking in recent years. Drill weighs 105 lb., breaks all records for speed of operation, ease in erection and taking down and for wear on steel. Said to be combination of Jackhamer and Holman features. In one experiment a machine cut 54 ft. in 4 hr. Nothing like this accomplished in mine before. Two pieces of steel can cut 8-ft. hole, something never accomplished with any other drilling machine. Ease with which machine is handled makes it additionally advantageous. Is now for footwall operation entirely; can be used to advantage in practically any kind of opening. Further experiments will be conducted before general adoption is recommended.

Iron

AMERICAN (Diorite)—Mine again working with normal force, to be increased as new places are opened underground. Shaft now in fine shape. Woodbury jigs installed in mill, replacing other type, better results being secured.

BRULE IRON MINING CO. (Iron River)—Company started Chatham mine; 150 men taken on. Nothing given out regarding reopening of Berkshire, owned by same company. With Rogers, Chicagon and Hiawatha, of Rogers, Brown Ore Co., opening first of coming month, there will be few unemployed in Iron River.

AMASA-PORTER (Crystal Falls)—Shaft being sunk has entered fine body of bessemer ore, not before known to exist. Drills had shown some bessemer, close to the nonbessemer, but it was not thought ore would be found where shaft is going down. Little bessemer has been mined in Crystal Falls district and discovery is considered important.

LAKE ANGELINE (Ishpeming)—All work stopped Jan. 16. No hoisting through shaft for several months; ore mined came from pocket under hill to south. There was no stocking room and ore mined had been loaded in cars until 140 were filled. Railroad then refused to permit use of more cars and mining had to cease. Ore left in workings will be taken out after navigation opens. Company will resume sinking at Iron Mountain Lake property about first of April. Work there stopped when shaft filled with water. New boilers will be installed, as those in use are too small.

MINNESOTA

ZENITH FURNACE CO. (Duluth)—Blast furnace resumed operations Jan. 21, with full crew of 175 men.

Cuyuna Range

IRON MOUNTAIN (Iron Mountain)—Two new boilers have arrived and will be installed at once. Ten carloads of ore being loaded for experimental test at Jones furnace, Marquette, Mich.

MERRIMAC MINING CO. (Crosby)—Company has taken option on lands immediately south of its Croft mine in Sec. 1, 46-29. Three drills will be put to work at once in endeavor to prove up extensions of its [illegible] bessemer orebody.

ROWE (Riverton)—Company advises that capacity of concentrating plant will be approximately 3000 tons of cleaned ore per day. All contracts for machinery and equipment let; work on erection will start [illegible]. Plant will not be custom plant, treating Rowe ore only.

HILL CREST (Ironton)—Contract let to Cuyuna Range Power Co. for current for stripping operations. 250 hp. will be used to pump water from [illegible] Lake and 200 hp. to force sand and water back into the lake. Hydraulic operations will be similar to those [illegible] mine. Company's surface plant now being constructed.

CUYUNA-SULTANA (Ironton)—[illegible] acres of this property, near Cuyuna Mille Lacs mine, will be stripped as soon as weather permits. Orebody consists of rich manganese iron ore, and is first deposit of such material to be removed by pit operation in Cuyuna district. Company is stock company with shares in open market.

Mesabi Range

WHITESIDE (Buhl)—Activity on property indicates operations will begin soon.

MINORCA (Virginia)—Third shift of miners added, giving work to 40 more men.

BRUNT (Mountain Iron)—Twenty-five men put to work repairing in preparation for inauguration of mining.

MACE (Hibbing)—Operations resumed. Mine was shut down by Oliver company some time ago and is now part of holdings of Arthur company.

OLIVER IRON MINING CO. (McKinley)—Rich deposit of ore struck by Oliver company under small lake. Three drill operating on ice since winter set in. Number of other drills at work in vicinity.

MISSOURI-KANSAS-OKLAHOMA

C. C. YODER AND ASSOCIATES, of Neck City, Mo., have leased 20 acres and mill of Lawton Mining Co., at Lawton, Kan., and have organized new company; will operate the mine and plant. Mine one of best in district, adjoining H. L. & S., and Eastern Lead & Zinc Co. mines. Work will be pushed.

NEW WAGE SCALE will go into effect, Feb. 1, in Flat River district reducing present wages about to point prevailing before 1913 strike. Machinemen on one-man drills will get $2.75 per 8-hr. shift and on two-man drills, $2.40; shovelers, $2.40; drill back-hands, $2.15; firemen, $2.20; surface laborers, $1.75 for 9 hr.

E. L. ARTHUR LAND near Galena, Kan., fast coming to front as producer; in last six months several good mines have been opened up on tract which lay idle for several years. Recent operations struck good lead and zinc; other prospecting resulted in good strikes and now several mines on tract make good turn-ins each week. Dirt at present handled by hand jigs or sold in rough, but land owner expects to build concentrating plant.

CLIFFORD & CO. (Galena, Kan.)—Another good mine brought in on Boice land. Fifth mine struck on this property recently.

JOHN W. PATE MINING CO. (Galena, Kan.)—Company moving mill from Old Times lease on Illinois Lead & Zinc land to lease at Klondyke where it claims to have struck good run of zinc ore; will enlarge plant and replace some of old machinery with new, enabling it to handle more dirt at less expense. Company has been successful in operations.

MONTANA

Broadwater County

OHIO-KEATING (Radersburg)—Stockholders voted to make stock of company assessable in order to liquidate indebtedness and provide funds with which to construct concentrator. Enough ore of low grade stated to be in sight to warrant installation of concentrator of approximate capacity of 100 tons. Mine was closed last year. Many of largest stockholders reside in Butte.

Jefferson County

SUNLIGHT (Whitehall)—This group to be actively developed by Martin Schweren.

Granite County

NEW ELECTRIC PLANT at Maxville just completed. Test run proved entirely satisfactory. Number of mines in upper Flint Valley contemplate using this power; this will permit employment of more men than heretofore, cost of steam power being almost prohibitive.

Lewis and Clark County

HAWKEYE (Helena)—At this group of claims, lying inside city limits in southwestern part of Helena, under development by Helena Mining Bureau, Inc., ore assaying from $8 to $15, was struck in bottom of inclined shaft which is down 173 ft. Promises to develop into valuable deposit. Helena Mining Bureau was organized by Helena citizens a year ago for purpose of developing mineral resources of the district and Hawkeye was one of properties recommended by expert engineers as worth expenditure required for development.

Silver Bow County

NORTH BUTTE (Butte)—Current report that company had purchased 700 acres adjacent to East Butte, denied by company officials.

LEONARD (Butte)—Mine resumed operations Jan. 21, Gagnon and Original mines of Anaconda company which were kept running to maintain output will probably close down soon, since Badger State is now supplying ore.

BUTTE & SUPERIOR (Butte)—Janey flotation machine, installed last of December proved so successful that it is stated by company official that six or seven more will be installed immediately when it should be possible to maintain recovery of 95%. Tailings from Janey machine are cleanest the company ever had.

PILOT BUTTE (Butte)—Drifting begun upon new vein recently cut on 1400-ft. level, 85 ft. north of shaft, with promising indications for considerable tonnage of ore. One foot of shipping rock, carrying about 6% copper, cut when vein was first opened. Width of this ore holding its own, with here and there bulge showing.

BUTTE & ZENITH (Butte)—Company proposes to resume sinking to 1000-ft. level as soon as metal conditions adjust themselves. Shaft now down 640 ft., two compartments to 460-ft. level and three compartments remaining distance. Pumps were left in shaft, and, although now submerged, believed no harm will be suffered because of heavy coating of oil and grease given machinery. Butte & Zenith plans to cut large station at 1000 level and install pumps of great capacity to care for heavy flow of water characteristic of country in which it is operating.

BUTTE-BALLAKLAVA (Butte)—Company started retimbering three-compartment shaft from 900- to 700-ft. level, which will require about two months; pending this, mining operations practically will suspend. With shaft in repair company will be in position to increase production to 200 tons daily as compared with from 100 to 150 tons before war. Company for past two months has been shipping about 50 tons a day, principally in conjunction with development work. About 15 men employed. With shaft repairs out of the way, it is expected steps will be taken toward sinking shaft to 1800-ft. level. Shaft now down 1600 ft., with showing on that level greatly surpassing that on next level above, the 1400-ft.

NEVADA

Esmeralda County

LONE STAR (Goldfield)—Shaft on Lazy George claim enlarged from two compartments to three and 15-hp. gasoline hoist installed. With shaft down 200 ft., 75-hp. electric hoist will be installed.

Lander County

TIN STRIKE northeast of Battle Mountain reported. Stated both lode and stream tin found.

AUSTIN-DAKOTA (Austin)—East drift on 310-ft. level of incline shaft started; expected will cut downward extension of shipping-grade oreshoot opened on 225-ft. level. Crosscut will also be driven to Jack Pot vein, distance of 200 ft.

White Pine County

WILLOW CREEK GOLD MINING CO. (Willow Creek)—Shaft will be sunk 200 ft.; whim installed. Drifting on main vein under way.

NEW MEXICO

Dona Ana County

MEMPHIS MINE (Organ)—A 28% copper shoot encountered on drift of 50-ft. level under lease by A. Roos. Strike considered one of richest in recent years. Norval Welch shipping from other parts of Memphis.

Grant County

CHINO (Santa Rita)—Company now operating seven days per week but has not increased forces.

85 (Lordsburg)—Good tonnage of copper ore high in silica being shipped daily to C. & A. at Douglas and to El Paso. Former company has issued notice that no more custom ores will be purchased until further announcement.

EMPIRE ZINC (Hanover)—Work on two-compartment shaft on Thunderbolt claims being pushed. Concrete bridge being built over Hanover Gulch and Santa Fé tracks to site of concentrator west of railroad. Carbonate zinc ore shipments continue.

Sierra County

ANIMAS PEAK GOLD MINING CO. (Hillsboro)—Company has started sinking of double-compartment shaft opposite old Kelly shaft. Property formerly known as Hillsboro Consolidated. Planned to do extensive work in spring.

Socorro County

SOCORRO (Mogollon)—Reliable reports state company has turned down Pacific mine on which it held option for $250,000. Tramway was under construction from mine to Socorro mill and much development work had been done. Heavy snows continue in Mogollon Mountains, fuel oil running low.

ERNESTINE (Mogollon)—Deep exploration under way on Last Chance vein. On 5th level below main tunnel, 1200 ft. below apex of vein, drift has been run in orebody 170 ft. Ore 10 to 15 ft. wide where crosscut and above average in value. Drift commenced on 7th level 200 ft. deeper. Persistence of good values at depth attracting much attention.

OREGON

GLEESON DEVELOPMENT CO. (Granite)—Cyanide plant has started up and is said to be successful.

POWDER RIVER GOLD DREDGING CO. (Sumpter)—Force of men at work sinking prospecting shafts on the D. E. Richen tract near Sumpter.

GRANT PASS Commercial Club has appointed committee of mining men to look into matter of securing custom mill to treat ores from smaller mines near town. Survey of extent of ores blocked out and ready for mill will be made, thought money can be raised to install a mill soon.

BEACH MINING in Lincoln County attracting mining men. Beach well panned down and most of creeks running into ocean have camps of from two to six men. Good wages being made with shovel and sluice box and some making more than wages saving fine gold and platinum.

BLACK SAND discovery in Jefferson County reported along the Deschutes River. Deposits extensive, said to carry $2.40 in gold, same in platinum and about $1 in silver per ton. Six Portland men and one Nebraska man have completed investigations, filed locations and are ready to work property. Those associated are: W. H. Baird, C. W. Clapp, J. B. Rossman, Thomas Hart, C. F. A. Peck, Edward D. Whitney, all of Portland, and Charles W. Ryman, of Lincoln, Neb.

UTAH

Juab County

KNIGHT CHRISTENSEN MILL (Silver City)—New rolls installed, and operations resumed Jan. 15.

CENTENNIAL-EUREKA (Eureka)—Development being done on gold ore opened on surface, 700 ft. above shaft house. Two tunnels being driven to reach vein.

MAY DAY (Eureka)—Preparations being made for resumption of shipments, as soon as development and connections are completed. Good tonnage of silver-lead ore opened.

YANKEE (Eureka)—Bunches of lead-silver ore cut in winze from lower Humbug tunnel level. Ore is west of old Humbug ore channel; hoped it is continuation of May Day oreshoot. If this proves case, it is predicted ore will be found in this zone in Uncle Sam, Beck Tunnel, and Utah Consolidated properties.

DRAGON CONSOLIDATED (Silver City)—Ore carrying gold being mined in north end, through Iron Blossom. This comes largely from 600 level. Silver-copper ore also being produced. Diamond-drill work will be started to prospect Dragon ground from 1900 level of Iron Blossom, as soon as station can be cut.

Piute County

WEDGE GOLD MINING & MILLING (Marysvale)—Lessees recently made strike of ore running well in gold and silver at this property in Horse Heaven country. Ore was found in tunnel about 85 ft. from surface, richest portion occurring on footwall side of 10-ft. vein, where streak 18 to 20 in. wide runs high in gold. Boulders of quartz carrying free gold were broken and shipped from this property in early days, but rock in place was not found.

Salt Lake County

OHIO COPPER (Bingham)—Labor claims against company reported settled, as result of sales of copper, stored and in transit.

CARDIFF (Salt Lake)—Raise on orebody now up 113 ft. Is to be continued to make connection with upper tunnel for better ventilation; 287 ft. still to be driven.

Summit County

DALY-JUDGE (Park City)—Zinc concentrates amounting to 500 tons or more monthly being shipped. These average about 45% zinc. Most of ore, both lead and zinc, comes from between 500- and 1200-ft. levels. Recent development has opened largest tonnage in history of company.

SNAKE CREEK TUNNEL (Park City)—During December number of water courses cut, which added 2 sec.-ft. to flow at portal, bringing this to about 11 sec.-ft. Tunnel has cut diorite, which showed traces of iron, lead, and copper along contact. During December 296 ft. progress was made. New compressor installed. Length at present more than 10,448 ft.

Tooele County

BEN HARRISON (Stockton)—New Stockton Mining Co.'s lease on this property recently turned over to Mills & Campbell. Most of work done on 200- and 500-ft. levels. Ore carries lead, silver, and gold.

BUFFALO CONSOLIDATED (Ophir)—Crosscut tunnel being driven by lessees to reach ore zone at 200-300 ft. Ore opened for 100 ft. at higher level, and appears to extend to greater depth. Carries silver, lead and some gold.

CANADA

Ontario

JUPITER (Schumacher)—Reported under option to Crown Reserve.

NIPISSING (Cobalt)—Statement as of Jan. 2 shows cash and bullion on hand amounting to $1,396,788, compared with $1,270,026 for the same date of 1914

TEMISKAMING (Cobalt)—New vein which comes in from Beaver on 530-ft. level followed for 40 ft., still good in face and 5 in. wide. Has yielded over nine tons of ore and wall rock is good milling ore.

VIPOND (Schumacher)—Annual statement to be issued about Feb. 15 will show about 16,000 tons of ore milled up to Jan. 1 and production in neighborhood of $90,000. Stated 40,000 tons of ore in sight above 300-ft. level.

TOUGH OAKES (Kirkland Lake)—New mill complete with exception of assembling some minor parts of machinery. Expected to be in running order by end of March. There are 7000 tons of ore on dump. Underground work suspended last summer was resumed Jan. 18.

LA ROSE (Cobalt)—Quarterly report shows dividend amounting to $187,000 was paid out of accumulated surplus. Cash surplus of Jan. 1 was $985,892 and total surplus $1,214,400, as compared with cash surplus $1,224,453, and total $1,396,619 on Oct. 1.

CROWN RESERVE (Cobalt)—Annual statement will show decrease of about 250,000 oz. in output, which remains approximately 1,500,000 oz. Of this only few thousand came from Carson vein which is about worked out. Porcupine Crown production for year is $667,000, of which about half is profit. Drummond Fraction operated jointly by Crown Reserve and Kerr Lake has done little more than pay for development.

HOLLINGER (Timmins)—Balance sheet to be presented at annual meeting in Montreal Feb. 2, shows profits for year amounting to $1,786,679, amount paid in dividends $1,170,000. Sum of $1,126,743 carried forward to profit and loss account. Bullion assets given as $201,861 and current assets, $603,632. New electric hoist ordered to handle increased tonnage required when 80 stamps go into operation.

MEXICO

Hidalgo

SANTA GERTRUDIS (Pachuca)—Reported in London new vein has been cut by crosscut, at point of cutting 10 ft. wide running 19 oz. silver, $1 in gold. Drift for 48 ft. assays 57 oz. silver, $4 in gold. Found on 16 level, 870 ft. east of San Guillermo shaft, 700 ft. south of north vein.

AFRICA

Transvaal

CORRECTED RETURN GOLD PRODUCTION in Transvaal in December is 695,137 oz. fine gold, compared with 715,826 in November, and 672,815 in December, 1913. For year ended Dec. 31 total was 8,794,824 oz. in 1913, and 8,378,139 oz.—or $173,176,133—in 1914; decrease of 416,685 oz. Number of native laborers employed at end of December was 173,354, decreased of 1665.

The Market Report

Metal Markets

NEW YORK—Jan. 27

Copper and spelter, especially the latter, were widely excited during the last week and exhibit sharp rises in price. Lead and tin were a little stronger in sympathy with the other metals.

Copper, Tin, Lead and Zinc

Copper—The price rose steadily from beginning to end of the week, the market being at about 13⅞@14c., regular terms, on the first day, and at 14⅛@14¼c., regular terms, on the last. In the aggregate a large business was done. Substantial sales to domestic wiredrawers were considered to reflect an improvement in domestic consumption. To the larger extent, however, the business continued to be in copper destined directly or indirectly for export, and in a large measure for military consumption. There were very large sales for export, although it is hard to understand where so much metal will be used, or in what form.

Indeed, the copper market for a month back has exhibited mysterious features. During the last week there were again peculiar inquiries, such as one for seven million pounds and another for 25 million pounds. Such inquiries coming from unusual quarters enhanced the mystery of the situation. There is a shrewd suspicion that some of the large transactions heretofore reported have simply been margined, delivery to be accepted after the termination of the war.

London reports buying there for governmental purposes only, with the London market closely following New York. American dealers are said to have been buyers of Standard copper.

The unfavorable statistics computed by an important consumer of copper attracted more attention from the daily papers and in Wall Street than they did in the producers' offices. The estimate of the large stock on hand was based on a guess respecting the consumption, while there were also some guesses as to production and exports. The producers have been reporting for some time past that their stocks of refined copper were shrinking. The recent behavior of the market is confirmatory of their statements. Certain of the smaller interests this week reported themselves sold out of copper for prompt and near-by delivery, but made sales of distant futures. In this connnection it is noteworthy that copper for distant deliveries has been sold at figures materially below current prices. We heard from one quarter of sales for delivery up to the end of September; and in another quarter, of sales of July-October contracts.

Exports of copper for the week ended Jan. 16 are reported by the Department of Commerce at 7,836,759 lb. Imports were 1,177,089 lb. metal and 1,891,381 lb. in ore and matte; 3,068,470 lb. in all. The larger exports were 3,755,479 lb. to France and 3,064,871 lb. to Great Britain; larger imports, 989,845 lb. from Peru, 840,000 lb. from Cuba, 725,381 lb. from Canada and 500,944 lb. from Chile.

Copper sheets were advanced ¼c. on Jan. 21, and again ½c. on Jan. 25, making the base price now 19½c. per lb. for hot rolled and 20½c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15¼@15¾c., carload lots at mill.

Brass Prices, base, announced by the American Brass Co., as follows to date from Jan. 25, showing an advance of about ½c., are: Sheets, high brass, 16c. net per lb.; low brass, 17¾c. Wire, high brass, 16[illegible]c.; low brass, 17¾c. Rods, high brass, 15¼c.; low brass, 18¼c. Tubes, both brazed and open seam, 19¾c. Angles and channels, 18¼c. Scrap allowances are 9½c. net per lb. for high brass; 11¼c. for low brass.

Tin—This metal has been stronger in sympathy with the others, but business was light.

Tin production of the Federated Malay States in December was 63,206 piculs. For the year ended Dec. 31 the total was 50,147 long tons in [illegible], and [illegible] tons in 1914; decrease, [illegible] tons.

Tin ore receipts in Great Britain in December are reported by H. A. Watson & Co., Liverpool, as follows: Bolivia, 422 tons concentrate, containing 253 tons tin; Nigeria, 421 tons, equal to 295 tons tin; South Africa, 60 tons, equal to 42 tons tin; total, 903 tons concentrates, containing 590 tons tin.

Lead—Right at the beginning of the week an important domestic demand developed and a round tonnage was turned over on the basis of 3.50c., St. Louis. A rather large business for export was also reported. This led to a slight stiffening of price, and at the close, 3.55c., St. Louis, was asked by some sellers. The New York price of the A. S. & R. Co. remained at 3.70c., but some outsiders were asking 3.72½c., and the latter price was in fact reported realized on some small business. There does not appear to be any great confidence in lead, which is regarded as supported only by sympathy with the other metals and the continued large export business.

Spelter—The spelter market was excited and crazy, and is extremely hard to quote with accuracy. The price rose by leaps and bounds from day to day, and transactions reflect a highly confused situation. The total business done represented a large tonnage.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Jan.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
21	4.8395	48[illegible]	13.70 @13.85	34¼	3.67½ @3.70	3.47½ @3.52½	6.47½ @6.67½	6.30 @6.50
22	4.84[illegible]	48½	13.85 @13.97	35	3.67½ @3.70	3.50 @3.52	6.62½ @6.92½	6.45 @6.75
23	4.8425	48[illegible]	13.90 @14.00	35	3.67½ @3.70	3.50 @3.52½	6.67½ @6.92½	6.50 @6.75
25	4.8413	48[illegible]	14.00 @14.10	35¼	3.67½ @3.70	3.50 @3.52½	6.80 @7.17½	6.62 @7.00
26	4.8408	48[illegible]	14.15 @14.25	35½	3.70	3.50 @3.55	6.92½ @7.30	6.75 @7.12
27	4.84[illegible]	48[illegible]	14.20 @14.30	35	3.70	3.50 @3.55	7.05 @7.30	6.87½ @7.12½

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Jan.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
21	22¾	61¾	13.44	62		158	150¼	18½	4.02	32	6.95
22	22[illegible]	62⅝	13.61	62¾	66¼	160	152	18¼	3.97	32½	7.06
23	22[illegible]										
25	22[illegible]	63[illegible]	13.77	63½		165	155	18⅜	3.99	33	7.17
26	22[illegible]	63¼	13.74	63½	67¼	165	157	18⅜	3.99	33½	7.28
27	22[illegible]	63⅜	13.77	63½		167½	166	18⅜	3.99	34½	7.50

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17⅜c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52½c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

The facts seem to be that the unsold stock of spelter on hand at the beginning of January has been exhausted and smelters have become practically sold out for spot, prompt and near-by deliveries. In the present situation, March is considered a near-by delivery. On the other hand, domestic consumers are slow about entering into contracts for later deliveries. However, one large block for April-June was sold for export, and several large blocks for April and later. Prices largely below the prices for prompt and near-by were accepted.

The wide range of price from day to day reflects the current confusion, the differences in times of delivery and also differences in grades of metal heretofore unrecognized. Prime Western spelter guaranteed a trifle better than the standard was sold at substantial premiums over the ordinary. Brass specials and intermediates were sold during he last week at extravagant prices, far above anything yet mentioned.

Base price of zinc sheets is now $9 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Other Metals

Aluminum remains in moderate demand, and the market shows no change of importance. Current quotations are 18@19¼c. per lb. for No. 1 ingots, New York. **Antimony** continues in demand and prices are advancing, under the general apprehension of short supplies. Ordinary brands are higher, selling at 16.50@17.50c. per lb. Cookson's is scarce and 19@20c. per lb. is named. **Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher. **Quicksilver** is active and inclined to be stronger. New York price is $52 for flask of 75 lb., with $53@54 asked for small lots. San Francisco, $51@52 for domestic business. London price is £11 10s. per flask.

Gold, Silver and Platinum

Gold movement in the United States for the year ended Dec. 31 is reported as below by the Department of Commerce:

	1912	1913	1914
Exports	$47,424,842	$91,798,610	$222,616,156
Imports	66,548,772	63,704,832	57,387,741
Excess..............	Imp. $19,123,930	Exp. $28,093,778	Exp. $165,228,415

The heavy exports this year were due to the altogether exceptional conditions brought on by the war.

The gold pool of $100,000,000 formed some time ago to regulate foreign exchange has been dissolved, and the money will be returned to the subscribing banks.

Platinum is still quiet and rather depressed, with light demand and sales. Prices show more range than usual; $38@43 per oz. is asked for refined platinum, and $46@49 for hard metal, according to quality.

Silver has moved within narrow limits, without special feature, for the past week, closing steady at 22⅝d. in London.

Imports and Exports of Silver for the year ended Dec. 31 are valued by the Bureau of Commerce as below:

	1913	1914	Changes
Exports	$62,776,631	$57,603,438	D. $11,173,193
Imports	35,867,819	25,959,187	D. 9,908,632
Excess, exports..	$26,908,812	$25,644,251	D. $1,264,561

The decrease in exports almost balanced that in imports; the latter was chiefly in the receipts from Mexico. In quantities the net exports were approximately 45,004,000 oz. in 1913, and 47,217,000 oz. in 1914; showing again of 2,213,000 oz. in quantities.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 23

Blende, high price, $61; assay base, 60% zinc, $51@58; metal base, 60% zinc, $49@52; calamine base, 40% zinc, $27@32; average, all grades of zinc, $48.40. Lead, high price, $50; base price, $47 per ton of 80% metal content; average, all grades of lead, $46 per ton.

A week of cold, the latter half of which ice covered the earth, together with an insufficient number of cars, reduced production and shipment of ores. Approximately 600 tons of the shipment is from reserve ore. There was no end of excitement in price making on Friday and Saturday, the base price being advanced from $55 on Thursday to $58 on Saturday.

SHIPMENTS, WEEK ENDED JAN. 23

	Blende	Calamine	Lead	Values
Totals this week....	9,289,800	1,103,190	1,541,360	$286,940
Totals this year....	40,922,020	3,165,720	5,480,400	1,181,350

Blende value, this week, $235,620; four weeks, $997,020.

Calamine value, the week, $15,840; four weeks, $47,950.

Lead value, the week, $35,480; four weeks, $136,380.

PLATTEVILLE, WIS.—Jan. 23

Following the sharp advance in spelter the base price of 60% zinc ore jumped to $56 per ton. The lead market is dull at $44 per ton for 80% lead ore.

SHIPMENTS, WEEK ENDED JAN. 23

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,417,050	60,000	321,700
Year	12,676,770	226,000	1,535,200

Shipped during week to separating plants 3,126,180 lb. zinc ore.

Iron Trade Review

NEW YORK—Jan. 27

While new business has been on a moderate scale, conditions continue to improve, and the steel mills are reported as operating between 50 and 60% of capacity. There is no rush, but a general increase of demand which is rather scattered but still quite appreciable.

The pig-iron market shows a better demand, mainly for moderate quantities but increasing steadily. Both foundry and basic iron are called for.

United States Steel Corporation earnings for the fourth quarter are reported as below, the net earnings including surplus over operating expenses and ordinary renewals:

	1913	1914
October ..	[illegible]	[illegible]
November	[illegible]	2,798,388
December	[illegible]	[illegible]
[illegible] quarter	[illegible]	$10,933,170
Subsidiary Co. [illegible]		$4,587,912
Interest and sinking funds		5,777,081
Total charges.		$10,364,993
Surplus for the quarter		$568,177
Dividend 1¾% on preferred		6,304,920
Deficit for the quarter		$5,736,743

Earnings for the quarter were [illegible] reported for any quarter since the formation of the corporation. In view of this the directors decided to declare no dividend on the common stock for the quarter. The total net earnings for 1914 were $71,661,149, against $137,181,345 in 1913, and $108,174,672 in 1912. The lowest earnings previously given were in 1904, when $73,176,522 was reported.

PITTSBURGH—Jan. 26

While the Steel Corporation's earnings past quarter were the lowest in the corporation's history, they have already started to increase, as January is showing heavier shipments, with naturally decreased manufacturing costs, and substantially unchanged realized prices. February is almost certain to see a further increase in shipments and a slight increase in average realized prices.

While steel orders are increasing only slowly, the market is making definite progress and there is less likelihood of setbacks than if there were more excitement. The railroads are buying more freely but are very reserved in discussing plans for future purchases, indicating perhaps that they do not wish the steel mills to stiffen their prices.

Last week the Carnegie Steel Co. reduced its pig iron stock by 21,000 tons and ordered into blast five additional furnaces, about all of which are now in, increasing the number in blast from 23 to 28, out of a total of 59. For several months most of the steel interests has been accumulating pig iron, so that a decided change in the operations of steel departments has undoubtedly occurred. The Carnegie company is understood to be operating more than 55% of its steel ingot capacity, against an average of 67% in 1914 and less than 40% in December.

Pig Iron—Buying of foundry is fair, in small lots widely scattered. Bessemer is inactive. We quote: Bessemer, $13.75; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market is very quiet. Some of the steel mills have signed the agreement offered by sellers of imported ferromanganese at the dictation of the British government, but it is not certain whether this will enable them to secure deliveries. The price remains nominally $68, Baltimore. Odd lots for shipment from stock can occasionally be picked up at $75@80.

Steel—The market is quiet, practically all the first quarter consumption having recently been put under contract at low prices. Mills continue to quote the advanced prices of $20 for billets and $20.50 for sheet bars, delivered Pittsburgh.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev	Jan. 5	Jan. 27	$0.03
Belcher Silver, Nev	Feb. 8	Mar. 1	0.10
Blue Bull, Nev.	Jan. 4	Feb. 8	0.01
Booth, Nev	Jan. 25	Mar. 1	0.02
Brunswick Con., Nev	Feb. 16	Mar. 9	0.01
Carbonate, Ida.	Jan. 28	Feb. 28	0.001
Cash Boy, Nev	Jan. 15	Feb. 15	0.005
Cedar-Talisman, Utah	Feb. 8	Mar. 1	0.005
Century, Utah	Jan. 2	Feb. 2	0.01
Clear Grit, Ida (post.)	Feb. 9	Mar. 3	0.0015
Clearwater Con., Ida	..	Feb. 15	0.001
East Hercules, Ida.	Dec. 23	Jan. 15	0.01
Emerald, Utah (three instal	....	June 9	0.01
Gethin Le Roy, Utah	Feb. 2	Feb. 23	0.02
Gypsy Qn., Nev	Jan. 12	Feb. 16	0.01
Happy Day, Ida.	Dec. 24	Jan 25	0.0025
Hypotheek, Ida.	Dec. 17	Jan. 29	0.006
Idaho-Nev., Ida	Jan 7	Feb. 1	0.001
Indiana, Mich	Feb. 4	....	1.00
Iron King, Ida	Feb. 18	Mar. 19	0.001
King Pine Crk., Ida	Feb. 12	Mar. 13	0.002
Laclede, Ida	Jan. 12	Feb. 3	0.003
Lucky Friday, Ida	Dec. 14	Feb. 11	0.003
MacNamara, Nev.	Jan. 12	Feb 3	0.03
Majestic-Idol, Nev	Dec. 15	Jul. 20	0.005
Manhattan Con., Nev	Feb. 30	Mar. 1	0.01
Moonlight, Ida	Dec. 30	Jan. 28	0.005
Nabob, Ida	Dec. 31	Jan. 25	0.005
Natl. Copper, Ida. (post.)	..	Jan. 29	0.002
Nor. Bnkr. Hill, Ida	Jan. 30	Mar 6	0.002
Ophir, Nev..	Feb. 11	Mar. 5	0.10
Oreano, Ida.	Dec. 26	Jan. 25	0.00075
Phoenix, Ida. (post.)	Dec 26	Jan. 26	0.005
Potosi, Nev.	Jan. 12	Feb. 4	0.02
Raven, Ida	Dec. 30	Jan. 30	0.0003
Reindeer-Queen, Ida	Feb. 15	Mar. 8	0.003
Rescue-Eula, Nev	Feb. 11	Mar. 22	0.01
Scranton Ex., Utah	Jan. 4	Feb. 5	0.00025
Sheba, Utah.	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev	Feb. 8	Mar. 2	0.05
Silver Star, Ida.	Jan. 5	Feb. 5	0.002
Sunset Dev., Ida	Jan. 18	Feb. 18	0.0025
Syndicate, Ida. (post.)	...	Jan. 28	0.001
Tarbox, Ida..	Jan. 28	Feb. 28	0.0025
Ton. Gip. Qn., Nev	Jan. 12	Feb. 16	0.01
Umatilla, Nev.	Jan. 4	Feb. 8	0.01
Union Con., Nev	Jan. 14	Feb. 4	0.05
Utah-Yerington, Nev	Jan 2	Jan. 23	0.0006
Verde May, Ida	Feb 1	Mar. 1	0.001

Stock Quotations

COLO. SPRINGS Jan 26		SALT LAKE Jan 26	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	05⅛	Beck Tunnel	06½
Cripple Cr'k Con.	‡01⅛	Black Jack	07
C. K. & N	.04¾	Colorado Mining	09
Doctor Jack Pot	.10	Crown Point	01½
Elkton Con.	48½	Daly-Judge	4.87½
El Paso	1.25	Gold Chain	09½
Findlay	02½	Grand Central	64
Gold Dollar	.04	Iron Blossom	95
Gold Sovereign	04½	Little Bell.	.10
Isabella...	17	Lower Mammoth	04¼
Jack Pot.	.08	Mason Valley	1.00
Jennie Sample	.03	May Day	13½
Jerry Johnson.	.03¼	Opohongo	.01
Lexington	‡.009	Prince Con	22
Old Gold	‡.01	Seven Troughs	02½
Mary McKinney	.33	Silver King Coal'n	2.60
Pharmacist	01¼	Silver King Con	1.92½
Portland.	1.17½	Sioux Con	02
Raven B. H	03½	Uncle Sam	05¼
Vindicator	1.30	Yankee	05

TORONTO		Jan 26	
Bailey	01	Dome Exten	07
City of Cobalt	‡.30	Foley O'Brien	15
Coniagas	‡.40	Hollinger	22.50
Peterson Lake	25	Imperial	01
Right of Way	02	Jupiter	10
Seneca Superior	75	McIntyre	[illegible]
T. & Hudson Bay	30.00	Pearl Lake	[illegible]
Timiskaming	17	Porcu. Gold	07
Wettlaufer-Lor	04	Preston E. D.	01
Big Dome	6.25	Rea	17

SAN FRANCISCO		[illegible]	
Comstock Stocks		[illegible]	
Alta	.04	Belmont	[illegible]
Belcher	.31	Jim Butler	[illegible]
Best & Belcher	06	[illegible]	[illegible]
Caledonia	30	MacNamara	[illegible]
Challenge Con	‡.05	Midway	07
Confidence	‡.10	Mont.-Tonopah	[illegible]
Con. Virginia	08	North Star	[illegible]
Crown Point	01	Rescue Eula	[illegible]
Gould & Curry	.03	West End Con	[illegible]
Hale & Norcross	.05	Atlanta	[illegible]
Julia	‡.01	Booth.	[illegible]
Mexican	17	C. O. D. Con	[illegible]
Occidental	.45	Comb. Frac.	[illegible]
Ophir	.07	Jumbo Ext.	[illegible]
Overman	14	Pitts.-Silver Peak	[illegible]
Potosi	.02	Round Mtn.	[illegible]
Savage	04	Sandstorm K.	[illegible]
Sierra Nevada	07	Silver Pick	[illegible]
Union Con	.19	Central Eureka	[illegible]
Yellow Jacket	28	So. Eureka	[illegible]

N. Y. EXCH. Jan 26	
Name of Comp.	Clg.
Amalgamated	57
Am.Sm.&Ref.,com.	62¾
Am. Sm. & Ref., pf.	102⅜
Am. Sm. Sec., pf. B.	‡78
Anaconda	27⅝
Batopilas Min.	⅝
Bethlehem Steel, pf.	103¼
Chino	36½
Colo. Fuel & Iron.	26¼
Federal M. & S., pf	29
Great Nor., ore., ctf.	33¼
Guggen. Exp..	51¼
Homestake	117
Inspiration Con.	18⅞
Mex. Petroleum	66½
Miami Copper.	19⅝
Nat'l Lead, com.	47
National Lead, pf.	107¼
Nev. Consol.	13
Ontario Min	2
Phelps Dodge.	‡175
Quicksilver, pf.	2¼
Ray Con.	17¾
Republic I&S, com..	21¼
Republic I&S, pf.	77
SlossSheffi'd, com..	25½
Sloss Sheffield, pf.	‡82
Tennessee Copper.	31
Utah Copper	54
U. S. Steel, com	51½
U. S. Steel, pf.	108

N. Y. CURB Jan 26	
Name of Comp	Clg.
Beaver Con.	27
Big Four.	08
Blue Bell	05
Braden Copper.	6⅞
B. C. Copper	‡50
Buffalo Mines	⅞
Can. Cop. Corpn	$1\frac{9}{16}$
Can. G. & S.	05
Caribou	58
Chambers Ferland	15
Con. Ariz. Sm	⅜
Coppermines Cons	‡1⅛
Davis-Daly.	95
Diam'field-Daisy.	09
Dia. Black B	04½
Ely Con.	‡01
Florence	70
Goldfield Con	1⅜
Goldfield Merger	37
Greene Cananea	23½
Kerr Lake.	5
La Rose	¾
McKinley-Dar-Sa	53
Mines of Am	2⅜
Mutual Min., pf	‡2½
Nevada Hills	35
New Utah Bingham	‡$\frac{7}{16}$
Nipissing Mines	5½
Ohio Copper.	12
Oro.	14
Pacific Smelt	$\frac{1}{32}$
Stand'd Oil of N. J.	402
Standard S. L	1¼
Stewart	1¼
Tonopah	7¼
Tonopah Ex	2¼
Tonopah Merger	33
Tularosa	25
West End Ex	03
Yukon Gold.	2¼

LONDON	Jan 14
Alaska Tre'dwell	£7 17s 6d
Camp Bird.	0 7 0
El Oro	0 9 0
Esperanza	0 7 6
Mexico Mines	1 5 0
Oroville	0 12 9
Philippine Dr..	1 0 0
Santa Gert'dis	0 8 9
Tomboy	1 5 0
Tough Oakes.	0 11 3

BOSTON EXCH Jan. 26	
Name of Comp.	Clg.
Adventure	‡1¼
Ahmeek.	240
Alaska Gold M	28⅝
Algomah	‡50
Allouez	36¼
Am. Zinc..	20
Ariz. Com., ctfs	4⅝
Bonanza	‡41
Butte-Ballaklava	‡2
Butte & Superior	44¾
Calumet & Ariz	55
Calumet & Hecla	370
Centennial	16
Cliff.	‡1
Copper Range	32½
Daly West	2
East Butte	8⅞
Franklin	4⅜
Granby	63¼
Hancock	‡11½
Helvetia	‡25
Indiana.	2½
Island Cr'k, com..	46
Island Cr'k, pfd.	‡87
Isle Royale	19¾
Keweenaw	‡2⅜
Lake	‡6¼
La Salle	3¼
Mass.	‡3½
Mayflower	‡5½
Michigan	‡50
Mohawk	51½
New Arcadian	5¼
New Idria Quick	‡3½
North Butte	23
North Lake	‡1¼
Ojibway	‡75
Old Colony	‡4¼
Old Dominion	‡43
Osceola	66¼
Quincy.	52
Santa Fe	1¼
Shannon	4¼
Shattuck-Ariz	24
Superior.	25¼
Superior & Bost.	1½
Tamarack	29¼
Trinity	2½
Tuolumne.	22
U. S. Smelting	21
U. S. Smelt'g, pf	39
Utah Apex	‡2¼
Utah Con.	10
Victoria..	‡1⅜
Winona	1¾
Wolverine.	36
Wyandot.	‡50

BOSTON CURB Jan 26	
Name of Comp.	Bid.
Alvarado.	70
Bingham Mines	‡3¼
Boston Ely	13
Butte & Lon'n Dev	24
Calaveras	95
Calumet-Corbin	17
Chief Con	80
Corbin..	‡1
Cortez	25
Crown Reserve	75
Eagle & Blue Bell	90
First Nat. Cop	$1\frac{3}{16}$
Houghton Copper	1¾
Iron Cap Cop. pf	‡5
Majestic	15
Mexican Metals	15
Nevada-Douglas	55
New Baltic	1⅜
Oneco	70
Raven Copper	07
Smokey Dev.	.10
So. Lake	4¼
Tonopah Victor	‡17
Trethewey	14
United Verde Ext	$1\frac{15}{16}$

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572		28.983	26.553	
February	61.642	57.506		28.357	26.575	
March	57.870	58.067		26.669	26.788	
April	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	...	64.304	..	69.488	
February	14.49	....	65.259	......	70.188	.
March	14.131	..	64.276	....	69.170	
April	14.211	...	64.747	.....	69.313	
May	13.99	..	63.182	....	67.786	
June	13.603	.	61.336	.	66.274	
July	13.223	.	60.540	...	64.955	
August	*		‡		‡	
September	*		‡		‡	.
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year	13.602		61.524		68.168	

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779		171.905	
February	39.830		181.556	
March	38.038		173.619	
April	36.154		163.963	
May	33.360		150.702	
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301		156.564	

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111		4.011		19.665	
February	4.048		3.937		19.606	
March	3.970		3.850		19.651	
April	3.810		3.688		18.225	
May	3.900		3.808		18.503	
June	3.900		3.810	.	19.411	.
July	3.891	.	3.738	....	19.051	
August	3.875	...	3.715	.....	‡	..
September	3.828	....	3.658	...	‡	..
October	3.528	...	3.384	..	‡	
November	3.683	...	3.585		18.500	
December	3.800	.	3.662		19.097	
Year	3.862		3.737	.. ..	19.079	

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262		5.112		21.533	
February	5.377		5.228		21.413	
March	5.250		5.100		21.460	
April	5.113		4.96		21.569	
May	5.074		4.924		21.393	
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213	.	5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94		$13.23		$13.99	
February	15.06		14.12		14.08	
March	15.07		13.91		14.10	
April	14.90		13.9[illegible]		14.13	
May	14.90		13.90		14.27	
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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Chloridizing Blast Roasting and Leaching--I

By Glenn A. Keep*

SYNOPSIS—Operating details of the new chloridizing-leaching practice at the Mines Operating Co.'s mill at Park City, Utah. The development of the Holt-Dern roaster has greatly cheapened the chloridizing of the ores and makes susceptible to this process low-grade complex ores formerly valueless. Tower acids from the roasters form the basis of the leaching solutions which dissolve the metals quickly when ores have been properly chloridized. Mill solutions corrosive of metals and wooden pipe and fittings are required: the suction fans have concrete-covered blades.

The subject matter of this article was derived from experience in operation of the Mines Operating Co.'s mill at Park City, Utah, treating the low-grade refractory stope fillings of the old Ontario mine. These fillings contain silver, copper, gold, lead and zinc in the forms of oxides, carbonates, chlorides and sulphides. The gangue is quartzite in the west part of the mine, and porphyry in the east part, and in some places contains 2 to 5% CaO.

Chloridizing Blast Roasting

Chloridizing blast roasting is accomplished by combustion of fuel, intimately mixed with the ore and salt, by forcing a blast of air through a mixture of ore, fuel and salt. The mixture must be damp, containing from 5 to 10% water, depending upon the ore and size of crushing. This moisture is driven off before reaching the roasting zone, making the ore above very damp, almost wet. The moisture acts as a blanket, confining practically all the heat of combustion to and beneath the roasting zone. A hard, dry cake about 1 in. thick forms directly on top of the red-hot ore, which also acts as a blanket. The forma-

Mines Operating Co.'s Mill at Park City, Utah tion of this cake is due to the cementing action of the salt after the moisture is driven from the mixture. However, as the roasting zone progresses upward the salt in this cake is decomposed, and consequently the roasted ore is loose and open, but does not, as a rule, fall apart unless disturbed. If excess moisture is used the resulting roast may be hard, although not in the least sintered.

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*Park City, Utah.

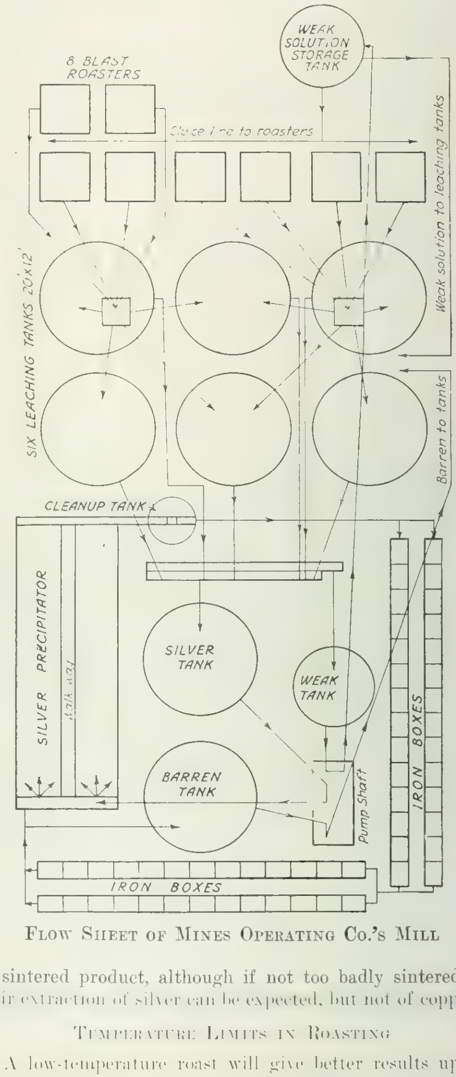
The commending points in chloridizing blast roasting are extreme low cost of roasting, the uniform, well chloridized product, and the ease of leaching this roasted product, although the ore before roasting be of a slimy nature. The amount of fuel required is surprisingly low, ranging from 2 to 3% of coal dust when no fuel is present in the ore. The coal dust used by the Mines Operating Co. is screenings from slack coal and costs 25c. per ton, f.o.b. cars at the coal mine. If pyrite alone were used for fuel, from 6 to 12% would be required. A heavy crude oil makes a good fuel where a low temperature is desired, there being no danger of too hot a temperature when using this fuel, as a high temperature will volatilize the oil ahead of the roasting zone. From 2 to 3% crude oil is sufficient to give a red-hot roast. In blast roasting, the heat is well conserved as the cold air first passes through the hot roasted ore where it is preheated, then into the roasting zone from which the highly heated gases pass into the damp unroasted ore above, thus heating the ore, and then into the flue at a temperature so low that one can put his hand into the flue without any discomfort.

The gases, when the ore contains sulphides, are extremely corrosive to iron. They contain water vapor, chlorine, sulphur dioxide, hydrochloric and sulphuric acids. Concrete is only attacked slowly by the fumes and concrete flues will last for years. Passing the fumes through mill solution or water forms a "tower acid" which contains chlorine, sulphur dioxide, sulphuric and hydrochloric acids. The tower acid smells strongly of sulphur-dioxide gas which is given off for several days if allowed to stand. The amount or strength of acid thus formed depends upon the amount of salt used in the roast to some extent, but mostly upon the amount of sulphides present in the mix. If the ore is not of a limestone gangue, 1 to 4% of sulphides as iron pyrite will make enough acid for leaching purposes, even if the ore contains 2 to 3% copper. The gangue of the ore has a great deal to do with the amount of acid produced in the fumes. A limestone gangue or an ore with a small percentage of lime will not produce much acid in the fumes as the acid is neutralized by the lime. Quartz gangues are good acid producers, a blast roast on quartzite and salt producing much hydrochloric acid. Some porphyries are better from the point of acid production than is quartzite.

The Roasted Product Should Be Slightly Cemented but Readily Friable

A damp mix will roast faster than a dry mix with the same amount of coal and at a higher temperature, and also gives a roast in which the particles are cemented together, sometimes forming a hard cake. A dry mix gives a roast in which the particles are loose so the roast readily falls apart. A damp mix would contain from 5 to 7% moisture, depending upon the ore. The mix should contain enough moisture to make the charge more porous than when dry. The finer the crushing the more moisture will be required. The best roast is obtained from a medium mix in which the moisture is such that the resulting roast is slightly cemented but is readily broken up. A high percentage of salt has a tendency to make the roasted product cemented or caked together.

Too much fuel in the mix results in a sinter, which is to be avoided, as the best extraction cannot be obtained upon a sintered product, although if not too badly sintered a fair extraction of silver can be expected, but not of copper.



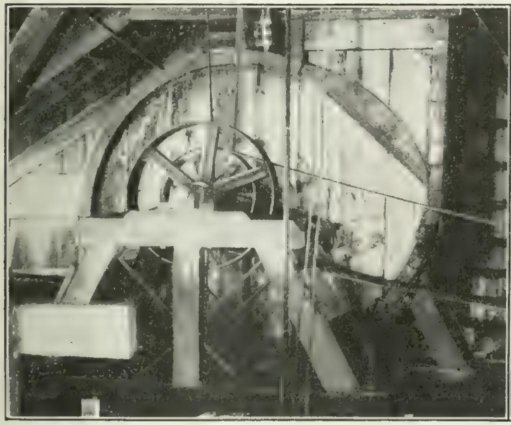
Flow Sheet of Mines Operating Co.'s Mill

Temperature Limits in Roasting

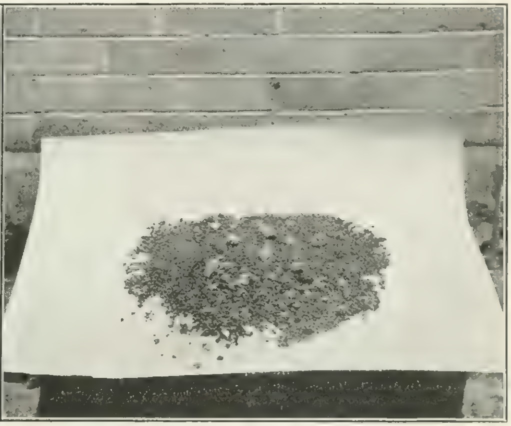
A low-temperature roast will give better results upon both gold and copper, while silver will stand a temperature up to 800° C. without bad effects. A temperature of 600 to 750° C. is the correct temperature for chloridizing silver in the blast roaster, while a temperature of 500 to 650° C. does good work upon copper. In chloridizing ores high in gold it would be advisable to discharge the hot roasted ore into a cooling bin beneath the roaster. As the gold chlorides are decomposed by the ordinary roasting temperature, cooling the roasted ore slowly will cause the gold to be rechloridized and hence readily soluble. Slow cooling to rechloridize gold is an art which was practiced in the old sodium-thiosulphate processes. However, other means mentioned later are employed to dissolve gold which has not been chloridized in the roast.

As the roasting zone is kept covered with unroasted damp ore there are no volatilization losses. Assays of material taken from the fans and flues at different times have never been greater than 2 oz. of silver and no gold. For the same reason there are no dust losses. Tests upon fumes from roasting copper ores show there is no volatilization of copper.

All ore going to the leaching tanks should be well roasted, as unroasted or partially roasted ore will usually give trouble in the leaching process. Ore which has not been heated to a red-hot temperature will not be leachable even if this ore has been on top of an 8- or 10-ft. column of roasting ore and had all the fumes from the roast pass through the ore. Such green ore is only slightly chloridized, and extraction will be poor. Green ore also consumes much acid, especially if it contains a little lime. Unroasted ore contains the original slimes in the ore and will give trouble in leaching by retarding or stopping the flow of solution through the leaching tanks. Partly decomposed pyrite in poorly roasted ore will cause reprecipitation of metals, due to generation of hydrogen sulphide gas by action of acid upon the partially decomposed pyrite. The construction of the Holt-Dern roaster is such that there is no opportunity for any unroasted or partially roasted ore to be discharged from the roaster, and hence no troubles of the above type would be encountered where this type of roaster is employed.



Suction Fan with Concrete-Covered Blades



Some 20-Mesh Ore after Roasting

Lime Hinders, but Pyrite and Manganese Dioxide Aid Chloridization

All copper and silver ores are amenable to chloridizing leaching, except those having a limestone gangue or containing an excess of lime. In roasting an ore containing a small amount of limestone, pyrite must be used in the mix. The action of the pyrite is to decompose and neutralize the lime in the roasting ore so that there will not be an excess consumption of acid in the leaching of such an ore. Ores with limestone gangue require slightly more fuel than other gangues. Good results can be obtained upon ores containing a small amount of lime, but as a rule, limy ores are not easily chloridized.

Pyrite in the mix also aids in chloridization by forming sulphates, which in turn combine with the salt, forming sodium sulphate and thus liberate chlorine, which combines with metals making the chlorides, the object of the roast.

Manganese dioxide also aids in chloridization by reacting with salt and acid and with the acid alone to form chlorine, which becomes available for chloridization. This chlorine might remain unavailable as undecomposed salt or pass off in the fumes as hydrochloric-acid gas if not acted upon by manganese dioxide.

Although it has been pointed out that both manganese and pyrite are aids in chloridization, it does not follow that they are a necessity for chloridizing in the blast roast. The importance of pyrite is much greater than manganese, and most ores will show a slightly better extraction upon the addition of 1 to 2% of pyrite in the mix. This is especially true in case of copper ores where more pyrite is required for the best results than for silver. Some authorities say there should be as much sulphur present as copper to chloridize copper ores, but experience with blast roasting indicates that to get the maximum extraction there should be about twice as much sulphur present as there is copper. For example, a 1% copper ore should have 1% of pyrite in the roasting mixture, more pyrite doing no harm. However, good results can be expected with 1 to 2% pyrite present in the mixture.

An important item in chloridizing blast roasting is the fact that the "slimes" in an ore are agglomerated, that is, one particle of "slime" adheres to another forming a small porous mass. This action results in making an easily leached product from an ore which before roasting was totally unleachable. Ore as fine as 80 mesh has been successfully leached due to this agglomerating action. However, such fine crushing has been neither desired nor necessary for good results upon any of the many different ores which have been tested.

A Deep Bed and Time Essential for Good Chloridization

In blast roasting, good chloridization can be obtained upon fairly coarse ore when there is a bed of red-hot ore from 2 to 4 ft. deep and where the ore is under the chloridizing conditions for 3 to 5 hr. For instance, on ½-in. material roasted under the above conditions, an extraction of 80% has been obtained, while the same mix roasted in a small experimental roaster would show only 40 to 50% extraction. In other words, as good chloridization cannot be obtained in roasting a thin bed as in roasting a deep red-hot mass kept under chloridizing conditions for a long period of time.

The amount of crushing required for good work will, of course, vary with different ores, but it is safe to say that few ores will require finer crushing than 6-mesh, while a great majority both of copper and silver ores need not be crushed finer than ¼ in. to obtain the best results where roasting is carried on under the above conditions. This rather sweeping statement is made after conducting tests upon many different ores, and may be partially explained by the fact that in the roasting process, the larger particles are shattered and rendered more or less porous. This shattering is, on some ores, so marked that after roasting, the larger particles can be crushed between the thumb and finger. Where roasting is carried on in a thin bed and when the roasting and chloridizing conditions are not maintained for considerable length of time, finer crushing and usually more salt are required to obtain the same degree of chloridization.

Recoveries of the Various Metals

With proper roasting and treatment an extraction of 85 to 95% of the silver and 90 to 98% of the copper can be obtained upon most ores. The extraction of gold seems to vary more with different ores, but many ores will yield more than 90% of the gold. What can be expected upon lead is not known with any certainty. The Mines Operating Co., in treating an ore so low in lead that it did not pay to make any special attempt to save lead, nevertheless cleaned up several tons of lead from the "iron boxes" each month. At present nothing of note is known concerning zinc and no saving could be expected.

The Mines Operating roasters, which are built of reinforced concrete, are 10 ft. square and can be charged to a depth of 10 ft. or less. The ore rests upon 2x2-in. wooden grates spaced ¾ in. apart. These wooden grates are supported by timber framework. Air is admitted by an 18-in. air flue to the space between the grates and the bottom. The top of the roaster is covered with pieces of sheet steel which are supported by grizzlies resting upon 5-in. T-irons set in the concrete. The fumes are taken off at one side of the roaster near the top by a concrete flue. This flue is connected to two suction fans which handle the gases from eight roasters.

Starting a Roast

Resting directly upon the grates is a 4- to 6-in. bed composed of roasted ore mixed with 2- to 4-in. rocks. In starting a new roast, about 75 lb. of coal dust, which has been moistened with a cheap grade of coal oil, is spread in a thin layer evenly over the bed. The coal is ignited and a blast of air turned into the roaster. The coal is allowed to burn fiercely for 2 or 3 min. until the layer of coal becomes a sheet of red hot coke. Then about 1½ tons of the mix of ore, salt and coal are shoveled into the roaster through the front discharge door directly upon the glowing coke. This ore is immediately ignited and is allowed to roast for a few minutes until nearly all the ore becomes red hot. The blast of air is then shut off and about 2 ft. of ore is charged into the roaster through the top, direct from the ore-bin chutes. The air is quickly turned into the roaster again and roasting continued for about 1 hr. Again the air is shut off and the charging of the roaster to the desired depth is completed.

After roasting, the ore which is still red hot is sluiced by mill solution from the roaster to the leaching tanks. The sluicing is accomplished by means of a 2½-in. rubber-covered and rubber-lined hose, using hard-wood (maple or hickory) nozzles. The flow of solution is controlled by an iron clamp on the hose. On account of violent explosions due to the red-hot ore, the nozzle is attached by a wire to the center of the discharge door and the direction of the solution stream is controlled by a man at one side using a 10-ft. pole.

As is quite evident, the capacity of these roasters depends largely upon the ease and quickness with which they can be discharged, or in other words, upon the hardness of the roasted ore. The time of one complete cycle of operation, starting, roasting and discharging, is about 24 hr. There are five roaster men in each shift, two men being employed in discharging roasters and three men in loosening the beds, starting, and loading the roasters.

Cost of Chloridizing, 93.3c. per Ton

The average cost of ore roasted during the six months ended Aug. 31, 1914, in the above described roasters, was 93.3c. per ton. This cost includes the maintenance and upkeep on the roasters, flues, suction fans, solution lines and launders, and is divided as follows: Labor, $0.40; salt, $0.32; supplies, $0.082; power, $0.061; coal, $0.059; and pyrite, $0.011 per ton of ore roasted.

The amount of salt used in the mix was 7 to 8%. The amount of coal dust varied from 2.4% when pyrite was used to 3% when no pyrite was added. The mix was run rather dry in order to keep the roasts as soft as possible. Air is furnished by one Connersville rotary blower requiring 42 hp., about ¼ hp. per ton of ore roasted. The pressure varies from ⅜ to ¾ lb. per sq.in., depending upon the number of roasters taking air at one time. At first, charges of ore 10 ft. deep were roasted, but it was found that the speed of roasting was considerably diminished in the top 3 or 4 ft., due to lack of air pressure. Hence 6 to 7 ft. was adopted as the most economical depth of ore charge to be roasted. Because of slowing down the speed of roasting due to the lack of air capacity, it did not pay to crush finer than ½ in., although mill tests upon ¼-in. ore showed an increased extraction of 12% over the 78% extraction which was the average extraction upon silver for the last year. The diminished rate of roasting caused by finer crushing was mostly due to roasting a dry mix. It was not practical to roast a damp mix which is much more porous and roasts faster than a dry mix, because a damp mix gives a harder roasted product. The capacity of the roasters would then be curtailed due to increased difficulty in discharging the roasted ore.

At the beginning of operations, it was supposed that the roasted ore could be economically cooled by a blast of air. In fact, it was thought that the ore would be cooled by the air blast nearly as fast as it was roasted. Experience in roasting a deep bed of ore soon disproved these assumptions. It was discovered that, after a 10-ft. bed of ore had been completely roasted, the top 6 to 7 ft. of ore was still red hot. Such a red-hot mass of chloridized ore will remain red hot for several days even when a blast of air is passing through it. Experience has demonstrated that roasters will not die out when the air has been shut off for 48 hr., but upon renewing the air blast, roasting will continue as if there had been no interruption. Due to the wire reinforcement breaking, the concrete roasters cracked badly. Also, there is much wear on the sides and back of the roasters on account of mechanical abrasion caused by the sluicing stream. It has, therefore, been necessary to reline these worn places every few months.

Roasting Costs Much Reduced by the Holt-Dern Roaster

The type of roaster which has just been described was designed to do the work only until a more substantial and more economical roaster could be built and thoroughly tested out under actual mill conditions. Such a roaster, known as the Holt-Dern roaster, has been in successful operation for nine months at the Mines Operating mill. Only mention of this roaster will be made here, as it is the intention of Mr. Holt to publish a detailed description of the Holt-Dern roaster in a short time.

An estimate of the cost of operating Holt-Dern chloridizing blast roasters for a 150-ton plant is: Labor, three men at \$3.50, \$0.07 per ton; repairs, \$0.01; power, \$0.049; coal dust, 3%, \$0.05; total, \$0.179 per ton. To these roaster costs must be added the cost of salt; the salt used would amount to 6 or 8% where a 24° Bé. salt-acid leach is employed for extracting silver, copper and lead. In case of a copper ore requiring only a straight weak-acid leach, or in case of an ore which is to be treated with cyanide after a chloridizing roast, 2 to 5% salt will probably be sufficient. An example of the latter class of ore is one which requires a chloridizing roast to obtain a good extraction by cyanidization, and which contains enough lime to make salt-acid leaching prohibitive on account of high acid consumption. As the Holt-Dern roaster only requires the attention of one man for 5 to 10 min. every 1½ to 2 hr., in a 50-ton plant containing one roaster this man could also attend the leaching department so that the above cost would only be slightly increased for the smaller mill.

(To be concluded)

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Right to Mine Ore Under Lake Bed

By A. L. H. Street*

One who owns land in Minnesota bordering upon navigable or public waters has a qualified right to remove ore between high- and low-water mark, according to a recent decision of the Minnesota Supreme Court announced in the case of State vs. Korrer, 148 *Northwestern Reporter*, 617. The court said: "While the title of a riparian owner in navigable or public waters extends to ordinary low-water mark, his title is not absolute except to ordinary high-water mark. As to the intervening space his title is limited or qualified by the right of the public to use the same for purpose of navigation or other public purpose."

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*Attorney, St. Paul, Minn.

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European Iron and Steel in 1914

The first half of 1914 was no better for the iron and steel trades in Europe than in America, and our chief rivals—Germany and Great Britain—did not make a good showing. The war has been a further drawback of a formidable character. It is of interest to see what actual production is and has been under the stress of the present time. The German Iron & Steel Union keeps up its regular reports, notwithstanding the disturbed conditions.

From the other important iron producers in Europe no returns are available. The industry in France is much disturbed, but a large part of its production is going on. In Austria-Hungary the iron industry was in a bad way early in the year and several of the large companies were embarrassed financially; undoubtedly their situation is much worse now. In Belgium, of course, the iron industry is prostrated for the time.

German Pig Iron

The make of pig iron in Germany shows some improvement over the early months of the war, the total for October, as reported by the German Iron & Steel Union being 729,841 metric tons, as compared with 580,087 tons in September, and 1,653,051 tons in October, 1913. All districts show decreases from last year, the greater ones being in the South German and the Lorraine-Luxemburg divisions. For the 10 months ended Oct. 31 the total make of pig iron was, in metric tons:

	1913	1914	Changes
Foundry iron	3,054,418	2,248,496	D. 805,922
Forge iron	416,304	317,718	D. 98,586
Steel pig	2,156,771	1,745,266	D. 411,505
Bessemer pig	301,746	227,226	D. 80,520
Thomas (basic) pig	10,179,698	8,214,023	D.1,965,675
Total	16,108,937	12,746,729	D.3,362,208

The total decrease in 1914 was 20.9%, which is less than might have been expected under all the conditions. Part of the German ore supply has been cut off by the war operations, notably that from the Lorraine Minette district. Of the ore imports those from Spain and Russia have been stopped, but probably those from Sweden have continued to some extent.

German Steel

Steel production in Germany which was 1,627,345 metric tons in July, fell off to 566,822 tons in August, but increased to 900,201 tons in October. No comparisons can be made with 1913, as monthly returns for that year were not published by the Union. For the 10 months ended Oct. 31 the make of steel was, in metric tons:

	Basic	Acid	Total
Converter	7,215,479	83,652	7,299,131
Openhearth	5,164,125	248,362	5,412,487
Direct castings	180,644	79,720	260,364
Crucible	......	78,975	78,975
Electric	..	72,730	72,730
Total	12,560,248	563,439	13,123,687

The total number of works reported as operating in October was 217, which compares with 202 in September and 238 in July. The smaller productions reported are in Lorraine, Luxemburg and the South German district. These returns show that notwithstanding all the troubles and drawback due to the war. Germany was operating nearly half her blast furnaces and more than half her steel-making capacity.

British Steel

The British return does not cover any part of the war period. Steel production in Great Britain in the half-year ended June 30, 1914, is reported by the British Iron Trade Association as follows, in long tons:

	1914			1913
	Acid	Basic	Total	Total
Converter.. ...	414,875	239,757	654,632	888,526
Openhearth.. .	1,815,371	1,183,117	2,998,488	3,205,983
Total..........	2,230,246	1,422,874	3,653,120	4,094,509

The decrease of 341,389 tons, or 8.3%, as compared with the first half of 1913, shows that the British steel trade, like our own, was feeling some depression in the early part of 1914, even before the war began.

The division of steel production in the first half of 1914 shows that converter or bessemer steel was 17.9% and openhearth steel 82.1% of the total. Taking another division, acid steel was 61.1% and basic 38.9% of the total make.

The production of manufactured steel products in the first half of this year is returned at 546,826 tons in bessemer and 2,422,126 tons in openhearth, these totals including forgings and castings made by the steel-ingot makers.

Copper in Idaho in 1914

By Robert N. Bell*

What appears to be the most important mineral discovery that has been made in Idaho, for a number of years, was disclosed during last summer in Adams County, at the north end of the Seven Devils mining district, on the Red Ledge group of claims. This deposit consists of a brillant red and yellow outcrop of siliceous porphyry in a region of dark, highly-altered diorite, or greenstone porphyry. The red porphyry is extensively faulted, sheared and sheeted and carries small amounts of gold and silver and traces of copper over its surface. The interesting feature of this deposit at present, however, is the discovery in a 300-ft. tunnel, driven in from the creek level in the greenstone for the purpose of cutting the red porphyry at a depth of 500 or 600 ft., at right angles to its course and at a depth of 200 ft., of a remarkably interesting body of gold- and silver-bearing copper ore. This deposit shows 30 ft. of spongy oxide mineral containing $7 gold and silver and a trace of copper, and 54 ft. of soft massive copper-iron sulphide mineral with a vertical schistose structure that averages 4.6% copper and $5 in gold and silver. The rich secondary copper sulphides, bornite, chalcocite and covellite are conspicuously in evidence in the main sulphide mass. The apex of this particular mineral course, which is still in the greenstone wall rock, is covered with débris and its lineal extent is yet undetermined Next to the main contact, the red porphyry has a spongy, honeycombed texture at the surface, for 50 ft. in width and several hundred feet in length, and gives encouraging evidence of another massive sulphide orebody to be penetrated by the crosscut tunnel. The main red-porphyry mass is 2000 ft. wide and several miles long in outcrop and if it fails to materialize as a disseminated porphyry-copper deposit of workable value, its structural conditions promise other important ribs of massive sulphide smelting ore like the one already encountered and a deposit of considerable commercial importance as a new source of gold, silver and copper ore.

Scandinavian Notes

Special Correspondence

Sweden's output of pig iron electrically produced from Jan. 1, 1914, to June 6, was 16,367 tons. The total for 1915 is estimated at 40,000 to 50,000 tons. The Tinfos iron works, Notodden, the only electric smelter in Norway operating on a commercial basis, has recently sold 1700 tons of pig iron to a Danish motor works and foundry, and 350 tons to other foreign firms. An inquiry has also been received from Italy for a delivery of 500 tons. The Dunderland iron-ore mines are still hung up, and are likely to remain so while the war lasts, owing to the requisite plant being held by Krupp. The Norwegian government has granted a concession to the Saude Falls Co. for the acquirement and regulating of the Store River, on the west coast, in accordance with the terms fixed by the Storthing. These are a concession period of 65 years, with right of redemption by the state after 40 years, a yearly royalty to the consumers of 50 öre per natural horsepower for the first 10 years, 75 öre for the following five years, and afterward 1 krone. A similar scale of royalties is payable to the state. The estimated power is 90,000 hp. At the same time the Electric Furnace Products Co., an American concern, was given permission to lease up to 80,000 hp. from the above proposition for a period of 40 years, after which the works may be taken over at their "technical value."

The Norwegian government has prohibited the export of unwrought copper, with the exception of that produced by Norwegian works and accompanied by a certificate of origin. Also rolled or pressed plates of copper of at least 3 mm. thickness, rolled or forged bars of copper or brass, rolled wire of copper or brass, copper or brass suitable for cartridge manufacture, and copper alloys.

The net profits of the Alby United Carbide, Odda, for the year ending June 30, were £66,252, with a carry-over from the previous year of £16,399. The company which has recently paid an interim dividend of 5% on the ordinary shares reserved further distribution, *pro tem*, on account of the war. The Meraker Smelteverk Co., of which the Alby United owns half, has shown a profit of about 400% of the book value of the proposition. The smelter, owing to the strong inquiry for ferro-chrome, has been in full operation and the prospects for the current year are particularly bright.

The export from Norway of unwrought aluminum has been prohibited from Dec. 24, 1914. An exception is made in the case of aluminum produced at Norwegian works accompanied by a certificate of destination.

State Geologist of North Dakota

In our issue of Jan. 9, we erroneously stated that H. A. Hard was State Geologist of North Dakota. We have since learned that A. G. Leonard is still State Geologist, which office he has held for the past 11 years.

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*State mine inspector, Boise, Idaho.

Canadian Molybdenite Deposits

By W. H. Smith*

SYNOPSIS—The great demand for molybdenite at the present time has drawn attention to the Canadian deposits, which are described here. They occur both in the east and west, the richest being in the Sheep Creek district of British Columbia. Large capital is not required for the successful working of the deposits.

Molybdenite is found widely distributed through the immense granite-gneiss areas of the Canadian Shield, included in the provinces of Ontario and Quebec. Other occurrences have been noted in Nova Scotia, New Brunswick, British Columbia and the Yukon Territory. The Ontario and Quebec deposits are mainly of two distinct types, which are both evidently genetically connected with the Laurentian granite-gneiss erupture.

One type is represented by dikes of coarse quartz-feldspar pegmatite, which, as a rule, follow the foliation of the inclosing gneissic rock and often attain large dimensions, both laterally and transversely. Molybdenite is found in these in small bunches and short, narrow stringers, the mineral in them always being of the crystalline, platy variety, sometimes showing near the surface a slight amount of alteration to the yellow molybdite. As a rule, the plates of mineral vary in size from ¼ in. to 2 or 3 in. in diameter, and rarely exceed 1 in. in thickness. Disseminated mineral is rarely seen in this type of ore body.

The molybdenite is easily separated from the adherent gangue by hammer and chisel, and 80 to 90% of the ore can thus be recovered in many cases. The coarsely crystalline texture of the pegmatite is favorable to hand sorting, as the molybdenite folia have but little adhesion to the faces of the quartz and feldspar individuals.

Usually the bunches of mineral follow one wall or the other of the dike, and often penetrate the first 4 to 6 in. of the inclosing gneiss, which is usually impregnated with iron pyrites and oxides. The limits of the ore-bearing streak are clearly defined by this rusty gneiss on the one side and a discoloration of the pegmatite inwardly. Individual bunches of mineral are often connected by thin knife-blade seams, slightly stained with iron oxides and the yellow molybdite. The slightest coloration of the latter mineral needs to be followed assiduously, as it invariably leads to another bunch or pocket.

The other type of deposit consists of veins of pegmatite, pegmatitic quartz, and greenish pyroxenite, the latter being impregnated with considerable pyrite and pyrrhotite. These always occur along or adjacent to the contact of the granite-gneiss with bands of crystalline limestone, pyroxene having been developed in the latter by contact metamorphic action. The greater number of the eastern Canadian deposits are of this type, which promises to be the more productive of the two, but often contains a large proportion of disseminated mineral for which concentration treatment is necessary. Both the unaltered limestone and the pyroxenic bands carry molybdenite, which appears to be always more abundant along the margin of the pegmatite, or pegmatitic quartz when it is present. In the pyroxenite and pegmatite the mineral exists in bunches, and sometimes intimately mixed with the iron sulphides. Through the limestone both bunches and disseminated mineral are found, the latter being in the form of small scales which are barely less than $\frac{1}{16}$ in. in diameter. Molybdenite has also been found in simple quartz veins cutting granites and granite-gneiss. In these cases the mineral is often associated with bismuthinite, fluorite, tourmaline, muscovite mica, and sometimes cassiterite, wolframite, hübnerite and radio-active minerals of the columbite group.

In British Columbia molybdenite has been obtained at one or two mines in massive form, and when this is free from gangue it constitutes a most valuable ore. On the other hand, if impure, the difficulty in handling it by any known concentration method renders it useless. The leading Ontario deposits are situated in the townships of Somerville and Lexton, Victoria county; Cardiff, Harcourt, Lutherworth, and Glamorgan, Haliburton county; Sheffield and Denbigh, Addington county; Anstrouther, Peterboro county; Clarendon, Miller and North Canonto, Frontenac county, and Lyndoch, Mattawatchan, Brougham, Sebastopol and Ross townships in Renfrew county. Through Quebec the important occurrences are found along the Gatineau valley and in Pontiac county, including the townships of Egan, Alleyn, Aldfield, Aylwin, Wright, Bouchette, Clarendon, Litchfield and Waltham. Quartz veins carrying molybdenite, bismuthenite and fluorite have lately been opened up near Lake Kawagama in northern Pontiac, Que., 15 miles south of the Transcontinental line of the Grand Trunk Pacific Ry., their appearance being highly promising. Another district that merits attention is that along the north shore line of the Gulf of St. Lawrence, eastward from Anticosti Island. The principal locations here are in Manikuagan Bay and on the island nearby called Romaine. About 100 miles further east along the shore and on McKenzie Island, is another noteworthy deposit on which some work has been done.

The Nova Scotia orebodies are situated at or in New Ross, Lunenburg county, Jordan Falls, Shelburne county, and Halifax, Cape Breton, Yarmouth and Victoria counties.

Most of these are quartz veins in granite or granite-pegmatite, and the association of minerals in these cases clearly indicates the pneumatolytic origin of the ore. In the province of New Brunswick, and on the southwest Miramichi River, molybdenite is found accompanied by wolfram.

Of the western occurrences, those on Sheep Creek and its tributaries in the vicinity of Salmo, B. C., seem to be the only ones of economic importance yet discovered. They are possibly the richest of all the Canadian deposits and are reported to average 8 to 10% molybdenum across their entire width. The inclosing rock is a granite gneiss, and tungsten minerals are found associated with the molybdenite.

The Ontario and Quebec deposits may be said to vary in their content from 1½ up to 5 or 6% molybdenum. Ore is now accepted by buyers carrying as low as 20% MoS_2, and all the deposits will yield a good proportion of such a grade. In many cases a certain amount of clean flake mineral can be hand-picked out that will run from 98 to 99% pure sulphide. The second-grade ore, vein material carrying disseminated mineral and the residue from hand-sorting operations, would have to be treated by some method of concentration. This matter has in the past acted as a deterrent to those who would otherwise have engaged in the mining of the mineral. It has been supposed that the recovery was a most difficult undertaking and necessitated the employment of complicated and expensive equipment. Recent experiments have, however, shown that by combining water concentration with either oil flotation or an electrostatic method a reasonable saving may be effected.

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Any units employed would be necessarily small as it would be generally possible to confine mining operations to the breaking of a comparatively narrow streak, producing a minimum of milling material. Great care must be exercised in the breaking of all ground containing lump ore and the holes so placed as to avoid sheltering the mineral as much as possible.

The Canadian molybdenite deposits are fully worthy of thorough and systematic exploitation. It must be borne in mind that the hand-picked mineral may defray a large portion of development expense and would now be easily disposed of at most attractive figures.

Making Cyanide from Cyanamide

Of particular interest at the present time, due to the shortage of cyanide in this country, is U. S. patent No. 1,112,893, granted to J. C. Clancy, of Colorado Springs, 51% of which is assigned to the Portland Gold Mining Company.

Clancy announces that it is a known fact that cyanide may be derived from commercial cyanamide by fusing it with sodium chloride, sodium carbonate, or potassium carbonate. Owing to the large percentage of lime and other impurities contained in commercial cyanamide, the fusing of this compound is rendered difficult unless a large proportion of flux is used. The salt which gives the largest yield in cyanide is potassium carbonate, but its cost is prohibitive for commercial use. Sodium chloride or sodium carbonate requires high temperatures, and the yield is so small that the production is not satisfactory. Clancy makes use of the peculiar action which is produced when an alkaline sulphide, such as sodium sulphide, is used in combination with salt in the fusion. If equal weights of sodium sulphide and cyanamide are heated with a proportion of carbon equal to one-fifth of the weight of the cyanamide taken, to a temperature of from 800 to 1000° C., alkaline cyanide is formed to the extent of 25% of the weight of the cyanamide taken. The resulting product contains a large amount of soluble sulphide. If equal parts of cyanamide and sodium sulphide are heated to the same temperature with the same proportion of carbon in the form of soft coal, the yield of cyanide is increased to 55% of the weight of cyanamide taken. It is desired, however, to get a product free from soluble sulphide, and containing a large percentage of cyanide which can be used in treating gold and silver ores. The result is accomplished by heating cyanamide with an equal weight of a mixture consisting of 50% sodium sulphide and 50% sodium chloride, with the addition of pulverized coal in the proportion of one-fifth of the weight of cyanamide taken. The cyanamide is thoroughly mixed with finely divided sodium sulphide and sodium chloride with the pulverized coal, and heated in a crucible or furnace with exclusion of air, up to 800 to 1000° C. As soon as volatile products cease to be given off, in practice 15 to 20 minutes after reaching red heat, the process is complete.

Nodulizing in Copper Metallurgy

By James H. Payne[*]

Usually when the copper metallurgist is approached upon the subject of nodulizing, his mind wanders back to the days of the Brückner cylinder and he shakes his head in doubt. If questioned, though, he will tell you that one of the worst troubles with the Brückner roaster was that it nodulized. Not having any way to get out, the nodules soon became snowballs, churning up meanwhile a cloud of dust. In order to get around this, the cylinder was tipped and became known as the White-Howell roaster. It is not clear just why White-Howell roasters never came into wide use, but it is probable that the pronounced success of the multiple-hearth roasters, which appeared about the same time, prevented this.

NODULIZING PRACTICED IN IRON METALLURGY BEFORE BEING APPLIED TO COPPER

At any rate the nodulizing kiln, which is simply a White-Howell roaster with the internally fired features of the cement kiln added, began to come into wide use about the year 1904 upon iron ores, such as flue dust, pyrites cinder, and the clayey Cuban ores.

When seeking to introduce the same idea into copper metallurgy, I approached Lawrence Addicks, then of the U. S. Metals Refining Co., upon the subject; nothing had been done with copper ores so far as we were able to learn. After a few preliminary tests, I made a demonstration run, witnessed by Mr. Addicks, which resulted in the installation of a nodulizer at Chrome, N. J., to treat copper flue dust.[1]

Nodulizing copper flue dust and low-sulphur ores does not differ materially from iron practice. The temperature, and consequently the fuel consumption, is much lower. Oil is too expensive a fuel for use on iron ores, although several nodulizers are running on oil, using 15 to 20 gal. per ton of nodules. Powdered coal is the favorite fuel, the consumption being about 12½% on the weight of nodules. Where the softening or sintering point is as high as 1800° F., there is no reason why powdered coal cannot be used on copper ores. It is quite as readily controlled as fuel oil and where a battery of nodulizers is in use it would prove a great economy over oil.

Copper ores differ from iron ores in that they carry no preponderating amount of any one element and therefore generate a much more vigorous chemical action at the sintering temperature. This enables them to be run at higher speed and makes them generally much easier to agglomerate to larger sizes.

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[1] "Eng. and Min. Journ.," May 24, 1913, p. 1037; Bull. of A. I. M. E., July, 1914, p. 1671.

Nodulizing Sulphide Concentrates

When the attempt is made to nodulize sulphide concentrates, conditions are at once seen to be entirely different from the simple cases of iron ores, copper flue dust, etc., because of the sulphur. Whether it be desired to retain all sulphur possible or whether roasting be desired before agglomeration, the effect of sulphur in excess of 10% or 12% is to heat the material, due to oxidation, above the point of incipient fusion for a considerable distance beyond the normal nodulizing zone; and this over-heating soon results in slag and matte formation, which makes operation impossible.

After considerable study and experimentation in a 20-ft. test kiln, at Yorktown, Va., I developed two methods of controlling this over-heating, one applicable where low sulphur is desired in the product and the other where high sulphur is wanted.

Controlling Overheating with a Diluent

The first method (U. S. Pat. 1,114,029) consists in adding to the material before feeding to the rotary a small percentage of a diluent, preferably of a refractory nature and in a fine state of subdivision, which will raise the melting point of the mass. In practice it is applied principally where low sulphur is desired in the product, and air is therefore freely admitted. The refractory diluent (which may be silica or siliceous ore or limestone) has the effect of holding apart the extremely fine sulphide particles and allowing them to roast, so that the material by the time it reaches the true nodulizing zone is low enough in sulphur to be controllable. The diluent also has the further effect of increasing the "range," or, in other words, the margin between incipient and liquid fusion, thereby reducing the slagging or matting effect. In the case of jig concentrates, the quantity necessary to use is not over 10%, as it is only the extremely fine sulphide particles that cause trouble. In the case of flotation concentrates, from 10 to 20% is necessary.

Sealing the Discharge End of the Kiln

The second method (U. S. Pat. 1,114,030) consists in nodulizing under conditions practically devoid of oxidizing effect upon the sulphur of the charge. In practice it is applied when high sulphur is desired in the product. The rotary is built with a seal at the discharge end so as to limit in every way possible the entrance of air over and above that necessary to burn the fuel. As a means of controlling the excessive slagging effect of the oxidizing sulphur this method has marked effect, enabling the nodulizing zone to be held near the discharge end within reach of tools, as desired. It has the further effect of enabling high-sulphur nodules to be turned out, although my original idea was simply that it would avoid the excessive overheating that the sulphur produced as it oxidized.

The application of these two methods has made it possible to handle successfully all ores so far tested, and the desired result as regards sulphur content in the product has in each case been obtained.

Advantages over Blast Roasting

In view of the increasing quantity of the extremely fine sulphide concentrates being produced by flotation methods, the introduction of a one-step agglomerate process will undoubtedly prove to be an important advance in metallurgy. Owing to their high sulphur content, which varies from 25% to 35%, they must be either partially roasted or mixed with a diluent to reduce sulphur to about 17%, if they are to be sintered by a blast-roasting process. Roasting makes a two-step process, and a large amount of flue dust is produced with such extremely fine material. Dilution is in many cases impracticable, as the concentrates are frequently self-fluxing. Briquetting has not proved practicable because the briquettes soon swell and burst when subjected to heat, due to the escape of sulphur.

One of the great advantages in the nodulizing process is, then, that concentrates can be fed directly to the apparatus without addition of other material or any special attention to the water content, and a highly satisfactory blast-furnace product obtained carrying any desired quantity of sulphur. This is particularly important from a pyritic-smelting standpoint. Flotation concentrates are well adapted to pyritic smelting, being self-fluxing and high in sulphur. It is possible to make nodules carrying 14% to 15% sulphur, sufficient to make pyritic or semipyritic smelting possible.

If, on the other hand, conditions are such that low sulphur is desired in the nodules, it is possible in the case of many ores to reduce sulphur to 6% or 8% without addition of other material. In other cases addition of 10% to 15% of a diluent is necessary—not enough to spoil the fluxing properties of the ore. Since the cost of nodulizing is about the same as the cost of multiple-hearth roasting of an extremely fine material like flotation concentrates, it is probable that nodulizing in this case will be able to replace roasters in reverberatory smelting. The small amount of fuel required to nodulize is more than offset by the freedom from flue dust in the reverberatory, and the greater speed which the furnace will have in smelting the already partially melted nodules.

Capacities and Operating Costs

As units of 100 to 150 tons' capacity per 24 hr. are practicable, and as one man can readily attend two furnaces, the labor cost is low. The fuel-oil requirements for a small unit of 50 tons were from 6 to 8 gal. per ton of nodules in the case of three oil-floated ores of widely different analyses. For a large unit, the fuel consumption will be less. Repairs are low; a lining which lasts six months to a year is the only part subject to constant replacement. Only 25 hp. is required for 150 tons' capacity. The cost of a 150-ton unit should not be over $12,000, including building, and therefore compares favorably with multiple-hearth and blast roasting.

Aside from the advantages of sulphur control, simplicity and low-operating costs enumerated above, a further important point is that the nodulizer makes absolutely no flue dust when operating on wet flotation concentrates. This will be doubted by acquaintances of the Brückner cylinder, I know, but it is true nevertheless. As the material is moving forward at a rapid rate, due to the inclination of the furnace, the particles soon reach the zone where they begin to roast and get just sticky enough to cling to their neighbors. That makes them too dense to be influenced by the draft, which, by the way, is extremely light. Any particles that do start out of the tube are precipitated in the atmosphere of steam near the entrance.

As regards the formation of accretions or "rings," this is an inherent defect in the nodulizing of all materials to a greater or less extent. The tests so far made upon oil-floated concentrates in the nodulizer at Chrome show less ring formation than upon flue dust. In neither case is the trouble as serious as in the case of iron ores because of the lower temperature employed, which makes the accretions more friable and causes less loss of time waiting for the furnace to cool. A furnace cools in 12 hr., so that it can be entered, and six hours' labor of two or three men is sufficient to put a furnace into a clean condition, after 18 hours' total loss of time.

The accompanying analyses of green ores and concentrates successfully treated serve to give an idea of the wide range of the nodulizing process.

TYPE OF PRODUCTS NODULIZED

	Cu	Fe	Insol	SiO_2	S	CaO	Gal. Oil per Ton
Flue dust	12.00	31.33	22.10	18.19	11.86	0.48	10
Green ore fines	2.60	27.20	30.98	27.28	17.50	11.92	6
Concentrates	6.13	35.91	20.79	....	21.72	0.51	8
Flotation concentrates	16.30	14.30	41.00	30.20	18.30	0.40	8
Flotation concentrates	12.30	23.40	31.90	28.80	25.40	0.40	6
Flotation concentrates	15.00	30.00	18.00	15.00	32.00	0.43	6

The following screen test, while not representing the best results, is typical of the product when operating on high-sulphur flotation concentrates to the best advantage as regards fuel economy and condition of furnace: Between 1 in. and ½ in., 13.60%; ½ in. to ¼ in., 18.85%; ¼ in. to ⅛ in., 40.55%; ⅛ in. to $\frac{1}{16}$ in., 20.48%; 16 mesh to 20 mesh, 4.22%; 20 mesh to 40 mesh, 1.45%; 40 mesh to 60 mesh, 0.66%; 60 mesh to 80 mesh, 0.13%; through 80 mesh, 0.06%; total, 100%; percentage of voids, 44.50. Although this product does not at first sight appear to be an ideal blast-furnace product, it has been smelted without difficulty at Chrome in quantities up to 30% of the charge. Hot nodules direct from the kiln smelted so much more rapidly than the balance of the charge, however, that it was necessary there to cool them. It will be interesting to see if any difficulties are met with at Braden in smelting this product. Three nodulizers are now being put in there and the blast furnace will operate upon nodules exclusively.

Nodulizing of sulphide concentrates, particularly flotation concentrates, clears up the problem of treating such material because it makes possible pyritic or semi-pyritic smelting. Further, the operation appears to be such a cheap one that it may compete with multiple-hearth roasting in reverberatory practice. If so, it would be preferable to roasting because of the large amount of dust that roasters must necessarily produce when operating upon such extremely fine material.

In concluding this account of the progress made to date, I wish to acknowledge the credit due Mr. Addicks and Mr. Draper, the smelter superintendent at Chrome, who stood by the first nodulizer in its uncertain beginning; also to E. A. C. Smith, of the Braden Copper Co., and F. Y. Robertson, of the U. S. Metals Refining Co., through whose coöperation the adaptation of the process to flotation concentrates was fully demonstrated.

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Production of Bismuth in 1913 in the United States is estimated by the Geological Survey at approximately 157,300 lb. and the imports for consumption of metallic bismuth were 117,747 lb. The prices quoted for bismuth ranged from $1.75 to $2.25 per lb., but production may readily exceed the demand as bismuth is contained in most lead and copper bullion.

Ponce de Leon

By T. M. C.

Shortly after the American occupation of Porto Rico in 1898, the island was visited by many tourists. Some of these were on scientific and semiscientific quests and by the liberal use of money brought to light many curios which had been treasured by the natives as family heirlooms. Among the latter were some curious black stones known locally as *piedras de rayo*. Some people conceived the name to be due to a popular superstition that the stones were meteorites; while others, who had in mind the claims which the possessors made regarding the curative properties, contended that the name should be translated to mean "stones of great power or efficacy of action."

Old voodoo doctors professed to have made wonderful cures by applying such a stone to ulcers and the like. Some stones were reputed to be "extra strong," and, therefore, of greater value. Like many native superstitions, the tales were commonly regarded as subjects for ridicule or for amused tolerance. Viewing the matter in the light of modern scientific knowledge concerning the sources and properties of radium, it is reasonable to suppose that natives of the West Indies have long possessed samples of uraninite containing more or less radium and that some of these contained sufficient to win for them the nickname of "stone of the rays of light."

Speculation on this warrants the reopening of the old case of Public Opinion vs. Juan Ponce de Leon, in which the defendant was convicted of the folly of seeking a fountain of perpetual youth and was sentenced to perpetual ridicule.

And it is proper for mining men to espouse, provisionally, the cause of a man who may justly be called the first mining engineer of the Western Hemisphere. Juan Ponce de Leon was practically the first man to make a careful study of the mineral deposits of Hispaniola and Boriquen, as the islands of Santo Domingo and Porto Rico were first named. His efficiency and tact in dealing with the natives gained him the post of Governor of Porto Rico. It is entirely reasonable to suppose that his intimacy with the aborigines led him to learn of such healing stones and that he may have personally witnessed an actual cure by radium. The instincts of a mining engineer would lead him to attempt some sort of investigation as to the source of supply of stones possessing such peculiar merit, even at the risk of courting ridicule. If, in the course of inquiries on this topic, he learned of vast and virgin fields for colonization, it is not surprising that he should have asked for and obtained a royal grant of this new territory in preference to retaining a post where malicious intrigues made life miserable.

The prototypes of the modern press agents must have existed in his day, and it is not at all difficult to conceive how a malicious humorist might concoct an elaborate yarn out of an incidental and subordinate motive.

Suppose, for a moment, that absolutely no progress had been made in the study of electricity from Franklin's day to the present, and that that gentleman had topped off his career with an unfortunate experiment with lightning. Then our public-school histories would teach us that Benjamin Franklin was a fairly smart man within certain limits, but that he was the victim of a foolish habit of playing with kites.

That Farm

By Mark R. Lamb

SYNOPSIS—The origin of the great mystery: What Becomes of All the Mining Engineers?

Choose from your last list of members of the American Institute of Mining Engineers the first 50 that stand high on the "D" scale. These men who get enormous salaries have all worked with a remarkable unanimity of aim. The experience of one is that of all. When surveying in a wet mine, working a night shift in an unwarmed mill in Nevada, teaching coolies to run a churn drill in Mongolia, or selling mining machinery in Bolivia, the vision that leads him on is the farm that he and the wife and children are going to enjoy just as soon as it is possible and the children are large enough to go to school. He reads those vicious stories in the *Saturday Evening Post* written by that man who covers apples, garden truck, chickens, rice, hogs and finance.

A trip through the apple district of Oregon will develop apple fever, though a more malignant form is developed by hearing the steam-shovel men on the Panama canal discuss the profits being made by Jackson, who used to fire on shovel No. 61. But the job in Oregon is short, and if the next one is in Brazil, our engineer will never think of anything but the profit from a coffee plantation, till he reaches Chile and figures the profits from shipments of the finest fruit in the world to New York in the dead of winter.

Men like Butters and Yeatman and Hammond can buy a large farm in Greater New York, and while they are learning farming the land will double in value, so they will not lose so much. I am not worrying about them. Even if they only lost their time and the entire investment, they would not be financially crippled. My concern is for the man like myself who has or shortly expects to have enough money to buy the farm and thus insure a secure and certain employment for his declining years and to his life's end. When he buys the farm he need never worry about finding something to do, and his years will decline and his life end promptly. All this is preliminary to the story of my life, or at least of the present part of it. I become a martyr to publicity in order to save you.

Providence, who is always on my side, decided one day to give me the farm experience below cost. To that end it was arranged that a certain Chilean gentleman should go to Europe and leave his city farm in my care. In Chile, a little farm of five acres in a city is called a quinta (keenta), and it is the same plot of ground that the stories located in Italy call a villa.

This villa is 30 min. from the office (walking or on the street car), so that I can leave the problem of "how to get the order" and take up the other one, "how to get a crop" with the loss of but a few minutes. You should know that my wife and I have enjoyed California fruit-ranch life, so we knew something about it. Stoping potatoes held no fears for us. As this vegetable has reached a prohibitive price in Santiago, we could figure the profit without a pencil. The profit we actually made on the potatoes was one of Rickard's new kind ("phantom").

But I must get this report right end forward. Raymond would make me begin over. And here is a good place to say that one of the reasons for writing this is so that Raymond will have some basis for my obituary. With what I give him here and his own efforts, he will be able to fill all the space allowed me. And an obituary alone at his hands is worth the cost of a life membership.

But to go back to the villa. The first move was to get a good farmer or gardener. Across the way was a Frenchman who had worked in Kew Gardens in London. Just the man! He came over, looked the place over carefully, said he liked the strawberry patch, thought potatoes should be planted in the west garden in order to clean it up preparatory to planting more delicate vegetables. (That sounded right—Irish preparing for aristocrats, you know.) He looked it over carefully, examined the peach and apple trees closely, said they had not been pruned for two years, and it was too late now to do it. He went over everything carefully, said it was a pity there were no tomatoes started, looked in the greenhouse and the artichoke quarter-acre and surprised me by asking how much I was ready to spend on the place in labor and fertilizer and insecticide and cyanide for scale, and seed and a pair of good horses for plowing, and a cart and the plow, and living rooms for the laborers, and a lot more that I have forgotten.

I asked for time to think it over. We discussed it and I decided that if it was necessary to put so much into plant I wanted to know the size of the shoot, the grade of the ore and what the copper market was going to be. But Mr. Gardener laughed at me. "It depends on the weather, the crops others have, the conditions at the hotels, the scale and other pests, and whether we follow the right lead or drift on a stringer and someone else gets the main lode." He suggested a possible pinching out of the potatoes, and his suggestions did not stop there, but it is now clear to me that he did not know the possibilities of my villa.

Finally, I gave him a free hand, but he decided to take a little piece of ground on his own account near by and grow early tomatoes. That is a great business in London and New York. People pay curious prices for the first of things. In Santiago they were just shipped in from Quillota and Coquimbo six weeks before we could possibly find a red one, and that, too, after buying tomato plants at specimen prices. The Frenchmen and I found this out at the same time exactly.

I did not get his help. Instead, appeared a Spaniard who had worked on the canal and knew how to handle American bosses. In looking back, I am surprised at how quickly the bargain was closed, but I suppose it was that.

Vicente decided what was to be done with every spot on the place. He got the potatoes in quickly. He bought the horse, the plow and the garden tools, with an assortment of seed. At first we were both enthusiastic, getting up at daylight and getting all the household out also. Even this early I could see disaffection creeping in. Part of the family wanted to stay in bed until six o'clock. We had a nice little stream of river water ditched through the place, and it was great fun at first to direct this stream at the various patches of ground. It reminded me of hydraulic mining in Trinity County, and I think now that it must have reminded the gardener of the same thing.

My Chilean gentleman had many rare trees, plants and flowers on the place. I remember one peach tree that leafed out before the others, which had a curious curled leaf. I called Mrs. Lamb's attention to it, and we watched the blossoms expectantly until a bulletin from the U. S. Department of Agriculture let us into the secret. The secret was, briefly, "Peach curl, caused by a bug, spraying with Bordeaux mixture is a help, remedy unknown."

That tree didn't have a peach.

The potatoes started out fine. Green and thick they grew at first, and the Spanish gardener hoed high the hills, much against the advice of Hernandez, the Chilean gardener, who said the roots were being cut. I sided with Vicente because I remembered that Lincoln had hoed potatoes. After a time the potatoes began to look sickly. There were no bugs, at least none that we could see, and Vicente said it was a blight and Hernandez smiled and said nothing. Hardly anyone had potatoes this year, and they are three times the price of the last year. We didn't even open up a drift, and it required five bags of seed potatoes to do the planting. Vicente said when the tops began to wither that that was a sign the potatoes were ready to harvest, but this was before his explanation of the blight. Those tops dropped so quickly they rotted on the ground, and we had to bury them quickly to avoid the plague. This year we will do it different. We have been saving the slacked lime from the acetylene plant. (I have to make the gas every morning and sometimes I forget, and there is an intermission in the dinner schedule.) This lime mixed with copper sulphate is death to scale and blights, and I like to make it. It reminds me of making up standard solutions on the cyanide plant.

Our first crop of cabbages was a failure, so we used a large quantity of the above solution on the next crop and planted more than necessary, in order to have a reasonable crop. This time the cabbages grew 2 ft. high and 18 in. in diameter, and we harvested 2000 of the best. By desperate efforts we could eat two a week. The gardeners only ate them for a short time. Of course, our large crop coincided with other similar large crops. Whenever I smell cabbage now, it conjures up a vision of a huge pile of cabbage heads in the back lot, with two horses and a cow trying to make inroads on the outer edges of the heap.

There were 10 *palta,* or alligator-pear, or *aguacate* trees on the grounds. These did not bear the first year. I asked for advice, and got a lot, but finally became discouraged about advice and expert opinion. The difficulty was solved by asking only one man at a time. If by any mischance I would mention the *palta* trees, or the artichokes, or the potatoes, or the other things which had not borne as they should, and there were two or more men present (whether agriculturists or not), the discussion resulting was almost sure to lose me at least one friend and start a free fight. The *palta* should be pruned drastically—it should never be pruned. The bark should be beaten as the walnut is—the tree is very susceptible to bruises. It should not be watered—it should be watered very frequently and liberally.

The quarter acre of artichokes died because they were cultivated too closely, because there was not enough water, because they were drowned out, because they only live three years, and finally because they were not cultivated enough. I lost one order for a nice little lead smeltery because Dr. River and one of the directors tried to advise me at the same time. Their company is now in liquidation, and nothing will convince me that there is anything to blame but the artichokes.

The horse Ajax was the best investment of all. The Spanish gardener bought him for 95 pesos (look up the value of a peso here), and he was fat and willing. We planted the pasture with alfalfa, intending it for him and Minerva, the cow. I could write pages of his history, but it would be too painful—for me. He slowly pined away, in spite of alfalfa, barley and baled hay. An American said he had bots, and the gardener said he had *avas,* which is something in the roof of his mouth that has to be cut. He also had something, the remedy for which was black gunpowder dissolved in water. He was treated for all these. The man who led him away insisted that I should pay at least five pesos, for fear the horse died on the way.

But the pig—there was the success of the place. Of course, the pig belonged to Hernandez. We named him Benjamin Franklin for his numerous discoveries. He grew and thrived and is still growing, but if Hernandez notices it, he says nothing to me. There were two turkeys on the place when we arrived, and as everyone knows how difficult it is to raise turkeys, we decided to give them no attention or thought and save our efforts for the garden. It seemed a pity to keep them penned up, so we turned them out. They helped keep the bugs and grasshoppers off, but they also liked strawberries. At first they were reasonable and only ate ripe berries, and ate them all up, but becoming bolder through immunity, they began to peck little holes in the partly ripe berries. This was too much. Then when the 13 little ones began to learn the habits of their parents, we held a council of war —and decided to double the berry patch, reserving a part for ourselves.

Except that the *Saturday Evening Post* has asked me to write an article on the commercial opportunities for American manufacturers in South America, I could tell you more experiences. We have been on the place now two full years, so it would take me two years to tell it all.

What you should do first after reading this far is sit down and write me what was the matter. I am sure you could do it. No one has yet said he did not know what we should have done. After that, you might again look up that farm, and perhaps buy it this time, determined to show a waiting world that *you* will not make a botch of farming because other mining engineers do it.

I have an inquiry this morning from a man who is beginning mining, just as you will be beginning farming, after you make the first payment. When you begin to lose faith in your ability as a farmer and look around for help, your letters to the Department of Agriculture will sound to them more or less like the following sounds to you, and you may judge how little you know about farming from this letter: "Our mine is now producing five tons of lead ore daily, but this can be greatly increased. If you find any radium or other valuable products in the sample sent you, please advise us and we will take it up later."

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British Guiana Produced in 1913, 77,435 oz. of gold and 94,871 diamonds weighing 12,506 carats. Promising showings of bauxite and lignite are also reported.

Johannesburg in War Time

SPECIAL CORRESPONDENCE

The outbreak of the war found the mines with fairly good stocks of all necessary stores and trusting to Great Britain being able to maintain command of the sea. Arrangements were soon made to obtain from other sources any goods formerly supplied from Germany, and so far no shortage has developed. It is rather a curious fact that about three weeks before the outbreak of the war I was informed by an engineer of one of the largest German firms here that they had received instructions to realize all stock at cost price, the ostensible reason being that trade was slack. Today the position is unique; nearly all the gold produced is somewhere near Cape Town lying to the credit of the Bank of England, which credits the company's account here and in London with 97% of its value.

The mines work as usual, and another mine, the State Mines, started up its 100-stamp, 50,000 tons per month mill in October. Trains arrive from Durban and Cape Town, yet the Rand is emptied of something like 10,000 of its young workers, one group, the Rand Mines, having sent 1000 men, and another 8000 are drilling for local defense. All over the Transvaal and the Orange River Colony a civil war is going on, while other forces are engaging the German troops in German Southwest Africa. The great bulk of the people of the country, especially the educated Boers, the Colonials and the British, support Botha and the British flag.

The rebellion is partly due to political rivals of Botha and partly due to race hatred and a desire for retaliation, sentiment and a longing to see the national flag again raised, among the ignorant and isolated farmers of the back veldt. There are 40,000 troops in arms for the government, and so far everything points to internal peace being quickly restored. The war seems to have destroyed all hope of raising the twenty millions of fresh capital needed to keep up the output of the Rand by developing the untouched area of the East Rand, and this despite very favorable results obtained by those mines which are developing. The State Mines has in four years' time sunk four seven-compartment shafts, two to 2300 ft. and two to 3600 ft., and has developed over two million tons of reef valued at about 27s. per ton. The Modder Deep has exposed reef, by 22,000 ft. of development, assaying 9.28 dwt. over 47.8 in., and has 2½ million tons of this ore ready for the 30,000-ton mill which is to start work at the end of the year.

Development at the Springs mine about five miles to the southeast of these mines, with no shafts being sunk between, has shown a large proportion of reef of good value, though development work is curtailed owing to the war. Three miles or more to the southeast of these mines, the Daggafontein shaft has struck reef at a depth of 3570 ft., assaying 8 dwt. over 40 in. Development has been suspended here also for financial reasons. Working costs are in almost all mines showing a substantial reduction and the outlook for the investment of new capital should be bright. The government has in the past asked too high a percentage of profit for the leasehold rights of its ground, and there is some hope that after the war it may be able to offer more attractive terms and to attract capital.

Some Electrical Developments in Mining in 1914*

An interesting railway is being constructed by the Bethlehem-Chile Mines Co. in Tofo, Chile. This road will be used for conveying iron ore from the mines, about 2000 ft. above the sea level, a distance of about 15 miles to the Port of Cruz Grande on the coast. The equipment of this road will include three 110-ton, 2400-volt direct-current electric locomotives which will be supplied energy by two 3-unit 1000-kw., 2400-volt synchronous motor-generator sets. This substation will be fed over a 22,000-volt transmission line from a main power house, which will contain three 3500-kv.-a. and one 300-kv.-a. Curtis steam turbines. The average grade on this road is about 3% and the locomotives are to be equipped for regenerative control, feeding power back into the system on the down grades.

MINE LOCOMOTIVES

All of the mine locomotives manufactured by the General Electric Co. in 1914 were provided with commutating pole motors and ball bearings as standard equipment, and the operating records of those placed in service during the year show that these improvements have reduced the number of interruptions to service and have resulted in decreased maintenance costs.

The increasing output of many mines has rendered it necessary to equip with locomotives of relatively large capacity, capable of handling heavy trips over steep grades and for long hauls. For this class of service there have been built a number of three-motor, 15- and 20-ton locomotives. The 20-ton unit combines some unusual features in design and construction. The body is made of rolled steel, each side frame being cut from a solid rolled-steel slab, while steel slabs in conjunction with steel channels are used for the end frames. The three driving motors are each rated at 85 hp., and are of the split-frame type. These particular locomotives were built for 42-in. gage, but the same construction and capacity can be utilized for a minimum of 36-in. gage.

Uptodate practice in haulage locomotives may be represented by reference to the constructive features of a typical 16-ton single-truck three-motor unit. In this, the latest type of industrial locomotive, the truck frame is built of steel throughout, both the sides and ends being cut from single pieces of solid slab. The platform is built of steel channels and plates, and the cab of steel sheets. It is a standard-gage machine; and, in so far as possible, all details have been developed along the lines of standard railway practice, the wheels, axles, journal boxes, brake beams, brake shoes and couplings being all in accordance with MCB requirements. It is driven by two 60-hp., 500-volt motors and equipped with straight air brakes.

An interesting type of locomotive has also been constructed for service at the mines of the Braden Copper Co. in Chile. It is a 25-ton, double-truck machine for 30-in. gage, and has an overall height of only 7½ ft. The four driving motors are each rated at 15 hp., 250 volts; multiple-unit control and automatic air brakes are also included in the equipment. It is probable that this locomotive is the heaviest with the narrowest gage and the lowest overall height of any machine of this type ever built.

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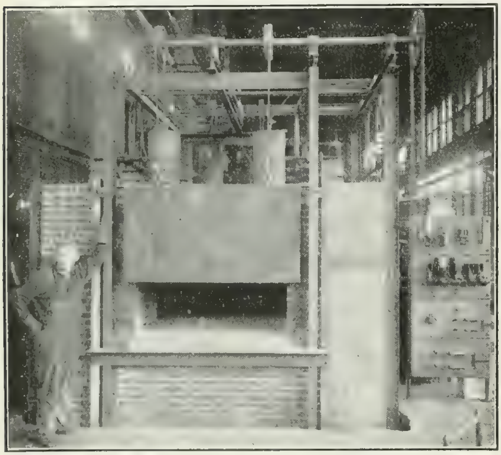
*From data furnished by the General Electric Co.

Mine Hoists

The largest induction-motor shaft-hoist equipment in America was placed in operation in November, 1914, at Lansford, Penn., for the Lehigh Coal & Navigation Co. The driving motor is rated at 750 hp., 300 r.p.m., three-phase, 25-cycle, and drives through a single reduction gear.

Positive control of the hoisting speed is secured by means of an improved type of liquid rheostat and high-tension air-break contactors, the motor circuit being 2300 volts. This hoist serves a 600-ft. vertical shaft hoisting 11,500 lb. per trip at the rate of 90 trips per hour with a maximum rope speed of approximately 1600 ft. per minute.

The liquid rheostat referred to above was developed primarily for mine-hoist service and insures safe operation at quick reversal. It employs two sets of fixed electrodes at different elevations. One set is widely spaced, while the other set has large electrode areas and has small spacing in order to obtain a very low final slip. The two sets of electrodes are connected in parallel after the electrolyte has reached a certain level corresponding to a predetermined decrease in rotor voltage. All parts of the rheostat itself are stationary, thus insuring absolute reliability. The electrolyte level is varied through the operation of a movable weir and a small motor-driven pump.



Electric Annealing Furnace, Resistance Type

Electric Furnaces

The fact that the electric furnace offers a compact, reliable and economical method of manufacturing crucible-quality steel has now become more generally recognized among iron and steel founders and, in consequence, there has been an appreciable increase in the number and size of the equipment recently installed or in process of construction, and a concomitant improvement in details tending toward improved efficiency.

Perhaps the most striking advance has been in the induction type of furnace; for, prior to 1911, the largest unit of this type in the United States had a capacity of only two tons, whereas during the year this was carried to 20 tons, two units of this rating having been completed. This 20-ton furnace is of the two-ring type. In operation it utilizes single-phase current of five-cycle frequency at 5000 volts; and, in this connection, it has been necessary to supply a special motor-generator set, consisting of a two-pole single-phase generator having an output of 4000 kv.-a., which is direct driven by a three-phase, 25-cycle, 2300-volt synchronous motor.

The exceptional size of the furnace, which is the largest of any type in the United States, used for refining steel, is best understood by reference to the core and coils, which elements for each furnace have a weight of approximately 60 tons. In operation the furnace rings are charged with molten metal, every part of which is thereby subjected to intense, uniform and positively controlled heat, and is then poured off after a treatment lasting from 60 to 90 minutes.

For the arc type of electric furnace, special forms of transformers and auxiliary equipment have been designed, together with a reliable system of automatic control, which is particularly interesting to the practical operator in that, except for a short period after starting the furnace, a constant power input is maintained at such a value as may be predetermined by the operator.

The resistance type of furnace, which utilizes heat generated by passing the electric current through a resistor composed of foundry coke, with auxiliary heating from a carborundum arch radiating heat downward on the charge, has also been provided with a simple current relay control that insures the maintenance of a constant temperature over a range of approximately 600 to 1300° Centigrade.

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Mineral Production of Austria in 1913

The output of mining and metallurgical products in Austria during 1913 and the two preceding years are officially reported herewith in metric tons, unless otherwise stated, the figures being taken from *Glückauf*. The labor statistics relate only to 1913.

Mine Products	1911	1912	1913	Workmen 1913
Gold ore	29,647	30,192	35,994	758
Silver ore	24,143	21,794	19,937	1,999
Mercury ore	111,018	117,780	130,608	998
Copper ore	10,974	17,354	16,353	753
Iron ore	2,765,815	2,926,686	3,039,324	6,270
Lead ore	23,845	27,952	25,751	3,614
Zinc ore	32,166	34,675	34,225	511
Tin ore	944	606	939	114
Antimony ore	270	4,520	1,270	26
Pyrites	15,805	13,996	10,561	171
Manganese ore	15,954	12,471	16,540	162
Graphite	41,599	45,375	49,456	967
Lignite	25,152,601	26,283,690	27,378,332	55,194
Bituminous coal	14,487,550	15,797,890	16,459,889	71,015
Uranium ore		11	11	207
Tungsten ore		66	52	27
Asphalt	.	4,234	3,026	121
Metallurgical Products				
Gold, kg	205	204	284	(a)
Silver, kg	50,244	49,355	54,000	381
Mercury	704	763	820	194
Copper	1,760	3,057	3,685	202
Pig iron	1,596,148	1,759,850	1,757,864	5,627
Lead	18,097	19,993	22,312	432
Zinc	15,766	17,298	19,508	1,459
Tin		13	11	(b)

(a) Included under gold ore, and silver. (b) Included under tin ore.

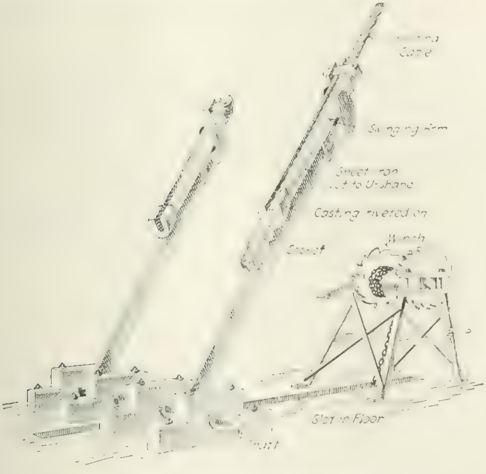
The total value of the mining output for 1913 is reported at 371,122,128 kroner, and of the metallurgical at 181,607,752 kroner, an increase, as compared with 1912, of 18,896,897 kroner in the former and of 2,395,110 kroner in the latter category.

Details of Practical Mining

Device for Holding Skip Rope

By L. Hall Goodwin*

The device used in the shafthouses of the Quincy Mining Co., Hancock, Mich., for holding the skip rope while one conveyance is being substituted for another on it, has advantages over the cruder methods generally employed. The arrangement consists of three arms rigidly fixed to a 4-in. round iron bar. The two arms shown carry the holders for the ropes, and each swings in an arc in the vertical plane which contains its respective rope. The third arm lies midway between the other two and extends beneath the concrete floor, a slot being left in the floor to allow the arm to swing; it carries a counterbalancing weight and also serves as a lever for rotating the bar.



Rope-Holding Apparatus

For convenience one holder is shown empty, the other engaging a rope. As a matter of fact the arms are in the position assumed when they are out of service; they are swung up when they are to be used.

The device is set at such a height in the shafthouse relative to the cranes on which the skips and man cars are stored that when one of them is swung into position over the track it will be at the right height for adjusting the clevis to the rope socket.

When a conveyance is to be changed, the holder is swung into position by rotating the arms until the holder engages the hoisting rope. The rotation is accomplished by means of a small hand winch which winds a chain attached to the counterbalance arm. On either end of the winch drum is a ratchet wheel, one of which holds the arms when in position, the other when out of position. The illustration shows the manner in which the holder catches the rope.

Safety around Surface Tracks

Surface tracks are used around practically every mine and metallurgical plant. They are a not infrequent source of accident. The *N. F. A. Safety Bulletin* offers suggestions toward promoting safety in the use and care of industrial railways, which are applicable not only to mine and metallurgical surface tracks, but also to the underground trackage.

In seeking to prevent injuries, it says, the condition of the tracks merits first consideration. The use of amply heavy rails will prove a safe and good investment, for heavy rails are not so easily damaged by hard usage as light ones and will wear much longer. To promote smooth passage of cars the rails must be substantially supported at sufficiently close intervals to avoid their sagging, binding or spreading; the rail joints must be well secured and in good alignment on both top and edges.

Where rails connect with a turntable, cars may be badly jolted or even thrown from the track altogether if the rails do not make good connection with the turntable or if the latter is not properly latched in line or if it is in a "rocky" condition. The same is true of switches which do not afford good and certain alignment. While jarring of loads or derailment of cars when carrying ordinary loads may cause injury by the falling of the loads upon workmen, the hazard is considerably increased when molten metal is being carried by such cars; it is then all the more important that the tracks be in good order.

Where workmen are frequently crossing tracks and are liable to trip over them or where it is necessary to wheel ordinary trucks and barrows across them, the tracks are frequently laid in concrete or set in wooden floors, with the rail tops flush with the floor, or the rails are cast as a part of rough-surfaced floor plates, laid level with the surrounding floors. When tracks are laid flush with floors, the grooves between the rails and floor form a catch-all for dirt and sweepings. These grooves must be kept clear to make the movement of cars safe and easy.

Where frogs or rail guards are likely to catch and injure workmen's feet they should be equipped with heel guards that will prevent the entrance of workmen's feet to an unsafe depth.

The position of the track may be a source of accident unless proper safeguards are provided. This is necessary, for instance, when a car runs on a track which forms a junction with another passageway and when, because the approaching car is hidden or partly hidden by piles of materials or by partitions or buildings, it cannot be seen quickly enough to avoid collision with men walking in the passageway. It may be feasible to deflect the footpath or the track to avoid this condition, or the piles of materials or the partitions or buildings may be moved from the junction of the track and pathway, and placed where their presence will not endanger workmen. If, however, these remedies cannot be applied it may yet be practicable to safeguard the hazard by the erection of guard gates or fences across the pathway where it meets the track; this arrangement will serve to slow down temporarily the workman's pace as he approaches the dangerous point and thus allow him time to notice if the way is clear. Or the guard gate or fence may be swung across the track where it meets the pathway in order to slow down the speed of the cars themselves as they cross the junction. Such guards are especially needful where a doorway from or into a building leads directly upon tracks. In every case, signs with the inscription "Danger" or "Railroad—Danger" should be conspicuously affixed to the guard gates or fences.

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*Mining engineer, 3 Barstow St., Allston Station, Boston, Mass.

Installation of automatic warning gongs on cars will also help to avoid accidents.

Where existing conditions make it necessary or convenient for workmen to walk on or about tracks which are located alongside fences, buildings or piles of materials, ample clearance must be provided, else workmen may be injured by passing between cars and these obstructions or by scrambling over stationary cars. If safe clearance cannot be allowed, the passage should be closed to all travel except that of the cars and of those who operate them. Here again proper danger signs will prove of great value in preventing injuries to workmen.

Switch levers should be arranged to throw parallel with the rails; when they are operated at right angles to the rails, the switchman is liable to be struck by an approaching car.

Sometimes the nature of the work requires that workmen should stay on industrial cars when they are in motion; ample clearance must then be provided to prevent the workmen from being jammed between cars and doorways or other obstructions. Coasting on cars should never be tolerated.

In some plants inclined tracks are used on which cars are propelled by cables or chains operated by a winch. Breakage of the cable or chain may precipitate an accident, and it is obvious that this extraordinary hazard warrants unusual care and constant watchfulness. The proper performance of car couplings and brakes is of particular importance on inclined tracks. It may be advisable, under some conditions, to fence in such tracks at points where loss of control may allow a car or train of cars to run down the incline. Portable rail-stops or permanent automatic rail-stops serve to check a runaway car or train, or blind switches may be installed at points where they will safely deflect or stop cars that have broken away from control.

The cars should be suitable for their purpose. This is as important from a safety viewpoint as it is upon grounds of economy and convenience. The attempt frequently made to utilize one type of car for all kinds of service is a mistake.

Cars are frequently used where moisture attacks the woodwork, corrosion weakens the iron parts and the bearings are exposed to sand, dirt and grit of various sorts. Such cars are subject to great wear and tear and therefore are particularlarly liable to cause injury to workmen on account of breakage or looseness of parts. Wear of axles, wheels or bearings may also cause poor alignment of the wheels, which may then bind when going around curves, or jump the track when passing over switches or turntables. All car bearings should be lubricated regularly, inspected frequently and kept in good order, particularly when used for handling molten metal or in especially hard service.

Wheels sometimes require guards or fenders. Accident records show that workmen frequently brace their feet against the track close to the car wheels, when the load is being lifted from or placed upon the car. In that case, the car has a tendency to lurch forward and crush the workmen's feet. It may be feasible to apply brakes or to wedge the car in place to prevent such accidents, but it is far safer to provide an appropriate guard on the car around the wheels close to the rails. Such a guard will prevent workmen from placing their feet on rails between the wheels, and will push their feet from the rails if they are in front of the wheels when the car starts.

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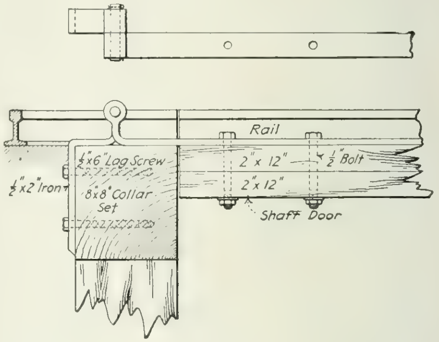
Hinge for Shaft Doors

By Clinton P. Bernard*

While shaft sinking is in progress it is usually necessary to place doors over the shaft at the collar for preventing muck from going down, and for carrying the rails if the material be dumped into a car. The illustration shows a hinge for such doors which can be made by any blacksmith, and has several advantages over the ordinary flat hinge. The center of the eye is set level with the rail and away from the edge of the shaft a distance equal to the thickness of the door plus the rail. The hinge allows a close joint between the rails, while the door in a vertical position is entirely clear of the shaft, and when thrown back the rails are superimposed, thus relieving the hinge of all strain. The door half of the hinge has a bearing on the collar set to give added stiffness to the door.



Shaft Door with Wrought Hinge of Special Design

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Eureka Shoveling Machine

The underground loading machine built by the Lake Shore Engine Works and installed at the Judson mine near Crystal Falls, Mich., was described in the Journal of Sept. 19. A description of the success obtained in actual operation, furnished by M. E. Richards, general manager of the Judson Mining Co., and also interested in the manufacture of the machine, is timely: "We are now working our ore loader underground at the Judson mine and it is doing better work than we had expected at the start. However, as we anticipated, we are finding a few mechanical devices and details which we are changing, in order to make the operation more simple, such as changing the length of teeth on the dipper, making the machine easier to get in and to operate, placing operation levers in a handier place, etc. Our trial runs so far have averaged loading a ton in from one to two minutes. We took just an ordinary pipeman out of the gang and put him on the machine, its operation being extremely simple. All the operator has to do is to open the throttle; the digging is automatic. The operator uses the propelling clutch to work the shovel in close to the bank and the swing clutch to load from all sides of the drift. From results to date it appears that we can at least cut our mucking cost in two, and it will make us much more independent in regard to labor."

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*31 Herriman Ave., Jamaica, N. Y.

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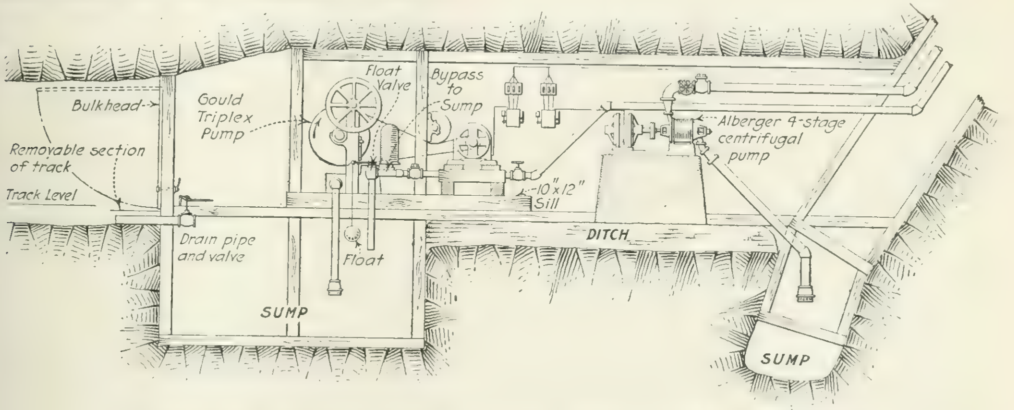
Economical Pump Arrangement

By Howard S. Lee*

At the Rainbow mine in eastern Oregon it became necessary recently to provide an additional pump to take care of extra water encountered in development work on the lowest level. In order to be able to handle surges of water and still not incur the expense of a pump with a capacity much greater than the normal flow, an installation was devised by E. A. Hamilton, master mechanic. While the arrangement is not entirely original, it may be of interest to those having similar problems on account of its low initial cost and its operating economy as regards both labor and power.



Layout of Two Pumps, Sumps, Ditch and Control Valve at Rainbow Mine

The pump already in use was an Alberger, four-stage centrifugal, with a capacity of 100 gal. per min., direct connected to a motor with a speed of 3600 r.p.m. This pump was connected to storage tanks on the hillside about 80 ft. vertically above the collar of the shaft, and the water thus pumped was used in the mill or allowed to overflow to waste.

The new pump is a Goulds triplex with a capacity of 175 gal. per min. It is connected by an endless balata belt to a 25-hp. motor. In order to place the belt and motor back against the wall and out of the way, the crankshaft and countershaft were turned end for end. An idler was applied to the top or slack side of the belt to give greater pulley contact and eliminate vibration due to belt whip.

Both the pump and motor were placed on wooden foundations to save the cost of concrete. The sills were well braced and securely bolted and there is no appreciable vibration. The motor foundation was built 21 in. higher than the pump foundation which will permit 2½ ft. of water on the floor of the station before the motor is submerged. The pump was set above the sump to eliminate unnecessary bends in the suction and make it as short as possible.

A bypass to the sump and a check valve were placed in the discharge column of the triplex pump and the flow of water governed by an angle float-valve in the bypass. Between the two sumps there is a ditch 2 ft. deep and the float works within this range. By this arrangement the centrifugal pump can never be without water and only the excess passes through the triplex pump. It would have been possible to connect both pumps to the same water column, but as there was already another column in the shaft which discharged into an old adit about 160 ft. vertically below the storage tanks, this was used. Now only such water as is needed in the mill is pumped to the higher level; the excess is discharged at the lower level thereby saving power.

To regulate further the flow of water, a bulkhead was placed in the main crosscut which may be closed when the power is off or when it becomes necessary to reduce the amount of water entering the sump. This bulkhead was made of two thicknesses of 1-in. lumber and provided with a felt gasket next to the timber. It is hinged at the top and when closed may be fastened with bolts and wing nuts. A 6-in. pipe and valve were provided so that all water can be drained before the bulkhead is opened. A short section of track may be removed when the bulkhead is closed. When in place the track is fastened by four loose pins.

By this arrangement the flow of water can be regulated absolutely. In case of power interruption it is not necessary to use the auxiliary steam pump to keep the electrical pumps from being flooded and the expense of fuel, firemen and pumpmen in these emergencies is eliminated. In addition to this the triplex sump acts as a settling sump and no grit can enter the centrifugal pump. With the float-valve arrangement the water is maintained at a constant level and no pumpman is required.

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*Mining engineer, U. S. Smelting, Refining & Mining Co., Rye Valley, Ore.

Details of Milling and Smelting

Laist Roasting Patents

Frederick Laist, of Anaconda, has patented a roasting process for copper-sulphide ores and especially for roasting and chloridizing such ores when containing silver, with the idea of bringing the metallic constituents into a form suitable for leaching and final recovery by precipitation. The roasting may be an oxidizing or sulphating process, as well as chloridizing. The accompanying illustrations show the type of furnace suggested in U. S. patent 1,114,371 and 1,114,372, but the process may also be carried out in the furnace covered by Mr. Laist's patent No. 1,070,490. The process patent covers the roasting of a charge on one or more hearths in the presence of hot gases from an external firebox, removing the hot calcines from the influence of said gases and completing the reaction in a region of comparatively low temperature, salt and oxygen being added on the lower heat-insulated hearths where the reaction completes itself without further application of heat. Mr. Laist claims that the fuel consumption is minimized by this process, as is also undue volatilization of metallic chlorides.

In Fig. 1 is shown the roasting and chloridizing furnace suggested by Mr. Laist in U. S. patent 1,114,372. It is of the McDougal type with two fireboxes at opposite sides of the furnace. The products of combustion pass from the fireboxes into hearth No. 3, counting from the top. This hearth is deeper than any of the other hearths, there being left a clearance of from 10 to 12 in. between the upper surface of rabble arms and the roof; the gases from the fireboxes discharge into the third hearth through openings *Z* above the rabble arms at the outer edge of the roof. As will be noted in the drawing, the "marginal" drop hole *Y'* of the second hearth *B* discharges the material on the floor of the third hearth *C*. On hearth *C* the roasting ore is moving toward the center drop hole *Y*; also the ore is moving away from the fireboxes, this being an important feature of the process.

In any direct-fired furnace used for roasting copper ore for leaching, it is important to avoid overheating the ore, since to do so causes a portion of the copper contents to become insoluble in the leaching solution owing to the formation of a "ferrite copper." The temperature on the floor on the hearth *B* is approximately 540° F. Before the formation of insoluble copper ("ferrite copper") becomes serious, a temperature of at least 1100° F. must be exceeded so that the quantity of insoluble copper on hearth *B* is negligible and the relative movement of the ore and flame is thereover immaterial.

On the third hearth *C*, however, conditions are different. Here there may be a temperature of 1280° F. about 2 ft. from the furnace walls, midway between the drop holes (from hearth *B*) and the gas discharge or firebox opening *Z*, the temperature being even higher close to the opening from the firebox. The ore dropping from the second hearth *B* has a temperature of about 500° F. and were it permitted to move toward the region of high temperature on the hearth *C*, the tendency would be for portions of the ore to become overheated and rendered insoluble as above pointed out. This overheating will obviously be much reduced by having the comparatively cool ore enter said heated region and move continually toward a region of lower temperature, that is to say, toward the center of the hearth. Accordingly, in a multiple-hearth furnace roasting ore for leaching by direct firing, it is essential that the direct-fired hearth shall be one in which the ore is moved toward the center, away from the zone of high temperature. To minimize the destruction of the rabble arms and rakes on the hearth *C*; the openings from the fireboxes are, therefore, placed immediately under the roof of the hearth, which is sufficiently high above the rabble arms to permit the flame to clear the arms and play between the roof and the arms.

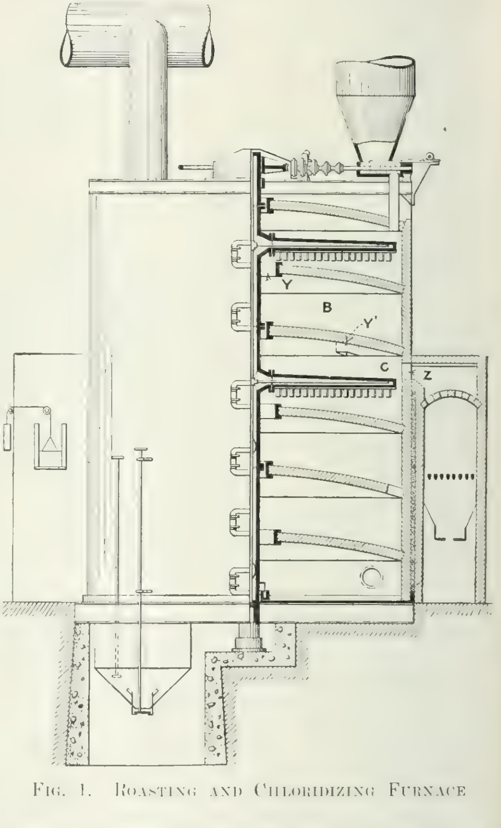


Fig. 1. Roasting and Chloridizing Furnace

Three distinct types of roasting may be considered in this connection, says Mr. Laist in his patent: (a) The oxidizing roast, pure and simple, which contemplates the conversion of the metal to oxide; (b) the sulphating roast which contemplates the formation of the sulphate of the metal; and (c) the chloridizing roast by which the metallic oxides and sulphates, together with decomposed sulphides, such as silver sulphide, are converted into chlorides of the metal. Mr. Laist's patent contemplates the practice either of the first two types or it may combine all three, depending on whether silver be absent or present in the ore. If no silver be present the ore charge is subjected merely to an oxidizing and sulphating roast; if silver be present then the charge is subjected to a combination of oxidizing, sulphating and chloridizing roasts. The ore is oxidized on the three upper hearths and sulphated and chloridized on the lower hearths, away from the heat supplied by the gases of the fireboxes. In the construction shown the furnace walls of the lower hearths are insulated against heat loss by radiation by a layer of asbestos or its equivalent or by making the walls sufficiently thick to prevent loss of heat.

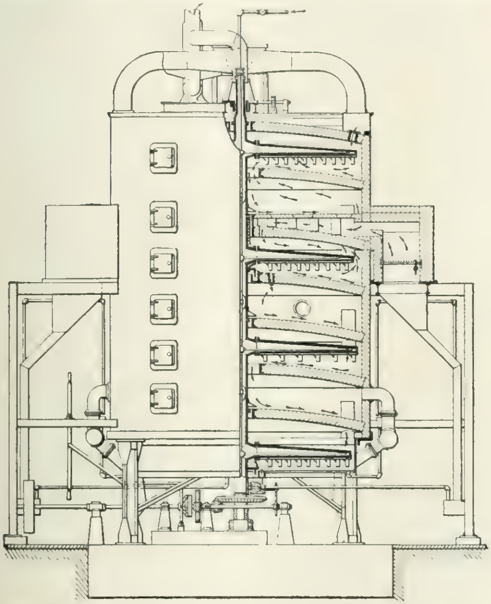


Fig. 2. Roasting and Chloridizing Furnace with Muffle over Third Hearth

In the upper part of the furnace the ore is oxidized, using this term in its generic sense; thus the copper sulphide is first converted into CuO and SO_2, any SO_3 which may form converting the CuO into $CuSO_4$, and the result is a mixture of CuO and $CuSO_4$, the sulphating process being an oxidizing one, speaking generically. Assuming that the ore treated is a copper sulphide carrying silver, the product of the oxidizing roast from the upper hearth is probably a mixture of CuO, FeO, Ag, Ag_2S with small quantities of Cu_2S, $CuSO_4$, Ag_2SO_4 and $FeSO_4$. In such a case there takes place on the lower hearth a sulphating reaction similar to that above described, and concurrently therewith a chloridizing action, common salt (NaCl) being added to chloridize the silver. The salt is fed to the fourth hearth in proper quantities through doors or any suitable form of automatic feeder. The temperature of the hearth on which the salt is introduced is from 850 to 1000 F., this being sufficient to cause the salt to react with the metallic constituents of the hot calcine. The salt chloridizes the silver present and that portion of the copper ($CuSO_4$), which may have escaped conversion into oxide on the upper floors. Other reactions will take place between the various products, the principal reactions identified with the chloridizing step of the process being as follows:

$$2\,Ag + 2\,NaCl + O = 2\,AgCl + Na_2O.$$
$$Ag_2S + 4\,O + 2\,NaCl = 2\,AgCl + Na_2SO_4.$$
$$Ag_2SO_4 + 2\,NaCl = 2\,AgCl + Na_2SO_4.$$
$$CuO + 2\,NaCl = CuCl_2 + Na_2O.$$
$$CuSO_4 + 2\,NaCl = CuCl_2 + Na_2SO_4.$$
$$FeSO_4 + 2\,NaCl = FeCl_2 + Na_2SO_4.$$
$$FeO + 2\,NaCl = FeCl_2 + Na_2O.$$
$$FeCl_2 + O = FeO + 2\,Cl.$$

The final product or calcine is cooled in any suitable ore cooler and subsequently leached with a solution containing 3 to 15% by weight of sulphuric acid and from 4 to 15% by weight of common salt. The dissolved metallic salt may be subsequently recovered by precipitation or any other method known to the art.

In most chloridizing-roasting processes, a certain percentage of the copper (usually as chloride) volatilizes. It is aimed to reduce volatilization to a minimum by the Laist process, but it is suggested that these copper fumes can be saved by leading the furnace gases to a suitable absorption tower or to Cottrell electric-precipitation apparatus, or both.

The charge to be roasted, in one instance, contained from 2.5 to 3% of sulphur and when it dropped from the third hearth to the fourth it still contained about 1% of sulphur. The finished calcine contained about 0.5% of sulphur, of which 0.1% was in the form of undecomposed sulphides, and 0.4% in the form of sulphates. When the calcine dropped from the third to the fourth hearth it contained about nine-tenths of the sulphur in the form of the undecomposed sulphide and one-tenth in the form of sulphate.

The decomposition of the sulphides by the oxidizing roast leaves but a small percentage of undecomposed sulphide to contend with in the chloridizing-and-sulphating hearths, the major portion in said hearths being probably silver sulphide. Thus the sulphur element as a fuel and heat generator is practically eliminated in the chloridizing hearth. The result is a chloridization with a minimum volatilization of copper chlorides.

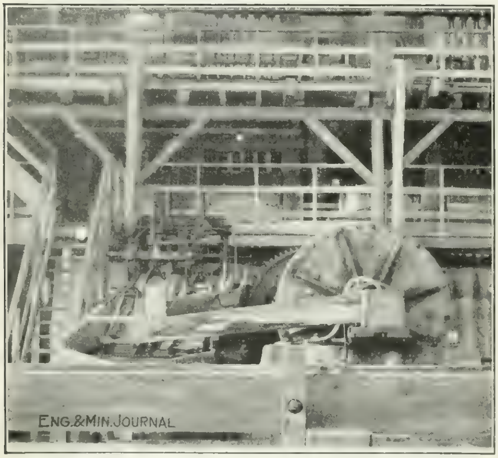
The furnace shown in Fig. 2 covered by Mr. Laist's patent, No. 1,114,371, is an improvement on a previous construction (U. S. patent 1,070,490). The improved furnace is characterized by the presence of a muffle or combustion chamber interposed between the second and third hearth. The result obtained is a gradual and less intense heating of the ore and at the same time a better combustion of the gases from the fireboxes. The flow of the furnace gases is shown by the arrows.

[At the January meeting of the New York section, A. I. M. E., it was stated that chloridizing roasting had been dispensed with at Anaconda and salt solution added in the leaching tanks with satisfactory results. In response to an inquiry on this point, Mr. Laist states: "After considerable experimentation, we decided to omit salt from the roasting furnaces. Under these conditions of course no chloridizing is done in the furnace, and there is also no volatilization of metals which means about 6% when salt is present in the furnace. We obtain an extraction in our case of about 75% of the silver by maintaining salt in the leaching solution. The silver in the calcine is chloridized by the copper chlorides and the iron chlorides present in the leaching solution. When salt was added to the furnace the silver extraction ranged from 85 to 90%. In our case the amount of silver in the ore is so small, being only ½ oz. per ton, that the difference of 10 or 15% in silver recovery did not amount to enough in dollars and cents to balance the greater difficulty of operating the furnace when salt was fed into it."—Editor.]

Grinding in Closed Circuit

Tube mills and classifiers are arranged in closed circuit where an all-slime product is required. The classifier oversize is delivered to the tube mill for regrinding and the tube-mill discharge is sent immediately back to the classifier, where it is freed of slimes and the oversize again reground.

Most present-day arrangements of closed circuits are about as is the practice at the Hollinger mill, at Timmins, Ont. This arrangement is shown in the accompanying illustration. The tube-mill discharge, to which some solution is added, is run directly to the classifier, while the oversize sand is delivered to the feed end of the mill through a scoop feeder which may be made of large enough diameter to account for the required lift. In this way the necessity for lifting or elevating machinery is avoided.



Tube Mill and Classifier in Closed Circuit at Hollinger Mill

Recovery of Molybdenum

Ascording to Frederick D. S. Robertson, of Toronto, Canada (U. S. pat. 1,118,150), molybdenum is best recovered by crushing the ores to about 8-mesh, preferably through rolls, as that preserves the flaky structure best. This ore is then exposed to a heat exceeding 790° C. in an atmosphere containing an excess of oxygen. The trioxide is formed under these conditions, and is volatilized. A baghouse or other suitable arrangement is then provided for collecting the volatilized MoO_3. The charge must not be allowed to sinter during roasting. This may be done by adding silica or lime, according to nature of the gangue, to the ore before roasting. If necessary the trioxide may be further purified by redistillation.

Slater Process in Lake Superior Copper District

Editorial Correspondence

The Slater process for leaching copper ores is to be tried on a commercial scale in the Lake Superior copper district in the near future. The Pacific Coast rights for this process are controlled by the Western & International Precipitation Co., of Los Angeles, this company also being interested in the Cottrell process. Some experiments on a small scale have been made on some of the copper sands of upper Michigan, and the results have been sufficiently satisfactory to warrent the experiments being tried on a larger scale. It is expected that by the coming spring, a 10-ton plant will have been built at some point on the South Range in the Copper Country. This process has been described in the Journal of Sept. 27, 1913. The men who are interested in the Copper Country project believe that the process can be used with profit in the Lake Superior district, but that at least, experiments on a 10-ton scale will bring defects and difficulties to light.

X-Ray Inspection of Castings

In the *General Electric Review* for January, 1915, is described the use of a Coolidge tube made for high-voltage X-ray work to examine the interior of a steel casting for blow holes. The casting in question was 3/16 in. thick at the point examined and a two-minute exposure was sufficient to secure a radiograph. The plates taken all showed peculiar markings apparently indicating a cavity. The plate was then cut into and flaws were found as indicated by the plates.

It is suggested that we may some day take pictures of steel ingots to see where to crop. Certainly thin castings are no longer a sealed book.

Preparing Pyritiferous Blende for Magnetic Separation

In the preparation of blende for magnetic separation it is attempted to convert the pyrite into pyrrhotite. If the oxidation is not carried far enough, some pyrite is left unchanged and therefore nonmagnetic. If the oxidation is carried too far, some of the pyrrhotite is changed to nonmagnetic ferric oxide.

Gilbert Rigg of Palmerton, Penn., states that by roasting in a muffle or shaft without air at temperatures ranging from 600° to 800° C., all of the pyrite is converted to pyrrhotite, and none of the latter is oxidized (U. S. pat. 1,103,082). In this roasting it is only necessary to guard against fusion of the charge. The sulphur escapes in elemental form and can be condensed and recovered. This latter process is covered by U. S. pat. 1,103,081.

The Assayer and Chemist

Economy and Rapidity in Copper Titrations

By Edgar A. Slagle*

Comparisons of the results obtained by the electrolytic, iodate and iodide methods for the determination of copper which have appeared in the Journal from time to time have shown that the accuracy of the iodide method is beyond dispute. An objection to the iodide assay that has been raised is the use of an expensive chemical, potassium iodide, especially since the present war has greatly increased the price of this chemical.

The following will be found a simple and convenient method of recovering the iodine and consequently reducing the cost of the copper assays: Directly after the titrations are finished an excess of sodium thiosulphate and several grams of lead nitrate are added to the beaker. This precipitates all the iodine present in sodium and potassium iodide as lead iodide. The portion of iodine combined as cuprous iodide remains undisturbed so the total precipitate is composed of lead iodide and cuprous iodide. The contents of the beaker can then be transferred to a large jar. At intervals, after settling, the liquid can be siphoned off and the iodine salts disposed of to chemical houses.

Chemists who use the iodide method for copper assays usually employ it on account of its rapidity. This method can be appreciably shortened by avoiding the use of ammonia or sodium carbonate to neutralize the nitric acid and subsequent acidification with acetic acid in the following manner: After solution and removal of all nitrous fumes, by boiling, the solution is diluted to about 250 c.c. and about 15 to 20 c.c. of a saturated solution of zinc acetate added and the titration carried out as usual after addition of about 10 times the weight of copper present of potassium iodide. The end point with starch can be determined without difficulty, but will not remain permanent for more than five or 10 minutes.

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Determination of Iron, Mercury and Arsenic in Sulphuric Acid

The following method was described by H. Nisjenson (*Chem.-Ztg.*, Sept. 29, 1914; abstr. *Journ. Soc. Chem. Ind.*, Nov. 30, 1914):

In an Erlenmeyer flask are placed 60 grams of pure zinc and 100 c.c. of sulphuric acid, freed from HNO_2 by heating, are added by means of a burette. The hydrogen is passed into a small Erlenmeyer flask, containing 1 c.c. of bromine, 100 c.c. of water, and a few drops of sulphuric acid. After about an hour and a half nearly all the zinc will be in solution. The rest of the zinc, which contains the mercury as an amalgam, is filtered, washed and dried. After being mixed with freshly burnt calcium oxide, it is placed in a porcelain crucible, covered with a weighed cover. The upper hollow of the cover is filled with cold water and the crucible is cautiously heated for 10 minutes; the cover is washed with alcohol, dried carefully, and weighed. The iron will be in the filtrate and is titrated with N/100 permanganate. The arsenic is absorbed as AsH_3 by the solution of bromine. The bromine is evaporated by heating the solution. The colorless liquid is reduced by boiling with Na_2SO_3, after which hydrochloric acid is added. The arsenic is titrated with a N/10 $KBrO_3$ solution, using indigo as an indicator. One cubic centimeter of $KBrO_3$ solution corresponds with 0.00375 gram As. This analysis of technical sulphuric acid can be done in about five hours.

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The Ferrocyanide Determination of Zinc*

The method by titration in alkaline solution is the method recommended for use at Broken Hill for the estimation of zinc by titration with potassium ferrocyanide. The first modification for use with acid solutions was formally rejected.

Titration in Acid Solution

Weigh out 0.5 to 5 grams of ore in an 8-oz. beaker and dissolve in 10 c.c. concentrated nitric acid. When all red fumes have ceased add a few crystals of potassium chlorate and evaporate to hard dryness. [This does not seem superior to the common Western procedure of treating in a casserole with a saturated solution of potassium chlorate in strong nitric acid.—Editor.] Allow to cool, and then add 50 c.c. of hot water, 15 c.c. of ammonium hydrate (sp. gr. 0.88) and 7 grams of ammonium chloride, and boil on a sand bath for at least four minutes.

Filter and wash thoroughly with a 1% NH_4CL solution until the filtrate measures about 300 c.c. Add 2 grams sodium thiosulphate and one drop of methyl-orange solution. From a burette then add concentrated hydrochloric acid until just acid, then 5 c.c. in excess. Heat to 80° C. and titrate with potassium ferrocyanide, using a saturated solution of uranium acetate as an outside indicator. The end point is reached when one drop of solution and one drop of the acetate indicator give a faint chocolate color on a white spot plate.

Standardization of the K_4FeCy_6 Solution

Weigh out 0.3 gram of c.p. zinc oxide, previously ignited to redness and cooled in a dessicator, or 0.25 gram c.p. metallic zinc, and dissolve in 10 c.c. of hydrochloric acid. Dilute to about 200 c.c. with hot water, then add 15 c.c. ammonia water (sp. gr. 0.88) and 7 grams of ammonium chloride and proceed as given above for the assay.

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*Chief chemist, Westminster Metal & Foundry Co., Westminster, Md.

*Excerpts from the report of the Assay Sub-Committee of the Australasian Institute of Mining Engineers (Broken Hill Branch), which investigated the methods used at Broken Hill, with a view to recommending a standard procedure.

TITRATION IN ALKALINE SOLUTION

The potassium-ferrocyanide solution contains 32.3 grams of the pure salt per liter (1 c.c. = 0.01 gram zinc). A ferric-chloride solution containing in each liter 200 grams of cream-of-tartar and 2 c.c. of a neutral ferric-chloride solution carrying 10% iron is also used. This emulsion must be well shaken before using and 30 c.c. used for each assay, as specified below. The outside indicator is pure glacial (99-100%) acetic acid.

To standardize the solution, weigh out two lots of pure, freshly ignited zinc oxide, dissolve in about 5 c.c. of dilute nitric acid (1:4) and evaporate nearly to dryness. Dilute with 100 c.c. hot water, add 7 grams pure ammonium chloride and 15 c.c. of 0.88 ammonia, dilute to about 300 c.c. with hot 1% ammonium-chloride solution and add 30 c.c. of ferric-tartrate emulsion. Titrate at 70° C. with potassium ferro-cyanide solution, until one drop of the solution gives a faint blue color on a spot plate with the indicator.

The difference in weight of the two quantities of zinc taken, divided by the difference in the cubic centimeters of solution taken, is the absolute standard. The weight of zinc taken, subtracted from the cubic centimeters of ferrocyanide used multiplied by the absolute standard, is the "blank" to be deducted from all determinations.

THE ASSAY

As no titration should require less than 2 c.c. nor over 25 c.c. of the ferrocyanide solution, weigh out 0.5, 1 or 2 grams of sample into an 8-oz. beaker. If sulphide, dissolve in 6 to 10 c.c. of strong nitric acid and boil. When red fumes cease, add 1 gram of chlorate and evaporate to complete dryness. This precipitates the manganese as oxide.

For roasted ores, oxides, etc., boil with 7 to 10 c.c. of strong hydrochloric acid, evaporate nearly to dryness and add 10 c.c. HNO_3. Boil until most of the acid is decomposed, then add a little powdered potassium chlorate and evaporate to complete dryness.

Cool, add 100 c.c. hot water, break up the mass with a rubber-tipped rod, and add 7 grams of ammonium chloride, 15 c.c. of 0.88 sp. gr. ammonia and about 0.5 gram sodium peroxide. Boil for a few minutes and filter off the precipitated iron, alumina and manganese. Redissolve the precipitate in the least necessary hydrochloric acid and reprecipitate. Wash the precipitate with boiling 1% ammonium-chloride solution until the bulk of the filtrate is about 300 c.c.

Add 30 c.c. of the ferric-tartrate emulsion and titrate at 70° C. with potassium ferrocyanide. If copper is found to be present, before adding the ferric tartrate emulsion make the solution just acid with hydrochloric acid, add 1 c.c. excess, and then about 20 grams of clean granulated lead (zinc free). Warm on the sand bath with occasional stirring until all the copper is precipitated, decant the liquid, wash several times by decantation, add 30 c.c. ferric-tartrate emulsion, 15 c.c. of 0.88 ammonia, and titrate, using the acetic-acid indicator on a spot plate.

It is advisable, when dissolving roasted and sintered ores, to rub with a little water first, to prevent adhesion.

With very low-grade ores the amount of ammonia present may prevent the precipitation of the zinc when titrating. In this case acetic acid is added until a precipitate forms, and the titration is then completed.

[In connection with any method of ferrocyanide titration it should be remembered that the zinc ferrocyanide precipitate is of constant composition only in case the ferrocyanide is in excess. To obtain the best results, therefore, the solution to be titrated should be divided into halves fairly closely, and one-half titrated. All except 1 or 2 c.c. of the second half of the solution should be added and the end point over-run with the ferrocyanide solution. Allow to stand a few seconds and add the last of the solution, finishing as accurately as possible.

Where many zinc determinations are run, c.p. ammonium chloride becomes a burdensome and apparently unnecessary item of expense, for the ordinary commercial sal ammoniac seems to answer perfectly.—EDITOR.]

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The Assay of Tin Ores

A modification of Beringer's method of assay for tin ores is given by H. W. Hutchin (*Bull.* I. M. M., No. 113), which appears to be a decided improvement over the original. The author's experiments are omitted, and only his conclusions concerning the proper procedure are given.

The amount of tin ore taken is 2.24 grams (since the assay is reported in pounds per long ton). This is mixed with 2 grams of burnt lime and placed in an alundum crucible (porcelain and platinum are not so good), the bottom of which is covered with a thin layer of precipitated calcium carbonate, and the sides rubbed with the same material. The mixture is then ignited for 15 min. over a ⅝-in. Teclu burner or for 20 min. over a ⅝-in. bunsen. Since the reducing gases from the burner take an active part in the reaction, muffle ignition is not an equivalent. A porcelain crucible may be used by igniting 5 min. longer.

After ignition the charge is tipped out, and the remainder, largely calcium oxide, brushed out with a small brush. Used thus the crucible has a long life. The crucible should be supported so that the flame envelops it.

The crucible itself is a good indicator of the position; as supplied it is slightly tinged with iron oxide. If it is at the proper height in the flame it will burn white, but if too high in the cone of flame, the upper part will burn to its original color. After this ignition the residue is dissolved in dilute HCl, reduced with nickel, and treated as an ordinary assay.

In the discussion (*Bull.* I. M. M. No. 115), it was pointed out that it was important to examine the solution following a bisulphate fusion for tin. It was possible, in any unknown ore, that some tin occurred in such form as to be rendered soluble by this fusion.

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Analysis of Copper-Tin-Silicon Alloys

In speaking of the analysis of copper-tin-silicon alloys, E. D. Koepping (*Journ. Ind. Eng. Chem.*, August, 1914) calls attention to the fact that they are insoluble in nitric acid and recommends that they be dissolved by boiling 0.5 gram of the alloy with 15 c.c. HCl and 5 c.c. HNO_3, then after complete decomposition, add 20 c.c concentrated H_2SO_4 and boil to copious fumes.

Correspondence and Discussion

Electric Smelting for Southeastern Alaska

I am inclined to take issue with the statement in the JOURNAL of Dec. 26, 1914, of electric copper smelting being an unknown art. It may be an art not practiced at the present time in America, but is not this because the conditions for its successful operation have not been thoroughly known? I would refer you to an article read at the August meeting of the A. I. M. E. by Lyon and Keeney and published by permission of the director of the U. S. Bureau of Mines.

In their introduction they did not claim the electric furnace would displace the combustion furnace but would be used for the treatment of ore deposits which are situated in regions where fuel is scarce and costly and where hydro-electric power is comparatively cheap, or for use in a district remote from railroad transportation facilities, and where there are deposits of sufficient value to warrant their being worked, but which, due to the cost of getting coke or oil to a smeltery, have remained unworked; and where, on the other hand, there is plenty of water power which can be developed at reasonable cost for production of electric power, by the use of which smelting the ores in an electric furnace with subsequent bessemerization, if necessary, a concentrated product may be obtained which can easily stand the transportation charges.

Or, comparatively speaking, the transportation facilities may be all right but the cost of fuel be too great to permit the ordinary methods of smelting, whereas, on the other hand, hydro-electric power can be developed in the district at a low cost and ores could be smelted in an electric furnace that would make their treatment possible. I believe the latter more nearly states the existing conditions in southeastern Alaska. At the present time good foundry coke costs in excess of $20 per ton in Juneau, while small shipments in sacks in the past have cost approximately $30 per ton. Compare this with coke selling in our Eastern markets for $2 per ton and less.

While the whole of southeastern Alaska, a network of mountainous islands adjoining a jagged mainland, is subjected to an extremely high rainfall, at Ketchikan the precipitation for 1913, according to government records, was 158 in., or over 13 ft. of water falling in one year. By far the cheapest all-year power of any place in the United States may be obtained in this section of Alaska. I refer to the Speel River power project where, according to E. P. Kennedy, late assistant superintendent of the Alaska Treadwell Gold Mines, hydro-electric power can be developed at tidewater in blocks of 10,000 hp. for a capital cost per horsepower of $27.95, or allowing 8% for interest and depreciation, $3.43 per horsepower year. These are figures published in *Western Engineering*, January, 1914.

Freight on ore from any port of southeastern Alaska to this power should not exceed $1 per ton. Quoting again from the aforementioned A. I. M. E.:

"The electric smelting of copper ores is nothing more than the substitution of electric heat for the heat derived from the combustion of carbon. Inasmuch as the carbon which is used either in the reverberatory furnace or in the blast furnace plays no important part in the necessary reactions which take place in these furnaces, there is no reason—metallurgically—why electric heat may not be substituted for the heat derived from the combustion of carbon. In fact, as we have tried to point out, in some cases the reactions would take place to better advantage in neutral atmosphere of the electric furnace than in the reducing or partially reducing atmosphere of the combustion furnace. Therefore, as to whether the electric furnace would be used for the smelting of copper ores would largely depend, so far as we are able to make out at the present time, upon the relative cost of coke and electric power. As the use of the electric furnace is not advocated as a competitor of the combustion furnace, but as a substitute for it, in those localities where it is not advisable because of the high cost of fuel, we see no reason why the electric furnace may not be developed as a substitute for the combustion furnace, where the conditions are such as to warrant its use, especially in the treatment of copper-bearing ores."

Although your editorial remark as to electric copper smelting being an unknown art is no doubt true so far as actual practice in this country is concerned, I maintain that it is not a lost art; that it is being practiced in Norway at the present day, and is extremely applicable to this section of Alaska. Your remarks regarding our government are, of course, your own private opinions and not subject to dispute.

F. C. FARNHAM.

[Our statement that electric copper smelting is an unknown art was not a matter of opinion but of fact. Jules Verne graphically pictured the submarine, but it was many years before the submarine became a real thing. Electric copper smelting may look easy, but we prophesy many failures before it is developed into an art. Up to the present time there has been scarcely any experimenting on this line.—EDITOR.]

Magnetic Separation of Tin-Wolfram-Bismuth Ores

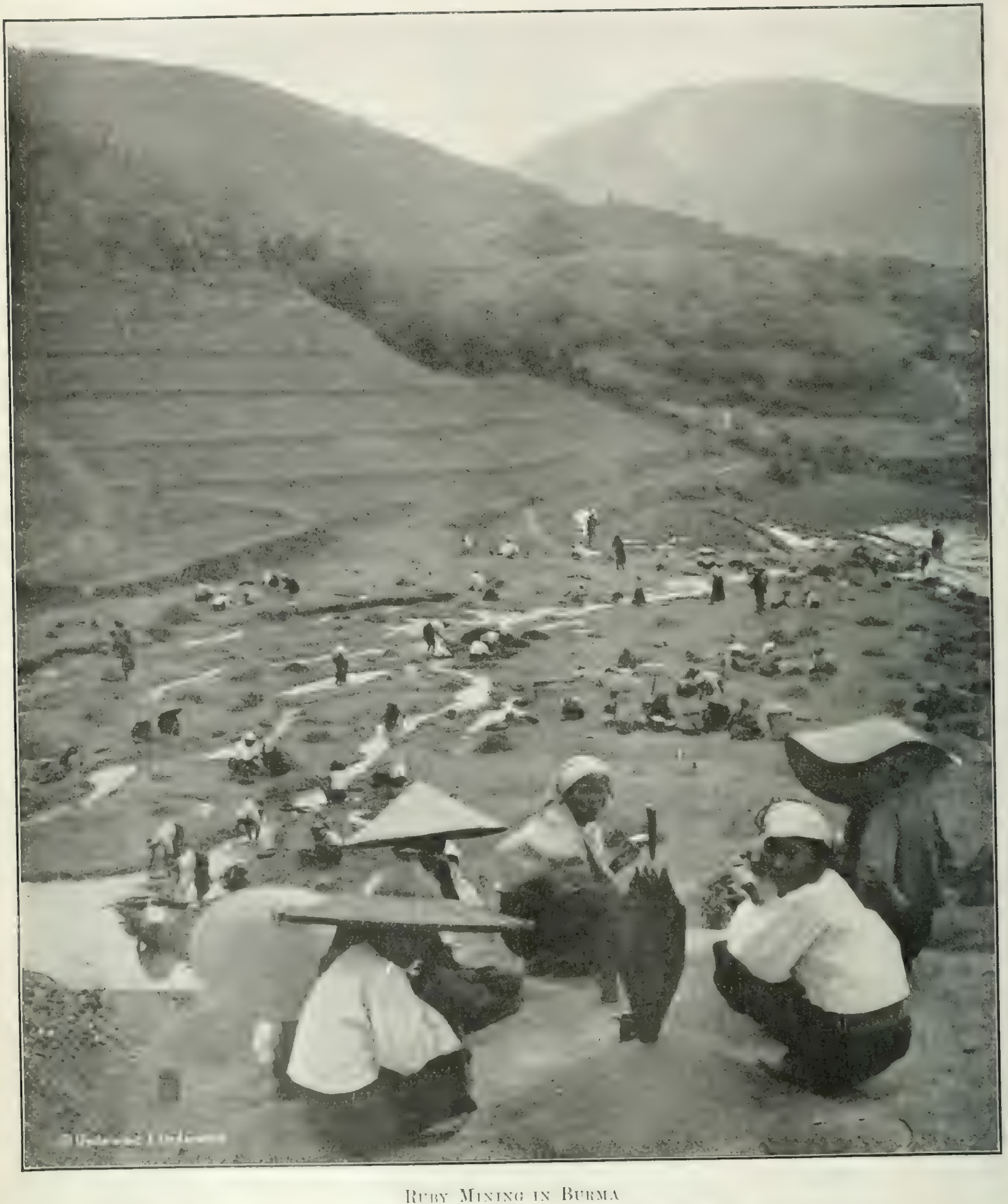
On p. 486 of the JOURNAL of Sept. 12, 1914, is a short article in regard to the treatment of tin-wolfram-bismuth ores by a magnetic process.

In this connection I wish to call your attention to the fact that various plants for the separation of tin-wolfram-bismuth ores with Ullrich magnetic separators have been built and are giving excellent results. As a rule a 2- or 4-pole separator with belt conveyor for feeding the crude ore is provided. The yield which we have been able to obtain has been as high as: Wolfram, 97.8%; tin, tin, 98.1; bismuth, 86.9 per cent.

FELIX A. VOGEL.

New York, Jan. 27, 1915.

Photographs from the Field

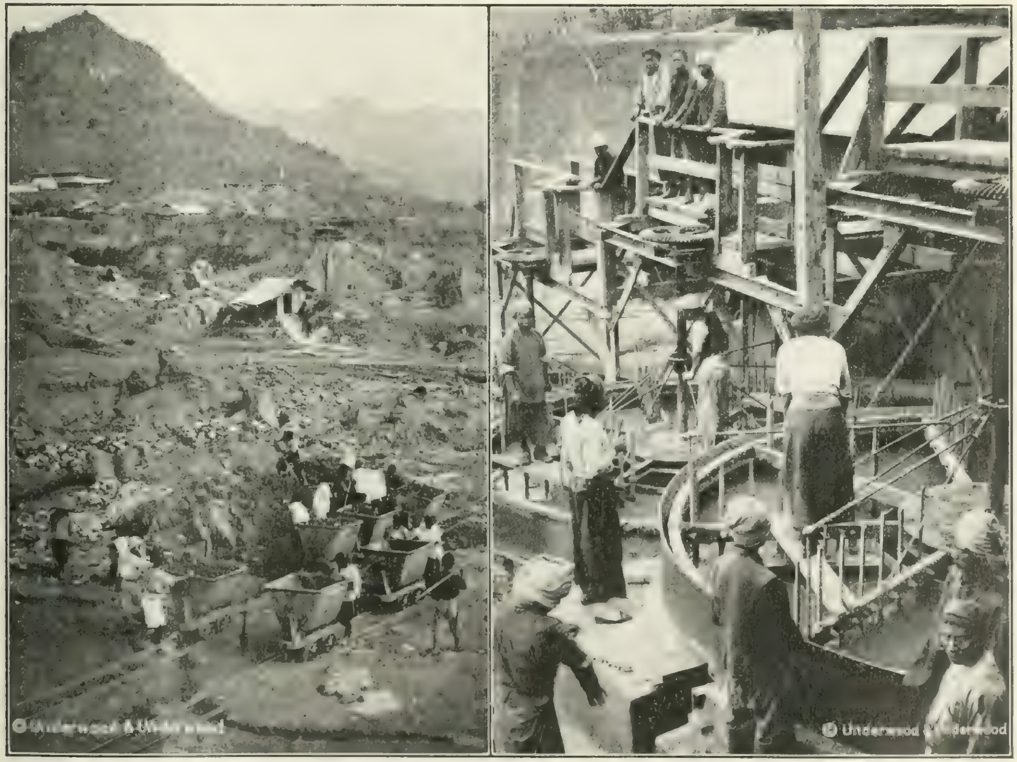


RUBY MINING IN BURMA

The native system; hand-sifting and washing the stream beds. This is the richest ruby district in the world and provides most of the finest stones

The Leadville District, Colo.

California Gulch, showing the Minnie, Col. Sellers, Moyer and North Moyer mines, Iron Silver offices, and surrounding district as it looks today



Ruby Mining in Burma

European methods applied to the district. At the Mogok mines the gravel is loaded in cars, which are delivered to a mill employing mechanical cleaning and washing machines

Improvements at Trail, B. C.

Extensive improvements have been in progress for several years at the Trail smelting works of the Consolidated Mining & Smelting Co. of Canada. The expenditures on improvements during the last fiscal year were $482,134. The objects of these alterations have been: (1) To increase the capacity of the plant; (2) to increase recoveries; (3) to decrease cost of operation.

The lead-smelting plant has been practically rebuilt, the new construction including three new lead blast furnaces; extensions to building; cranes for handling the forehearths and byproducts, such as matte; two Wedge roasters; conveyors and automatic scales for handling the ore from storage to the roasters, and for handling the preroasted product from roasters to sintering pots; a Cottrell plant for clearing the blast-furnace gases of lead fumes; new charge cars and some small equipment for the lead sampling mill.

General Manager R. H. Stewart states in the report that the lead plant formerly handled high-grade clean concentrates, comparatively low in sulphur and free from zinc, supplied mainly by the St. Eugene mine. Following the exhaustion of this mine, it was necessary to replace the tonnage to a large extent with ore of lower grade and of a much more refractory nature, largely from the Sullivan mine; this charge carried more sulphur and required greater capacity for roasting and furnacing in order to produce an equal tonnage of lead. In the old roasting plant, the seven Godfrey roasters had a daily capacity of only 25 tons each of Sullivan ore; the Wedge roasters just installed each have a capacity of from 85 to 95 tons per day, and cost to operate about 50c. per ton less, the saving being mainly in fuel and firing. The substitution of conveyors and mechanical equipments for handling the ore and the product of the Heberlein pot plant also reduced operating costs. The building of new lead blast furnaces was considered necessary on account of the condition of the old ones, and in rebuilding it was decided to place them farther from the copper plant, so as to permit any necessary extensions to the latter, and also to allow for better charging arrangements. The new flues and Cottrell plant are now saving about eight tons per day of material high in lead, a considerable portion of which was previously lost.

In the copper-smelting department, the improvements consisted of: Rebuilding three of the five blast furnaces and increasing the dimensions of two of them; building a new smoke-stack; repairs to the flues; installaion of a crane in the furnace building, and rebuilding the launders to the slag dump.

In rebuilding, two of the furnaces were increased in size from 300 to 420 in. in length, and from 42 in. to 50 in. in width at the tuyeres. The enlarged furnaces so far show an increase in smelting capacity of from 60 to 80%, with proportionate decrease in cost of labor and some reduction in amount of coke required.

Other improvements include the installation of an additional blower having a capacity of 40,000 cu.ft. of air per minute; rebuilding the fire-protection system; stacks and tunnels for recovering ore from storage and extra locomotives for charging the furnaces.

General Manager Stewart expects that the changes made in the smelting works during the last two years will result in sufficient saving in cost of operations and recoveries to pay for the expenditure within the next two or three years.

Russian Chemical Industry Possibilities

With the idea of extending the chemical industry of the country a number of Russian technical societies have been turning their attention to its resources in raw materials for the production of some of the finer chemicals, says the *Chemical Trade Journal,* Jan. 2. 1915. They find that the quicksilver industry, which has been allowed to lapse, could be revived by exploiting the cinnabar deposits known to exist in Daghestan, Ter, Kuban, Trans-Baikal, in the Urals, Nerchinsk and Ekaterinoslaff. As to lead ore, this is found in the Caucasus, in the Don, Altai and Nerchinsk. It is a slow-developing industry in Russia, where only about 80,000 poods a year of the metal are produced, and over 3,000,000 poods are imported. The production of silver is negligible.

Zinc, however, is produced in considerable quantities in Poland. It is found also in the Caucasus, in Finland and in the Donetz and Nerchinsk districts. Russia produces about one-third of her consumption of zinc, the rest being obtained from Germany. Bismuth is found in Finland, Trans-Baikal, and Eastern Siberia, but it is imported almost entirely. Arsenic in combination is found in the Urals, in the government of Orenburg, in the Caucasus, in Finland and in Eastern Siberia. Magnesia salt is found in the Zlatoust mining district, but this too, is mostly imported—to the extent of 450,000 poods a year.

There is abundance of material in Russia for the production of phosphates; but foreign factories can produce this article too cheaply for Russia to compete even in her own market. Manganese exists in immense quantities in the Russian Caucasian territories as well as in South-European Russia at Nikopol, and in less important quantities in the Urals, etc. Most of this product is exported. It is maintained that with such an abundance of raw material the volume of Russia's importations of some of the finer chemicals should be much reduced.

It is stated that at a recent meeting of the Russian Technical Association, the announcement was made that a group of Petrograd capitalists is contemplating the erection of a factory for the production of chlorate of potash.

The Rivadavia Oil Field, Argentina

Near Comodoro Rivadavia, in the Territory of Chubut, Argentina, the oil field is under exploitation both by the national government and by four private companies. The government has reserved a zone of 5000 hectares for exploration and has put down 15 wells, of which nine are productive and two are nearly finished, according to information received from the Direccion General de Minas, Geologia e Hidrologia. The four private companies working in this region are the Cia. Argentina de Perforaciones Sistema Raky, Cia. Especial de Perforaciones, Sindicato Petrolífero Pozo de Menendez, and Cia. de Petróleo de Comodoro Rivadavia. The first named company has two wells in process of completion, one of which has reached the petroleum horizon. The second company has four wells, one of which has reached the petroliferous strata. The other two companies have one well each, but neither of these has yet arrived at the petroleum horizon.

Up to the present, only the government has commenced the exploitation of the Rivadavia deposits in a systematic manner, having already various important installations and having constructed at Comodoro Rivadavia a wharf and tanks of large capacity. As means of transport it employs two tank steamers.

In the territory of Neuquén there have been some explorations for petroleum, but up to the present none of these has reached the petroliferous strata, the existence of which has been determined by the geologic studies of the governmental officials.

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All-Northwest Smoker

The annual All-Northwest smoker of the Mines Society of the University of Washington was held at the Men's Building on the evening of Jan. 15. The Mines Society, which is affiliated with the American Institute of Mining Engineers, is composed of all upperclassmen of the College of Mines and three students chosen from the Sophomore class. All members of the mining faculty are honorary members of the Society. Meetings are held twice a month, at which the students discuss their experiences in mining work. Smokers, which outside mining men are invited to attend and at which they are often called on to talk, are given from time to time.

The All-Northwest smoker is held in January of each year for the especial benefit of the short-course men, who commence work in January and continue until April. Music, talks, boxing and wrestling bouts, and refreshments play a large part in the program. Considerable time is devoted to "mixing" and getting acquainted, with excellent results.

At the 1915 meeting there were 66 present. The talk of welcome (all formalities, including "speeches" and "addresses," are strictly taboo) was made by Villeroy Gleason, president of the Society, who explained that the fundamental purpose of the smoker was to make each and every visitor and "short horn" feel that he was "one of the gang." Talks by visitors and members of the faculty followed, punctuated by bouts and refreshments. Among the mining men who spoke were the following: Ralph Bliss, Charles Simonstad, Wm. R. Hocking, C. L. Anderson, and George W. Otterson.

One of the interesting features of the entertainment was an oil well and derrick, symbolic of the wild-cat oil boom to which Seattle and the Northwest has recently been treated. The fact that the product of the well was more suitable for internal lubrication than for fuel purposes did not detract from the enthusiasm of those present when the ceremony of uncapping was performed.

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Cripple Creek Metallurgy

A contributor calls attention to an error which crept into the review of mining in Colorado, in the statistical issue of the JOURNAL. It refers to the roasting and chlorination of the high-grade ores of Cripple Creek, whereas it is well known that these ores are smelted, and the low-grade material cyanided. There are no operating chlorination mills in the district.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

BRIQUETS—Process for the Manufacture of Briquets from Suitable Briquet Materials. Carl Fohr, Munich, Germany. (U. S. No. 1,123,719; Jan. 5, 1915.)

CARNOTITE—Method of Treating Complex Carnotite Ores. Charles W. Danforth, Youngstown, Ohio, William P. Samuels, New Castle, Penn., and William T. Martersteck, Youngstown, Ohio. (U. S. No. 1,126,182; Jan. 26, 1915.)

CASTING METALS of High Melting-Point. Augustin Leon Jean Queneau, Philadelphia, Penn., assignor, by mesne assignments, to Samuel P. Wetherill, Edgewater Park, N. J. (U. S. No. 1,126,079; Jan. 26, 1915.)

COPPER—Reinforced Copper and Process of Making Same. William Marshall Page, Ridley Park, Penn. (U. S. Nos. 1,125,162 and 1,125,163; Jan. 19, 1915.)

CRUSHING—Tube Mill. David H. Atkins, San Francisco, Calif., assignor to Atkins, Kroll & Co., San Francisco, Calif. (U. S. No. 1,125,921; Jan. 26, 1915.)

DRILL—Mine-Drill Support. Howard P. Corsa, Bingham Cañon, Utah. (U. S. No. 1,125,480; Jan. 19, 1915.)

DRILL-BIT-RETAINING DEVICE. George H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,126,628; Jan. 26, 1915.)

DRILLING—Apparatus for Handling Casing in Drilling Wells. Earle Derby, Coalinga, and Henry B. Truett, San Francisco, Calif. (U. S. No. 1,121,718; Dec. 22, 1914.)

DRILLS—Dust Collector for Rock Drills. Emmet F. Galligan, Idaho Springs, Colo., assignor of one-half to Henry E. Woodward, Denver, Colo., and one-fourth to William H. Galligan, Idaho Springs, Colo. (U. S. No. 1,124,605; Jan. 12, 1915.)

EXCAVATING MACHINES—Dipper Front. Ellison Edward Vanderhoef, Ruth, Nev., and Frank E. Johnson, Salt Lake City, Utah, assignors to Edgar Allen American Manganese Steel Co., Augusta, Me. (U. S. No. 126,319; Jan. 26, 1915.)

FILTERING PAN. Walter E. Trent, Reno, Nev. (U. S. No. 1, 125,769; Jan. 19, 1915.)

FLOTATION—Ore-Concentrating Apparatus. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,124,853; Jan. 12, 1915.)

FLOTATION—Ore-Separatory Apparatus. John M. Callow and David J. Kelly, Salt Lake City, Utah, assignors to Metals Recovery Co., Augusta, Me. (U. S. No. 1,124,855; Jan. 12, 1915.)

FLOTATION PROCESS — Process of Concentrating Ores. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,125,897; Jan. 19, 1915.)

FURNACE LININGS—Process of Forming and Repairing the Linings of Furnaces. Alfred Schwarz, New York, N. Y., assignor to New York Cement Gun Co., New York, N. Y. (U. S. No. 1,125,741; Jan. 19, 1915.)

GOLD-SAVING APPARATUS. Isaac Anderson, Lawndale, Calif., assignor to Lawndale Utility Manufacturing Co., Lawndale, Calif. (U. S. No. 1,125,631; Jan. 19, 1915.)

GRINDING MILL. Raymond Nicely Bailey, Muncy, Penn. (U. S. No. 1,123,217; Jan. 5, 1915.)

INGOT IRON—Process for Improving the Properties of Ingot Iron and the Like. Hans Goldschmidt and Hans Biewend, Essen-on-the-Ruhr, Germany, assignors to Goldschmidt Thermit Co., New York, N. Y. (U. S. No. 1,122,272; Dec. 29, 1914.)

MIXING DRUM—Rotary Mixing Drum. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,124,854; Jan. 12, 1915.)

ORE-BELT EDGER. Albert W. Harp, Angels Camp, Calif. (U. S. No. 1,126,456; Jan. 26, 1915.)

ORE-ROASTING FURNACE. Emile Bracq, Lens, France. (U. S. No. 1,125,949; Jan. 26, 1915.)

PHOSPHORIC ACID—Process for Rendering Available the Phosphoric Acid in Phosphate Rocks. Alfred Hutchinson Cowles, Sewaren, N. J., assignor to The Electric Smelting & Aluminum Co., Sewaren, N. J. (U. S. N. 1,126,408; Jan. 26, 1915.)

PLATINUM—Process of Recovering Native Platinum Metals. Robert E. Lyons, Bloomington, Ind. (U. S. No. 1,126,646, Jan. 26, 1915.)

POTASSIUM—Process of Extracting Potassium from Flue Dust. Samuel Peacock, Philadelphia, Penn., assignor to International Agricultural Corporation, New York, N. Y. (U. S. No. 1,124,798, Jan. 12, 1915.)

SALT—Apparatus for the Manufacture of Salt. Herman Frasch, Cleveland, Ohio, assignor to United Salt Co., Cleveland, Ohio. (U. S. No. 1,125,998; Jan. 26, 1915.)

SCREEN or Separator. Thomas Leggett Sturtevant, Quincy, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,125,762, Jan. 19, 1915.)

SINTERING APPARATUS. Stephen Arthur Krom, Birmingham, Ala. (U. S. No. 1,125,125, Jan. 19, 1915.)

SMELTING FURNACE. Thomas M. Kekich, Aire Libre, Mexico, assignor of one-half to Carl Hanssen, Aire Libre, Mexico. (U. S. No. 1,126,028, Jan. 26, 1915.)

TIN—Process for Electrolytically Refining Tin. Georges Michaud and Eugene Delasson, Montreuil, France. (U. S. No. 1,124,315, Jan. 12, 1915.)

ZINC—Improvements in or Relating to the Separation of Zinc from Sulphide Ores. H. T. Durant, London, Eng. (Brit. No. 21,584 of 1913.)

ZINC LYES—Treatment of Zinc Lyes. Wilhelm Buddeus, Charlottenburg, Germany. (U. S. No. 1,120,683, Dec. 15, 1914.)

Editorials

The Kinds of Spelter

The unusually large demand for spelter of superior quality that has developed since the outbreak of the war has drawn out a good deal of inquiry about the kinds of spelter that outrank the main staple, which in the United States is known as "prime western," this being equivalent to the "good ordinary brands" of the European markets. The bulk of the production of virgin spelter, both in America and in Europe, consists of the prime western and G.O.B.'s. The production of all other kinds is relatively small. No specific data of the production of the several kinds of spelter can be given, for the reason that no statistics bearing upon this subject have ever been collected.

In the United States four kinds of virgin spelter are recognized and have been officially defined by the American Society for Testing Materials. These are: high grade, intermediate, brass special, and prime western The official distinctions are as follows:

KINDS OF SPELTER

Kind	Pb.	Fe	Cd	Total Not Over
A. High grade*	0.07	0.03	0.05	0.10
B. Intermediate*	0.20	0.03	0.05	0.50
C. Brass special*	0.75	0.04	0.75	1.20
D. Prime Western	1.50	0.08	...	...

*To be free from aluminum.

Besides the virgin spelters there are the kinds of the metal that are obtained by remelting scrap, resmelting dross, etc. Remelted spelter is sometimes called "hard spelter" and is apt to be impure from the solder and other metallic substances adhering to the scrap, the mere remelting not being a refining process, except for the separation of excess lead and the elimination of dirt, oxides, etc., in skimming. Spelter produced by resmelting (redistilling) dross, scrap, etc., may be of good grade, even of high grade, according to the care and skill of the smelter.

The production of the superior grades of spelter is chiefly a matter of the ore employed, which must be free, or nearly free, from lead; but besides that there must be special care in the smelting process, particularly to avoid contamination of the spelter by iron. The commonest impurity of zinc ores is lead, and lead being volatile a certain proportion inevitably goes over with the zinc and condenses with the spelter. If lead-bearing ores are smelted it is impossible to produce the highest grades of spelter by a single distillation, at least not in any way that would be economical from the standpoint of zinc extraction.

Thus it happens that the highest grade of spelter is made from the willemite ore of New Jersey. Previous to the war a considerable tonnage of that ore was regularly exported to Belgium and Germany and used for the manufacture of high-grade spelter there. With the outbreak of the war exports of this ore ceased. The extinguishment of the European supply is one of the causes creating the recent unusual demand upon American smelters.

Even in ordinary times, the price commanded by high-grade spelter is so much above that realized for prime western, that to all intents and purposes it is a different metal. Normally the premium has run anywhere from 2@4c. per lb., while the premium for intermediate spelters has been usually from 1@2c. per lb. Writing in 1912, however, it was remarked that "the supply of high-grade spelter could no doubt be greatly increased if there were need for it, and prospective competitors in this market would find it hazardous to reckon upon the full premium now realized." In the exceptional conditions resulting from the war, the ordinary premiums increased. Thus, we reported on Jan. 13 that high-grade spelter was then worth about 10c. per lb. New York, while intermediates were selling for 7½@8½c., basis St. Louis, and brass specials at 6¼@6¾c. when ordinary prime western spelter was selling at about 5⅞c. St. Louis. We heard of sales of high grade at 11@12c. Since then the prices for all of the specials have gone up to extravagant figures, and consumers have been willing to pay a premium for brands of prime western that are a little superior to the ordinary but yet are inferior to the brass specials as officially classified.

High-grade spelter also is made from the zinc blende of the Holston River district of Tennessee. Intermediate spelter is made from the same ore, and also from specially selected Joplin ores. In these cases it is chiefly the excellence of the ore that determines the superiority of the spelter.

High-grade or intermediate spelter may, however, be made from base ores by hydrometallurgical treatment and electrolytic precipitation. Such spelter is regularly produced in small quantity at Winnington, in England, and it is contemplated that some may be produced in California. However, save for the works at Winnington, the production of electrolytic spelter has not yet passed beyond the experimental stage.

Although the production of high-grade and intermediate spelters is chiefly dependent upon the kind of ore used, such spelters may be made from inferior products by refining, two methods of refining being available, viz., electrolysis and redistillation. The only question to be answered is, Will the added value offset the cost? And, naturally, the answer may be different in different parts of the world.

Electrolytic refining was tried in Upper Silesia upward of 20 years ago, the process being analogous to the electrolytic refining of crude copper. As tried in Upper Silesia, it was not found profitable, and so far as we are aware there has been no subsequent trial anywhere. Redistillation, on the other hand, is a process regularly employed. With the exercise of sufficient care, high-grade spelter may be made out of scrap and junk, just as pure water may be distilled from brine. Certain American brands of high reputation have had such an origin. Similarly, may prime-western spelter be converted into high-grade, but when this has been tried there has not been found to be any profit in the operation. There is not only the cost of the operation itself, but also the loss of zinc experienced in the course of it. In Norway and Sweden, however, a considerable quantity of high-grade spelter is produced from impure spelter by redistillation in the electric furnace.

There are some who hold that high-grade spelter made in any other way than by direct distillation from ore is not quite equal to the latter although the two may be identical so far as the ordinary chemical analysis shows. One explanation of this idea is that the high-grade spelter derived from certain ores may contain infinitesimal quantities of rare elements, not commonly determined, which may give it superior toughness or other desirable qualities. So far as we are aware neither the claim nor the explanation has been positively demonstrated.

Brass-special and prime-western spelters are made from the same ores and depend merely upon keeping separate one of the "draws" of metal. In American smelting practice the spelter is commonly drawn from the condensers of the distillation furnace three times during the 24 hours of the distillation. The first draw gives metal distilled at the lowest temperature and consequently lowest in lead and iron. In ordinary times the premium for brass specials is small, say 0.05 to 0.10c., sometimes rising to 0.25c. and sometimes being *nil*. When it is small many smelters do not take the trouble to keep their draws separate, letting their whole product go as prime western. At present they are, of course, making as much of it as they can.

The Rise in Spelter

It has been the invariable experience for decades that whenever the price for spelter has risen above 7c. per lb., this has eventually proved to be a calamity for the industry. No matter what may be the immediate profits of the miners of ore and the smelters of spelter, the losses they experience later and the penalties they pay outweigh their previous profits. There is scarcely anybody of long and conservative experience in the smelting business who is not of this opinion now and who does not deprecate the sensational and extravagant rise that has recently occurred in this metal.

The explanation of the rise is simple enough. By the end of 1914 the stock in the hands of smelters had been reduced to a figure that was small in comparison with the middle of the year, although according to the ideas and standards of only two or three years ago, it was still large. During January the demand exhausted this stock and the smelters became practically sold out, not only for immediate delivery but also for what is normally called prompt delivery. In these circumstances a rise in price was natural, but that it should have been carried out of bounds was due to the fright experienced by consumers.

There has been talk about a corner in the metal, suspicion that there are concealed stocks and charges of manipulation. There is no good reason to believe anything of that sort, and the sooner consumers disabuse their minds of such ideas, the better off they will be. The leading smelting interests have stated repeatedly that they were sold out. Assuming that to be the case, and it ought to be so assumed, there is no use in consumers frantically bidding up the price against each other. If there were concealed stocks they might hope to pry them out, and eventually would do so, of course, but the bidding up of the price to 7½c., St. Louis, has failed to loosen any hidden stocks and probably there never were any, at least not in any quantity sufficient to sway the market.

Of course it is to be remarked that English and American buyers have been bidding up the market against each other. If the buyers would regain their senses and withdraw from the market, they would probably find that they can get as much spelter a cent a pound lower, as they can now. The present situation is, of course, bringing into use all of the idle capacity that can quickly be put into commission. There is, however, so much uncertainty in the situation that the owners of the moribund works in Kansas consider it hazardous to restock them with ore at present prices, and put them into commission on the basis of conditions that are likely to be ephemeral. In the meanwhile, smelters who have sold out all the spelter that they expect to make up to the end of March find it difficult to sell April and later deliveries even at considerable concessions in price.

The Chloridizing-Leaching Practice at Park City

The article by Glenn A. Keep, begun in this issue, presents some interesting details of the new chloridizing-leaching practice at The Mines Operating mill in Utah. The new mills at Park City and elsewhere in Utah, while not applying any new chemical reactions, have made such improvements in roasting and in other details as to constitute a new practice, though it can hardly be designated as a new process.

The improvements in the process today permit the handling of material formerly discarded by the Ontario mine as too low in grade for chloridizing and thiosulphate leaching. While changes have been made in many phases of the practice, the most striking development is in the chloridizing. The blast roasting of a deep, moist charge has brought about a great improvement in the process of chloridization. Not only has the chloridizing been accomplished more efficiently but loss by volatilization has been reduced practically to zero. Concurrent with this has been the improvement of the roasting apparatus itself, thereby greatly reducing the cost of the process. Mr. Keep's paper abounds in interesting information regarding the operation and technical control of the process; the practice is probably not yet developed to its highest state, and there are many points on which further information will be desired. The Park City practice, however, is an important metallurgical accomplishment, since it has taken low-grade complex mine filling of no value in former days and is making therefrom a profitable enterprise. While the practice is apparently simple and capable of being applied in small units, operators elsewhere must exercise the usual care in the adoption of the new practice. Not all districts, which have similar ores, have the surrounding conditions that make this process applicable at Park City.

Society Meeting Program

The light-hearted manner in which society secretaries juggle with the program is such as to call forth great admiration at their efficiency in the use of time, and curses at some other phases of the subject. No doubt it is a great saving of the time of those present, on suddenly discovering that Tuesday evening's program is 30 minutes shorter than was anticipated, if Thomas Smith can be found to give his paper on openhearth steel practice, which was originally billed for Wednesday morning.

But the feelings of two pilgrims who catch the seven o'clock train from Philadelphia to New York on Wednesday morning in order to hear Mr. Smith speak, and arrive to find James Brown preparing to speak on the latest developments in cyanide practice, would, if entered in the Society minutes, cause that volume to be unmailable. Similarly it does no lasting good to any society, however well it may look in the preliminary announcements, to bill highly instructive looking titles, and have the papers withdrawn by advice of counsel. Here again, the policy may lead to a considerable expenditure of time and money in the effort to hear a paper which has been withdrawn.

BY THE WAY

Our attention recently fell upon the prospectus of a GRQ promoter who promised to make all his suckers wealthy out of the dividends to be derived from a molybdenum mine. The production of molybdenite is a nice little business, but it is not big enough to make any one man rich, much less a bunch of stockholders. Molybdenite ore realizes prices that to the uninformed appear to be fabulous, but the total volume of transactions amounts to only a few tons. A correspondent who is very practically engaged in the molybdenum business made the following illuminating remarks: "A few lots of selected molybdenite concentrates were sold in 1914 in small quantities at prices above $1 per lb. of MoS_2 contents. Indeed one lot of one ton realized $1.50 per lb. This was an emergency sale, and when it became known naturally caused many small producers to have visions of great wealth, and many of them raised the price of their prospects in proportion. In my opinion, the very high prices will give the owners temporary happiness, which will not be realized upon a cash basis. Eventually this mineral will become much better known commercially, most people will then be able to spell it correctly, and those of us who are more familiar with it will not, on account of uncertain supply and treatment problems, be compelled occasionally to allude to it as molybdedamite."

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There is a faint similarity between following up a report of a "boranza strike" and running down a reference upon some technical subject. The practical miner hears that in such and such a district a good vein of ore has been found or that someone has panned rich gravel on a tributary of a certain river. He often spends considerable of his time and energy and more or less of his money in following up such a clue, only to meet with disappointment. On the other hand, one may find in the text or in a footnote of some article a rumor that more information on a subject may be found in such and such a publication on page so and so. When one is anxious to cover a subject very thoroughly it is well to leave no stone unturned. You are studying, let us say, the uses of copper in combination with other metals and you note that some author mentions that you will find some interesting data in J. B. 627-1895. That is equivalent to telling some old placer miner and stampede-runner that in the valley of the seventh tributary of the East Fork of the S. J. River may be found gravel running several ounces to the pan, and then skipping off so that he cannot question you further. If he follows up the hint, he will have a number of S. J. rivers to choose from. He might worm out the information from some friends of yours that S. J. means St. John, and he may eliminate several St. John rivers, for geological or other reasons. Picture his disgust when he eventually learns that you meant the *San Juan* River, and the *west,* instead of the *east* fork, in the same place where he prospected summer before last with but moderate success. How interesting, then, after being told that J. B. means "Jahrbuch," and looking up "Jahrbuch this" and "Jahrbuch that," to find that the reference J. B. 627-1895 is a sort of cryptographic way of referring to "Jahresbericht über die Fortschritte der Chemie," part 1 for the year 1895, p. 627, and to perceive that the matter is merely an incomplete abstract of an article which you have previously studied in great detail. On the whole, the practical miner has the best of it; for he gets plenty of good exercise, often has a good time hunting and fishing, and is constantly in touch with the unperishable library of the greatest author of all things.

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It is interesting to note the number of important new constructions required in the development of a large metallurgical operation. A case in point is that of the International Nickel Co. and its predecessors; in the treatment of the Sudbury copper-nickel ores, much "pioneer" work was involved and in consequence new treatment plants were planned almost as soon as works were completed and in successful running order; these constructions have culminated in the present splendid works of the Canadian Copper Co., at Coppercliff, Ont. The first blast furnace was installed under the direction of Dr. E. D. Peters, Jr., at the East Smelting Works in 1888; a second furnace was added in 1889, and in 1892 the first bessemerizing plant was completed. The East works suspended operations in 1901. In 1899 the West Smelting Works was erected near No. 2 mine. It was destroyed by fire on June 14, 1904. In July, 1900, the Ontario Smelting Works was erected by the Orford Copper Co., a company closely associated with the Canadian Copper Co. and one of the corporations included in the amalgamation in 1902, whereby the International Nickel Co. took over the interest of a number of corporations. This plant began operating in January, 1901, and was destroyed by fire on Feb. 19, 1904. Meanwhile it had been decided to erect another smelting plant about half a mile from the now old West Smelting Works and not far from the site of the original East works. Construction work was begun on the new plant in April, 1903, and it was placed in operation on July 17, 1904. The new plant contained two blast furnaces of about 400 tons capacity each; in 1905 it was enlarged by the addition of three more 400-ton furnaces. A new bessemer building was constructed in 1907 and operations started on May 14, 1908. In 1911, five basic converters of the Peirce-Smith type were substituted for 10 stands using 8x10-ft. acid-lined shells. The construction of two reverberatory furnaces, 19x112 ft., was undertaken in April, 1910, the first furnace being placed in operation on Dec. 23, 1911. In 1912 a new blast furnace was added; also four seven-hearth Wedge roasting furnaces, each 22 ft. 6 in. in diameter; however, the old practice of heap roasting is still employed.

Prospecting for Tin*

A recent discovery of stream tin at Battle Mountain, Nev., has led to inquiries at the Mackay School of Mines as to the method of prospecting for tin and of testing for it in the field. Director Lincoln spent last year in Bolivia, which is the only important tin producing country in the Western Hemisphere, and makes some suggestions covering these points.

Cassiterite is practically the only tin ore. It is an oxide of tin that when pure contains 79% of tin. Cassiterite occurs both in placer deposits and in lodes, but up to the present time the greatest production has come from tin placers, Bolivia being the only country whose principal production is from lodes. The rounded particles of cassiterite occuring in placers are called stream tin.

Cassiterite is a hard, heavy nonmetallic mineral ranging in color from light brown to black. It is most readily confused with the oxides of iron—hematite and limonite—but it is much heavier than these having a specific gravity of 7 whereas limonite has one of 4 and hematite one of 5. Moreover, both the iron oxides are soluble in acid whereas cassiterite is not attacked even by *aqua regia.*

If the tin prospector carries into the field some muriatic acid, granulated zinc and a test tube, he can readily test for cassiterite after the following manner: Place a piece of granulated zinc in the bottom of a test tube, put a fragment of the mineral to be tested on top of this, and cover both zinc and mineral with muriatic acid. The zinc will then dissolve with violent evolution of hydrogen and this nascent hydrogen will come in contact with the mineral. If the mineral is cassiterite, tin will be reduced on its surface, forming a silvery metallic coating. This adheres so strongly that if the specimen is rubbed it will polish the coating without detaching it. If, on the other hand, the fragment is not cassiterite, no such coating will be formed.

Placer-tin deposits are in almost every way similar to placer gold deposits. The stream tin being heavier than the rest of the gravel, it works its way to bed rock where it occurs concentrated. Small quantities of fine tin may occur distributed throughout the upper part of the gravel, especially if the valley is large and the stream small. As the prospector works up stream toward the source of the tin, the particles of stream tin will become more angular and larger—just as the gold colors become rougher and larger as the prospector approaches a gold lode. Thus it is that prospecting for tin placers and tin lodes is in every respect similar to prospecting for gold placers and gold lodes, the only difference being that it is somewhat more difficult to determine tin on sight.

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Japanese Mining Exhibit, Panama-Pacific Exposition

In the Japanese exhibit, now being installed in the Palace of Mines and Metallurgy, all branches of mining will be represented by raw specimens as well as the finished product. This exhibit, which is one of the largest individual showings in the building, covers about 7500 sq.ft. of floor space.

Built entirely by native workmen, the booths and kiosks are Oriental in style and the same scheme is carried out in the furnishings. One of the most interesting features of the exhibit is a large relief map of the Japanese mining region, done in colored clay. Among the more important exhibitors are the Kaijima, the Japan Sulphur and the Sumitomo Besshi copper mines.

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January Mining Dividends

Mining dividends paid in January, 1915, by 17 United States mines amounted to $2,516,551, as against $7,258,-432 paid by 34 mines last year. Industrials allied to mining paid $2,404,070 in 1915 as against $4,085,688 in January, 1914, and of the former $117,250 was in scrip, while Canadian, Mexican and Central American mines this year paid $1,114,508 as against $2,505,321 in 1914.

United States Mining Companies	Situation	Per Share	Total
Anaconda, c.	U.S.	$0.25	$1,165,625
Bunker Hill & Sull., l.s.	Ida	0.25	81,750
Bunker Hill Con., g.	Calif.	0.01	5,000
Caledonia, l.s.	Ida	0.02	52,100
Camp Bird, pfd., g.	Colo.	0.085	110,565
Continental, z.	Mo	0.50	11,000
Center Creek, z.	Mo.	0.05	11,000
Golden Cycle, g	Colo.	0.10	150,000
Hecla, l.s.	Ida.	0.01	10,000
Homestake, g.	S.D.	0.65	163,254
Portland, g.	Colo.	0.02	60,000
Tennessee, c	Tenn.	0.75	150,000
Tonopah, g.s.	Nev.	0.25	250,000
Tonopah Belmont, g. s.	Nev.	0.12½	187,500
Tonopah Extension, g.s.	Nev.	0.07½	70,757
Vindicator, g	Colo.	0.03	45,000
Yellow Aster, g	Calif.	0.02	2,000

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Butters-Salvador, g.	C.A.	0.36	$96,750
Consol. M. & S.	B.C.	2.00	116,088
Crown Reserve, s.	Ont.	0.02	35,376
Hollinger, g.	Ont.	0.20	120,000
La Rose, s.	Ont.	0.25	187,329
Lucky Tiger, g.s.	Mex	0.10	71,534
McKinley-Darragh-Savage, s.	Ont.	0.03	67,431
New York & Honduras Rosario, g.	C.A.	0.30	60,000
Nipissing, s.	Ont.	0.25	300,000
Porcupine Crown, s.	Ont.	0.03	60,000

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Sm. Sec. pfd. A.	U.S.	1.50	375,000
Am. Sm. Sec. pfd. B.	Mex.	1.25	255,000
Bethlehem Steel, pfd	Penn.	1.25	186,375
Brier Hill Steel, pfd	Penn.	1.75	83,452
Guggenheim Expl.	U.S., Mex.	0.87½	727,768
International Nickel, pfd.	N. J., Can.	1.50	133,689
Penn Salt	Penn.	1.00	100,000
Sloss-Sheffield, i.	Tenn.	1.75*	117,250*
U.S. Sm. Ref. & Min. pfd.	U.S., Mex.	0.87½	425,536

*Scrip.

Yellow Aster is the only property in the January list which has not been a regular recent payer.

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Tungsten Wire Filaments

O. Ruff in *Zeit. Ver. deutsch Ing.*, 1913, L., p. 1615 (through *Journ. Soc. Chem. Ind.*), says that to prepare a dense, ductile wire suitable for electric lamps, pure tungsten is first obtained by reducing the trioxide in hydrogen, and it is then compressed into rods which are hardened by heating gradually in a current of hydrogen in a tube furnace to 1000° C. for one hour. The rods are sintered by heating electrically up to 2850° C., the heating being carried out very carefully and slowly, as the quality of the final product largely depends on this process. The rods are then hammered and rolled at 1200°—1300° C. in a current of hydrogen in a special machine, the operation being repeated until the rods are reduced to the desired diameter. To point the rods before inserting them in the wire-drawing machine the ends of the thicker rods are dipped into molten potassium nitrite, and the thinner ones are made the anode in an electrolytic cell containing potassium cyanide. The finished tungsten wire is silvery white, malleable, tough, ductile and nonmagnetic. It is stable in air at ordinary temperatures but oxidizes at a red heat so that electric lamps with tungsten filaments have to be exhausted.

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*A bulletin of the Mackay School of Mines, Reno, Nev.

PERSONALS

S. F. Shaw is at San Antonio, Tex.

R. B. Lamb is at Grass Valley, Calif., examining some gold properties.

D. H. Ladd, of Houghton, Mich., is in New York on his return from London.

W. Spencer Hutchinson has removed to 1021 State Mutual Building, 50 Congress St., Boston.

C. H. Palmer, Jr., is inspecting the property of the United Eastern Mining Co. at Oatman, Ariz.

George H. Garrey is in Nevada, where he has been on professional work for the past two months.

L. F. S. Holland has returned to Los Angeles, Calif., from Searchlight, Nevada, where he has been making an examination.

G. F. Ehrenzeller, Pennsylvania Building, Philadelphia, now is representing the Carlton Iron Co. of England, manufacturer of ferro-manganese and spiegeleisen.

Baylies C. Clark has recently returned to California from Antioquia, Colombia, where for the past year he has been for Breitung & Co. examining placer properties.

H. S. Stebbins, who has been connected with the iron ore firm of Oglebay, Norton & Co., Cleveland, since 1892. has resigned. Mr. Stebbins is now enjoying a vacation in the East.

Thomas H. Bennett, superintendent of the Algomah, North Lake, South Lake and Indiana mining companies, in the Lake Superior Copper Country, spent several days in Chicago recently on business.

Edgar L. Newhouse has been chosen first vice-president of the American Smelting & Refining Co. in place of the late Barton Sewell. Edward Brush and S. W. Eccles are also vice-presidents of the company.

M. B. Tomblin, of Boulder, secretary of the Boulder County Metal Miners' Assciation, has been appointed deputy mine commissioner of Colorado and will live in Denver. He will also soon undertake the duties of secretary for the Colorado Metal Miners' Association.

J. Frater Taylor has resigned as president of the Lake Superior Corporation, Sault Ste. Marie, Ont., in order to devote his energies to the Algoma Steel Corporation, Ltd., of which he is president and general manager. Thomas Gibson, of Toronto, was appointed to fill the vacancy caused by the resignation of Mr. Taylor.

The Salt Lake Stock & Mining Exchange has elected the following board of governors for the coming year: R. J. Evans, president; W. D. Nebeker, A. L. Jacobs, J. T. Hodson, E. A. Hartenstein, F. C. Dern, W. H. Child, B. W. Dickson, and H. B. Cole. G. P. Norton is treasurer, and James Shorten, secretary. This exchange kept open notwithstanding the closing of exchanges throughout the country.

OBITUARY

August Heinbach, former superintendent of the old Franklin mill at Ripley, near Houghton, Mich., died at Butte, Mont., last week. He went from Prussia to the Michigan copper district in 1861 and was machinist at the Franklin mill. He installed the first engine in the South Pewabic mill. While working in the Franklin mill Heinbach, with John Funkey, now a leading hardware merchant of Hancock, invented the Frue vanner, a concentrating device that later became generally used. The idea originated with William Frue, then superintendent of the mine and Funkey and Heinbach worked it out and made it a practical success. It was the progenitor of the Wilfley table.

Colonel Timothy Kyle died at his home at Oakland, Calif., Jan. 13, aged 80 years. Born and brought up at Malden, Mass., he joined in the rush to California about 1850, when still a boy. After some years passed in that state he went to Colorado, and was among the pioneers there. After a time he settled in Leadville and for 30 years after that period he was a figure of prominence in Leadville mining circles, developing many mining properties which brought wealth to him and to others afterward. The Boulder, White Cloud, Bessie and other mining claims there are still held in his name. Some years ago he retired from active business and went to California to live.

SOCIETIES

University of Nevada—The Board of Regents announces the election of Archer Wilmot Hendrick, president of the University.

Idaho Mining Association—At the annual meeting in Boise James F. McCarthy, of Wallace, president of the Hecla Mining Co., was elected president.

Colorado Metal Mining Association—This association at its recent convention, elected the following officers for 1915: President, Bulkeley Wells, Telluride; first vice-president, George O. Argall, Leadville; second vice-president, Horace F. Lunt, Colorado Springs; third vice-president, Richard Roelofs, of Cripple Creek; treasurer, A. M. Collins, Creede; secretary, John M. O'Connell, Denver. Mr. O'Connell desires to withdraw in order to devote his time to newspaper work, and will probably be succeeded by M. B. Tomblin.

Wisconsin State Mining Trade School—A students' engineering society has been formed at the Wisconsin State Mining Trade School at Platteville. It is the purpose of the organization to hold meetings once in two weeks, at which some paper on a mining subject will be read and discussed. An interesting feature is the discussion, which is planned, of current articles in the engineering papers. At the first meeting, held Jan. 11, two papers were read by students, one on the "Kennedy Mine at Hazel Green," by Leslie Burns, and the other on "Mining Methods on the Menominee Iron Range," by David Skillings. Both papers were the results of personal experiences.

Canadian National Clay Products Association—The annual convention of this association was held Jan. 26-28 at the King Edward Hotel, Toronto, about 200 delegates being in attendance. Charles A. Miller of Toronto, president, in his opening address dealt with the present industrial situation. Mayor Church of Toronto extended an official welcome to the delegates. Officers were elected as follows: President, J. Edward Frid, Hamilton; vice-presidents, A. F. Greaves-Walker, Toronto; Thomas Kennedy, Swansea, Ont.; Wm. Burgess, Toronto; secretary-treasurer, Gordon Keith, Toronto; councillors, C. B. Lewis, D. A. Lochrie, W. McCredie, Angus German and John S. McCannell. It was announced that the association would give a complete ceramic laboratory to the new Toronto Technical School, which with its full equipment will cost about $6000. A number of technical papers were read and discussed. The proceedings were brought to a close by a banquet.

INDUSTRIAL NEWS

Chalmers & Williams, Chicago Heights, Ill., announces that it has the exclusive right of manufacture in the United States of the Nissen stamp mill.

The Hardinge Conical Mill Co. is in receipt of an order for three of its largest size ball mills, which are to be installed in the plant of Moose Mountain, Ltd., at Sellwood, Ontario.

The Terry Steam Turbine Co. has appointed Earl F. Scott, with offices at 702 Candler Bldg., Atlanta, Ga., representative for Georgia. Its Pittsburgh office—in charge of Mr. H. A. Rapelye—is now 1624 Oliver Building.

Wm. H. Kritzer, formerly connected with the Mine & Smelter Supply Co., also the Traylor Engineering & Manufacturing Co., has returned to San Francisco after supervising some changes in a mill at El Dorado, California.

A manufacturer near New York desires a supply of amorphous silica (either the gelatinous form or dehydrated) such as is produced in analytical operations. Will anyone in nearby territory producing this as a byproduct please advise the editor as to quantity and prices.

David A. Wright, who for several years has been connected with the Yale & Towne Mfg. Co. as district manager in the West, has opened an office as manufacturers' agent, at 140 South Dearborn St., Chicago, Ill. He is specializing on pneumatic machinery, cranes, hoists and trolley systems.

A sand is wanted to take the place of French sand for fine statuary casting in bronze. This sand contains 80% silica and 20% alumina, that is, it is supposed to be a prepared mixture of sand and clay. The August Griffoul Bros. Co., 280 Chestnut St., Newark, N. J., will be glad to test and report free of charge on samples of sand sent to that address. Samples should not be less than 1 cu.ft. in bulk.

Editorial Correspondence

SAN FRANCISCO—Jan. 27

At the Exposition in San Francisco, California mining and metallurgical exhibits arranged by the several counties will be displayed in the California building. The State Mining Bureau exhibit will occupy space in the Mines and Metallurgy building. Seventeen of the northern and Mother Lode counties will form a composite exhibit. Siskiyou in the north and Calaveras and Tuolumne in the Mother Lode region will have seperate exhibits. Some of the southern counties also will have separate spaces. But the whole will be so arranged and placed as to make a harmonious display of the resources of the state. The 17 northern counties, including Amador, Butte, Colusa, Eldorado, Glenn, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Solano, Sutter, Tehama, Trinity, Yolo and Yuba formed an organization provided for by the legislature, composed of one commissioner from each county. Charles H. Dunton, mining engineer, of Sacramento, and M. E. Dittmar, of Redding, were placed in charge of collecting and assembling the various county exhibits of this organization. About 5000 sq.ft. of floor space are reserved for this mining exhibit, with a 90-ft. frontage and a depth of 50 ft. The main entrance columns are 5 ft. in diameter, the bases 5 ft. square, of metal construction. The columns are of blister copper, the surface having a high luster. Copper mines are represented by a column 12 ft. high, 4x4 ft. in section, showing characteristic ores set off in blocks. The same plan is observed in representing gold-silver and lead-zinc ores, and also cinnabar, iron, coal, manganese, magnesite, pyrites, asbestos, etc. The granite display contains one mass 27 ft. long, 10x12 ft. in section. Clay and clay products are strong features. The centerpiece of the mineral exhibit is a round plate-glass case on a mahogany base, 8 ft. in diameter, divided into segments, one for each gold-producing county. This contains specimens of native gold aggregating more than $100,000 in value and including nuggets worth as high as $1200. Every form of native gold known in these counties is shown. One of the great features of the exhibit is an exact working model of La Grange hydraulic mine in Trinity County, showing giants in active operation. A model dredge built by Yuba Construction Co., on a small scale, but equal to practical demonstration of the methods of recovering gold by the California type of bucket-elevator dredge, will operate within the exposition grounds and produce the gold as in the operation of La Grange mine. The model milling plant consisting of two batteries of five 20 lb stamps, rock breaker and concentrating tables, etc., will crush gold-bearing ores and recover the gold. Besides the ores and the methods of treatment exhibited, the mineral-producing counties will be represented by specimen cases, which are always of interest to the general visitor.

Moving Pictures are to be a feature of the mining exhibits in the California building, and also in the Mines and Metallurgy building. The pictures prepared for the California building are now being exhibited at San Diego, where the Panama-California Exposition opened on Jan. 1. The principal photographs in this exhibition are a complete illustration of actual mining and milling of ore at the Kennedy mine in Amador County, the largest gold mine in the Mother Lode region and the deepest mine in the state The initial picture is taken from the 3600-ft. level, showing three drills operating in an 11-ft face of ore Breaking down of the ore, tramming to the bins on this level at the shaft, hoisting to the surface, dumping into the orebins at the mill are followed by the picture machine. Then the actual operation of the stamp mill, amalgamation, concentration and the cleanup are shown, then the retort room and the ultimate production of a gold brick. The compressor room, hoisting machinery and all other operating parts of the mine are reproduced. The pictures to be exhibited in the Mines and Metallurgy building at San Francisco include underground and surface mining, both deep mining and hydraulic operation. It is understood that the Goldfield Consolidated will contribute to this exhibition and that coal and iron mining will also be included.

At the San Diego Exposition, 10 of the northern and Mother Lode counties are represented. These are Eldorado, Placer, Plumas, Sacramento, Shasta, Solano, Tehama, Yuba, Colusa and Glenn. The two last named are not strictly mining counties, though Colusa is the largest producer of sandstone in the state. Southern counties exhibiting at San Diego include Kern, San Bernardino, Inyo and the oil-producing counties, embracing the large fields. Altogether the Panama-California Exposition at San Diego is making a fine showing of the mining industry of the state.

DENVER—Jan. 28

An Appropriation of $20,000 for the further equipment and operation of the experimental ore dressing and metallurgical plant at the Colorado School of Mines at Golden has been introduced in the legislature. The appropriation will be used for equipment, maintenance, heating plant, and salaries for experts attached to the plant. An emergency clause makes the bill take effect from and after passage.

If Spectacular Ore Finds afford an index to the earnestness with which Colorado's miners are exploring, one might predict that 1915 will prove an unusual year in mining activity. Nor are the numerous strikes fictitious, although, of course, material discount must be applied to all newspaper accounts of such discoveries, in order to reduce them to facts. These rich finds have occurred in various camps. Naturally there has arisen a rivalry among the country journalists to outdo one another in "stories"; but when one sifts down all these accounts and rumors he finds that there exists a determined revival in mining and prospecting and that the old districts—not new ones—are furnishing genuine surprises. The Cresson at Elkton, the Dunkin at Breckenridge, the Two Forty at Central City, the Gordon at Twin Lakes—these are instances of bonanzas recently opened and are cited to show that they are wide spread in their occurrence. This latter fact encourages prospectors all over the state although, until summer, it is unlikely that they can accomplish much except in mines that are already more or less developed.

BUTTE—Jan. 28

Labor Unions—Six weeks ago a mediation board was created for the purpose of reorganizing the miners of the Butte camp. To this board, which is indorsed by the Silver Bow Trades & Labor Assembly, the differences between the miners' unions of Butte were referred. At a recent meeting it came to the conclusion that the only avenue left for the reorganization of the miners is through the Western Federation. This suggestion was condemned by all speakers at a meeting of the Butte Mine Workers' Union held Jan. 25, but no action was taken upon it. Hearing of the case of the Western Federation against Butte Miners' Union No. 1 took place in Judge McClernan's court Jan. 25. The Federation seeks to compel those in charge of the local union to turn over to the parent body all moneys and property it may have This consists of a big sum of money, besides ownership of what is left of the old hall and a big mortgage on the hall in Lead, S. D. Arguments have been along the lines as to whether an incorporated and voluntary organization can sue in the name of its officers and without the rest of the membership being parties thereto. The biennial convention of the Montana Federation of Labor will be held in Helena, beginning Feb 1. It is stated that the convention will take steps to initiate a law governing and limiting the issuance of injunctions as between employer and employed. The compensation measure will also come before this body, and possibly the convention may take a stand on the proposed prohibition measure which will be submitted to the state legislature or initiated. At a meeting of the Silver Bow Trades & Labor Council, held Jan. 25, this body went on record as opposed to prohibition in Montana.

SALT LAKE CITY—Jan. 28

At the Arthur Mill of Utah Copper, several sections were started again Jan. 25. These have been put in operation in order to limber up the machinery and to take care of material formerly treated in a part of the Magna mill, which is undergoing some alteration. Also, as is usual at this time of the year, some trouble has been experienced from frozen ores No increase in copper production above the 50% basis will be made. A few more men will be given employment on account of the changes. The December output was 6,795,567 lb.

SEATTLE—Jan. 27

At Nome in Alaska a new gold strike showing 4 ft. of pay dirt, according to information, has aroused the interest of operators. Edward ("Nugget") Johnson, a well known old timer in the district, has struck gold on a claim near Montroville, halfway between Nome and Little Creek. The strike was made about Jan. 1 but the news has only just leaked out. Johnson drifted under a frozen lake and found a body of gravel 4 ft. deep carrying an average of 40c. to the pan. Drifting has been done for a considerable distance, the pay continuing to hold as far as the ground had been worked and it is estimated that Johnson now has about $100,000 worth of ground blocked out. Many of the well posted miners in the district maintain that this strike is a continuation of the Walrus, on Little Creek, which produced heavily a few years ago. Numerous outfits are now prospecting in the vicinity and mining activities have received a new impetus.

In the Chisana camp of Alaska miners are reported busy. A gang of men is blowing out the falls on Bonanza Creek, and another is at work on the cañon on Johnson. There is a crew on the McCarthy trail via Scolai Pass getting it in shape, as many operators are expected the last part of the winter and many supplies are coming in. G. R. Goshaw is doing work on Little Eldorado on the right limit benches and has a good chance of hitting the old channel. He also has a large interest in six claims on Ptarmigan Creek, a tributary of Beaver, where considerable prospecting is being carried on and where colors are showing. Rim prospects look fairly well. Pumps are being brought in for the wet ground on Alder Creek where considerable work is being carried on and the indications are that it will be the best creek in the district next summer.

Quartz Men are optimistic in the Fairbanks district of Alaska and properties will be developed with rapidity during the present winter according to report. A custom mill has been built by Charles Heilig. The plant consists of a Huntington mill and was formerly located on the Tolovana quartz property; it has a capacity of about 10 tons of ore a day. It will be ready for work during the early part of February and the prospectors of the district will have about 100 tons of ore ready to mill by that time. Crites & Feldman who have recently installed a new plant are reported to be doing well and are well pleased with the showing made. They have enough ore blocked out to keep them busy for many months. There will be much more development on the quartz properties in the vicinity of Fairbanks Creek after Heilig's mill is working than before, as the cost of freighting and milling will be reduced from about $14 a ton to less than $6.

Among the Placer Mines, those on Happy Creek report promising conditions. John Fahy who first struck pay a few weeks ago, is in dirt now that looks even better than when he reached bedrock. He has drifted about 50 ft. from the shaft and the dirt pans an average of 8c. Strauss, Cosgrove & Letendre are working about 700 ft. above Fahy and have struck equally good dirt. A new outfit is expected to start work within a few days and the men think that before winter is over there will be others taking lays on the ground. Good pay on Pedro Creek has been located by laymen on No. 2 Below bench claim. They sunk a shaft to bedrock several weeks ago but found practically nothing. Starting to drift recently they discovered pay running on an average of about 7 to 8c. per pan. Although the creek requires opencut methods, and is worked most extensively in summer, there are a number of small outfits now on the ground and doing well.

SPOKANE—Jan. 27

A Complete Directory of Inland Empire mining properties is being compiled by the Mining Men's Club of Spokane in connection with the Northwest Mining Convention to be held in Spokane Feb. 22 to 27. H. H. Shallenberger, chairman of the committee in charge of the ore show to be held in connection with the convention, is endeavoring to get in touch with the owners of every mine in the Inland Empire in an effort to get samples of ore for this display and for subsequent permanent exhibition in Spokane. Each exhibit is to be accompanied by complete information as to output, value, character of formations and development, in addition to available maps, plans and photographs. Mr. Shallenberger has opened headquarters in the Hotel Spokane, where ore shipments will be received. Emissaries to herald the convention and ore show in the mining districts started a series of visits to the different camps this week. Mr. Shallenberger went to Nelson, Rossland and Trail; N. C. Titus and E. L. Bruce are visiting the Cœur d'Alenes. E. P. Wheeler, of Conconully is covering the Okanogan country, and F. R. Wolfle, who is in the Ainsworth district, is representing the convention. J. W. Douglass is covering the Similkameen district.

Active Placer Mining operations are contemplated by several companies, in the Pierce region, in Clearwater County, Idaho, according to information received recently. John M. Porter is planning to work 100 acres of placer ground formerly owned by the American Placer Mining Co., on Orofino Creek, seven miles from Pierce. It is estimated that it will return about 25c. per yard. The Pierce placers yielded hundreds of thousands of dollars in the early '60s, and while the ground has been worked over several times since, dredging operations still are profitable. A dredge that was removed from Delta to Pierce by a company organized by M. H. Hare, who disappeared several months ago from Spokane, has been acquired by Mr. Porter. A 2000-ton daily capacity dredge has been constructed by the Hare company and is operating. W. J. Harris has a large tract of placer ground on Quartz Creek, about four miles from Pierce. A sawmill has been constructed and a contract let for 100,000 ft. of lumber for a dredge, to be operating some time this summer. With the installation of the Harris dredge there will be three boats operating near Pierce.

LAKE CITY, COLO.—Jan. 27

The Lake City district has witnessed lately several strikes of importance. That made by Carey & Ochsenbein on the Last Chance group late in December is proving up well. At a depth of 50 ft. in the shaft the ore is over 2 ft. wide and is increasing. A recent sample showed $3 in gold, 180 oz. of silver and 60% of lead. Buskirk & Witherite are opening up an excellent streak in the shaft. They expect to sink another 50 ft. and drift; in the meantime they are sacking some fine lead-zinc ore showing wire silver. Shipments are running well. Ralph & Watson have just shipped a 20-ton car of gray-copper ore; two cars recently shipped ran $108 and $120 to the ton. They are working a lease on the Fanny Fern. Monroe & Quayle have taken a lease on the Cora and the Sulphuretts and will soon make a shipment running $60 per ton. Jeff and James Pool will ship soon a car of $100 gray-copper ore from the Belle of the East. Will and John Rawson have moved down from Schafer Basin and have packed provisions up to the crosscut tunnel which they expect to continue as long as weather permits. Their work is on the Crown Point property operated by William Taylor, of Kansas City.

JOPLIN—Jan. 30

Activity Among the Mines has been still further increased by the continued high price of zinc ores. Sheet-ground mines are being opened up and got into the producing column as fast as is possible, although activity along this line is somewhat restricted because of adverse weather conditions. A large number of the operating plants have been forced to shut down because of freezing. With the advent of warmer weather the district will become much more active. There are now a number of projects on foot to pump out large tracts of old ground formerly mined at shallow levels. At most of these places prospect drilling has proved the existence of orebodies at lower levels, such as the Maggie Taylor tract at Galena and the Missouri Zinc Fields' and Carterville Land Co's. tracts at Webb City, where the operators are even now mining rich ore under the old workings. A number of others are sinking their shafts preparatory to taking up stope in the old drifts or going down to entirely new levels. The Oronogo Mutual Mining Co. at Oronogo is sinking a new shaft on the west side of its lease in order to mine a rich run of ore that the Oronogo Circle Mining Co. is said to have mined up to the line. The sinking of this shaft will take place practically within the city of Oronogo, and it will require great care on the part of the shaft sinkers to avoid damage to property. The Oronogo Circle recently completed an entirely new haulage system for the transfer of the ore from the various shafts to the mill. This system is a regularly constructed railway using gasoline locomotives of the Milwaukee type, weighing 5½ tons, and ordinary three-ton end-dump cars. The company is getting more than enough ore to supply the mill and this at a much reduced cost per ton. The transportation cost under the old system was about 3c. per ton, while under the new system it is about 1c. The plant is milling about 900 tons daily. This property was recently sold to Turner & Co. of New York. Since the new management has taken charge a number of changes have been made with a consequent saving in the cost of operation.

DULUTH—Jan. 30

Steel Corporation Pensions have been paid to iron-country employees to the extent of $21,331. This includes the two Minnesota ore roads. The pension system began to operate in 1911. Pensions are computed as follows: For each year of service the employee receives 1% of his average monthly pay during the last 10 years of service. All male employees who have been in the service 20 years or longer and are 60 years or more of age are eligible to a pension. Women are eligible at the age of 50 years. More than 70% of those now on the pension rolls voluntarily requested to be pensioned. Early in 1913 the permanent disability rule was amended so that any employee, age not considered, who has been in the service 15 years and who has become absolutely unable to earn a livelihood, through no fault of his or hers, as a result of sickness or injuries sustained while on duty, is taken care of by the voluntary accident relief plan. The distribution of the fund received by the various properties operated by the Oliver Iron Mining Co. and by the Duluth, Missabe & Northern and the Duluth & Iron Range is as follows: Mesabi Range, Adams, $288; Canisteo, $223; Glen, $52; Graham, $24; Spruce, $898. Vermilion range, Pioneer, $334; Soudan, $734; Zenith, $98. Menominee range; Aragon, $659; Chapin, $1744. Marquette range; Champion, $1685; Lake Superior, $6720; Queen, $1306. Gogebic range; Atlantic, $288; Norrie-Aurora, $3362; Tilden, $1726. Duluth & Iron Range R.R., $599. Duluth, Missabe & Northern, $591.

CHICAGO—Jan. 30

Experiments with Drills continue in the Lake Superior copper district, notwithstanding the fact that the Calumet & Hecla, after extensive trials and experiments, threw out the old two-man type several years ago and substituted a lighter machine, the whole transaction undoubtedly representing a considerable expenditure. Numerous tests are being made at the present time there and others are contemplated. Moreover, there are those who believe that the innovation of three years ago may be superseded in the not distant future by a still more efficient machine. It is certain, too, that competition among the drill manufacturers is keen, and it would be surprising if the ultimate result of these efforts was not an improved drill exceeding in efficiency anything yet adopted in that district. While it is too much to expect that a company using several hundred machines would discard them for a new one that differed only in some small particular, it is equally certain that any radical improvement which can show a material increase in efficiency, reduction in cost of production, lower cost of maintenance, etc., will be given serious consideration. And no better time than the present could be found for testing machines of any sort in that district.

This January has been its best month in two years, according to a concern making a variety of mining and milling machinery. A manufacturer of an important adjunct of hoists, grinding mills and other machines used in mining is taking on skilled men to such an extent that it has created comment among the men themselves. These indications that the mining business is improving are supported, too, by recent developments in the Lake Superior ranges. In the Copper Country the welcome announcement was made recently that the Copper Range group, the Trimountain, Champion and Baltic, commencing Jan. 19 would continue operations on full time. Since early last fall this company has been operating at a greatly reduced capacity, 15 days on and 15 off. In the Michigan iron country also the scale of operations is being increased.

Sand-Leaching experiments, it can be stated positively, are being carried on in the Copper Country with other processes than that to be employed by the Calumet & Hecla. And they have been sufficiently successful, in at least one instance, to warrant increasing the scale of experimentation. It is also certain that men who have no direct interest in the mines of that district are watching these experiments with great interest. If entirely successful on the larger scale, it will probably mean that the Lake Superior country will witness the development of a new industry, the leaching of once discarded stamp sands. There are great quantities of these sands available from the mills of the Wolverine, Mohawk, Franklin, Quincy, Copper Range and possibly some other mines. In some of these cases, the work would undoubtedly be performed by the mining company itself, but it is not unlikely that in other cases separate companies might be formed for the purpose, or outside individuals might obtain the sands under satisfactory arrangements, and conduct the work as separate enterprises. To be successful the operations must be conducted on a large scale, which is, of course, in keeping with the traditions of the district. Much machinery of various sorts would be necessary. The leaching of these sands is a live subject, and its success on a commercial scale, whatever the process be, means much for the district.

HOUGHTON—Jan. 30

The Calumet & Hecla for 44 years has been producing almost continuously from the conglomerate formation upon which it was originally opened, and today the old conglomerate lode still continues to furnish the bulk of the tonnage which goes to the stamp mill. Thirteen fully equipped shafts, each one practically a mine by itself, produce a monthly tonnage of 250,000 and account for more than four-fifths of Calumet & Hecla's copper.

About 80% of normal output is coming at the present time from the conglomerate mines of the Calumet & Hecla and they are working just three-quarters of the time. At the Hecla four shafts are in operation, Nos. 2, 3, 6 and 7. These are all doing as good work as at any time in their recent history. In fact, for the past five months the grade of rock in the lower openings of both the Calumet and the Hecla branches has shown a slight appreciation. None of these Hecla shafts is taking down pillars. At the South Hecla, the branch which is more nearly worked out than any other part of the C. & H. property, there are four shafts in operation, Nos. 8, 9, 10 and 11. In No. 11 the work practically is confined to the removal of pillars and this rock is, of course, the richest that is going to the mills from any part of the mine, running over 40 lb. to the ton and getting richer as the work comes closer to the surface. Shafts 9 and 10 constitute a double shaft; this has a good deal of workable ground yet to go before reaching the limits. It is in healthy general physical condition. At the Calumet branch four shafts are in use, Nos. 2, 4, 5 and 6, 5 and 6 being a double shaft. The conglomerate lode is averaging at the present time 30 lb. of copper, refined, to the ton. This is about the general run of the lode for the past few years. The average for the year 1914 was, however, nearer 26 lb. to the ton, the first seven months of the year showing a poorer grade. In addition to the three main mines, South Hecla, Hecla and Calumet, another important producing shaft of the conglomerate formation is the Red Jacket which mines a territory north and west of the Calumet branch and beyond the Tamarack lines. Its hoisting speed and magnificent equipment enable this one shaft to handle a large tonnage. Working three-quarters time it produced 36,000 tons of rock in January. This is all high grade.

On the Osceola Formation the Calumet & Hecla mine is operating five producing shafts now. This lode is showing no change in general character. The mine is young as yet and its production possibilities are very great. While the grade of rock is low, the grade of copper produced is the best in the world, ranking with the Quincy and Mass in the government metal tests. This Osceola lode is wide and variable in quality. It can be mined to show a product of 9 lb. to the ton, or 30, depending upon the selection after breaking down. At the present time the grade is running 14 lb. to the ton. This is profitable mining at the present price of copper and with Calumet & Hecla economy.

On the Kearsarge Lode on the Calumet & Hecla property proper no operations are being conducted. Contrary to general understanding but one shaft has been opened on this lode by this company. The exploration work has not been extensive enough to prove conclusively, one way or the other, just what the values may be on the extensive spread of this formation through the Calumet & Hecla territory.

Minority Interests in various properties in the Lake Superior district were bought in 1905 by the Calumet & Hecla, $9,000,000 being expended. Notes were given for these stocks. They have been paid off in full. Of these assets the Ahmeek is undoubtedly the richest and most profitable at present. Calumet & Hecla owns nearly one half of the stock in Ahmeek. This is a young mine, richest on the Kearsarge lode, has four workable shafts, two now in operation, and but 60,000 shares outstanding. It will, in a few years, become one of the largest producers of the Lake Superior district, as well as the richest, excepting the conglomerate lode. Next to the Ahmeek, the ownership in the Osceola Consolidated is the most valuable asset held in any producing corporation. Both of these companies are in excellent physical condition and are heavy contributors to the Calumet & Hecla treasury in normal times. The stock ownership of 27,000 shares in the Isle Royale, instead of being a liability, as at first feared by the management, is now a profit producer. Of the various exploratory undertakings which the Calumet & Hecla interests financed in their efforts to acquire additional opportunities to utilize their marvelous organization and equipment, the White Pine property in Ontonagon County holds out the best hope for the future. While it is impossible to secure from any of the managerial heads any expression beyond the expectation that the White Pine will repay the money spent in its development and equipment, the fact remains that all of the experienced miners who are working in this property unhesitatingly state that it is richer than the Calumet conglomerate. Its narrow vein makes mining costs high. But the fact remains that the true worth of White Pine will be given a practical demonstration within a few months when the thousand ton stamp mill commences work. There is no public ownership of this stock, so that there can be no market gage of its speculative value.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—At stockholders' meeting Jan. 21, issue of debentures and increase of capital stock authorized.

ARIZONA

Cochise County

RAISE IN WAGES in Bisbee announced Jan. 27 for all three leading companies, following increase in copper prices. Copper Queen notice provides four scales based on "Engineering and Mining Journal" copper quotations. Sample as follows: Present rate $3.50; copper, 13c. to 14c., $3.65; 14c. to 15c., $3.75; over 15c., $3.90. Merchants, men and officials all much pleased.

Gila County

RAILROAD RATE REDUCTION reported as ordered by corporation commission on ores, concentrates, etc., from all points on Southern Pacific and Arizona Eastern to Globe and Miami.

CALIFORNIA

Eldorado County

GROUND SLUICING in Hangtown Creek which runs through town of Placerville recently started by E. L. Hews and G. A. Finnigan. Plant situated in rear of courthouse. Hangtown Creek in early days was mined by ground sluicing and hydraulicking and produced large amount of gold. Recent effort made to change name of Placerville to Hangtown, name first given to town.

Nevada County

THOMAS THOMPSON RANCH (Grass Valley)—This 80-acre ranch near North Star mine, containing well defined gold-bearing ledge striking north and south, bonded by W. A. Simpson. Number of previous efforts made to purchase property.

BEN FRANKLIN (Grass Valley)—Company organized by Toronto men to reopen mine a few miles south. Pump started to handle water which is 200 ft. deep in 400-ft. shaft. Mine said to have record of $750,000 production. Hoisting and building equipment said to be complete.

UNION HILL (Grass Valley) — Three-compartment shaft completed to 800-ft. point. South crosscut being driven to cut downward extension of oreshoot intersected in winze from 600-ft. level. Vein opened by drifts 100 ft. on 600-ft. level, showing width of 4 ft. Ore assays $15 per ton.

OUSTOMAH (Grass Valley)—Twenty men employed; 10-stamp mill crushing ore from 400-, 500-, 600- and 700-ft. levels. Lower levels being unwatered and 800-ft. level will soon be ready for extraction of ore. Shaft being repaired; new track being laid; 1500 ft. of cable added to underground equipment; four new drills installed; other improvements being made. Deepening shaft contemplated.

Shasta County

ROSS (Coram)—A. R. Ross making arrangements for installation of five-stamp mill in Stillwater district.

MAD OX MINING CO. (Stella)—Time extended for payment of purchase price of this group of mines near Old Whisky Town. Extensions to July 1915 and May 1916.

MAMMOTH (Kennett)—Arrangements made for regular shipments of high-grade zinc-silver ores to Oklahoma. Sorting plant about completed. Reported large tonnage of ore averages 26% to 40% zinc. Also zinc has been developed in Friday-Lowden property recently purchased by Mammoth.

Tuolumne County

SANTA YSABEL (Sonora)—Preparations being made for reopening property under management of J. A. Prentice of San Francisco. Mine former producer.

CONFIDENCE (Soulsbyville)—Company organized to reopen this old mine. Understood tunnel will be driven from Davis Flat section to tap vein at depth.

COLORADO

Boulder County

LIVINGSTON (Boulder)—Roasting plant of United States Gold Corporation's mill, comprising Herreshoff unit, under erection. No. 2 shaft unwatered and equipped with electric pump. Levels being opened to furnish ore for mill when latter is ready.

Clear Creek County

UNITED GOLD MINING, MILLING & TUNNEL CO. (Idaho Springs)—All property of company, situated in Spanish Bar district, to be sold at public auction in Idaho Springs, Feb. 1, in accordance with decree of foreclosure in which Central Savings Bank & Trust Co. of Denver, as trustee, is plaintiff. Property includes many lode claims and water rights.

Eagle County

LADY BELLE (Eagle)—This silver mine, that came into notice two years ago and after short, brilliant operation was thought exhausted, has resumed shipping under lease. First orebody proved to be detached block of sandstone highly impregnated with silver [illegible]. When this great rock was excavated, formation in place could not be found. Now, R. A. Messa, and others, have located true orebody and are shipping same sort of ore.

Gunnison County

CARTER MINING CO. (Ohio City)—At recent stockholders' meeting old board of directors was reëlected and acts of officials during 1914 approved. During 1914 company performed about 10,000 ft. of development work, including completion of four-compartment vertical raise which has total height of 1100 ft. Company plans considerable new development during present year. Several new leases will be granted during 1915. C. M. Carter president of company and A. H. Schreiber superintendent of property.

Lake County

PENROSE (Leadville)—Machinery arriving and being set for Down Town Mines Pumping Association which plans to unwater lower part of district.

GORDON-TIGER (Twin Lakes)—George W. Boyce, manager and principal stockholder in Twin Lakes M. & M. Co., reports discovery, above the fifth adit level, of 3-ft. shoot which his own samples show to run better than 1 oz. gold, while 8-in. streak in same vein runs much higher. Ore is white quartz with some pyrite and galena, gold occurring in free state. Interval of 280 ft. between fifth and fourth adit levels, assures abundance of stoping ground. For some time, Boyce has been making shipments to Arkansas Valley plant, of ore assaying about 1 oz. gold, a little silver and 10% lead.

BIG FOUR (Leadville)—Mining plant, including new shaft-house, engine-room, dwelling house, snow-sheds and some of the surface tramway, demolished by fire supposed to be incendiary, night of Jan. 20. Machinery thought to be badly injured if not total loss; total estimated loss set at $20,000. Fortunately, fire did not extend down new shaft. Last week Big Five company, which leases property, entered into contract with Colorado Power Co. and proposed to substitute electric motors for steam ends of machines. These had already been ordered and will be placed in rebuilt plant. Supt. Olie Strom has been in Denver consulting directors of Big Five, states they propose to build new mine plant promptly. All headway gained in unwatering together with pump and motor now total loss.

Summit County

FRENCH GULCH GOLD DREDGING CO.(Breckenridge)—Reiling boat went into winter idleness Jan. 5, close to Wellington mills. Until spring conditions warrant resumption of digging, time will be utilized in various repairs.

Teller County

GRANITE (Victor)—Gold Coin shaft being sunk.

PORTLAND (Victor)—Sinking No. 2 shaft discontinued; skip-pocket being put in on 17th level.

ACACIA (Cripple Creek)—South Burns shaft-house destroyed by fire, 6 p.m., Jan. 26. Shaft had just been sunk 100 ft.

STRATTON ESTATE (Cripple Creek)—Plant of machinery at Logan shaft leased to Kishman and Rainger. This plant supplies most of Bull Hill mines with compressed air.

EL PASO (Cripple Creek)—New electric hoist being installed and steel headframe nearing completion on old shaft. Work through shaft and on drainage tunnel suspended since fire last fall.

VINDICATOR (Independence)—No. 2 shaft-house destroyed by fire 4 a.m., Jan. 27. Shaft timbers not damaged. Shaft not used except by lessees. New electric compressor installed and put into commission.

CRESSON (Cripple Creek)—Shipment of high-grade ore sent to Copeland sampler Jan. 24, from now famous vug on 12th level. Two cars in one lot, 80 tons, of first grade and three cars, 88 tons, of second grade. Entire shipment sampled twice, and extra precautions taken for sampling. Sent for treatment to Denver plant of A. S. & R. company. Average grade about $3 per lb.; total about a million dollars.

IDAHO

SUCCESS (Wallace)—Work resumed in shaft, sinking to 1100 ft. level. Chief value of ore from this mine lies in zinc. Present high price stimulating development. Mine now making about 80 tons zinc concentrates daily.

H. E. M. (Wallace)—Stockholders have approved plans for erection of 100-ton concentrating mill at mine. Steps taken to raise $20,000. Work to start as soon as season permits. Tunnel No. 4 in 2276 ft. Vein drifted on 250 ft.; good body of ore uncovered and high grade will be shipped.

IDAHO-NEVADA (Wallace)—First shipment of copper ore made from Castle Rock mine. Sent to Tacoma; expected to run 27% copper with some gold and silver. Ore taken from dump and sorted. Shipment an experiment. Smelting cost low, as iron content is high. Work on shaft discontinued awaiting stockholders' meeting Feb. 6; bottom was still in good ore, although ore was dipping out of shaft. Oreshoot said to be proved over 200 ft.

MICHIGAN

Copper

BOHEMIA (Rockland)—Bohemia, selling in market at $1.06 a share has over $100,000 in cash in treasury.

MICHIGAN (Rockland)—Idea of ridiculously low figures at which idle copper properties are selling given by case of Michigan mine. Standing white-pine timber on property alone said to be worth practically twice the present market selling price.

ARCADIAN (Houghton)—Arcadian has about $10,000 in treasury. Monthly expenses now a little over $2000 so that company has enough money to keep up present operations until next summer. In addition there is $8000 due in uncollected payments on last assessment levied. This can be forced at any time with market in present position.

MINNESOTA

Cuyuna Range

MERRIMAC MINING CO. (Crosby)—Company states it will not drill lands south of Croft mine.

JOHN HARRINGTON granted lease on lands willed to City of Brainerd by late Judge George W. Holland, of Brainerd. Lands have some prospective mineral value. Term of lease 50 years, royalty 30c. per ton, with 10,000-ton minimum first year and 25,000 tons annually thereafter. Exploration work will start at once.

STRIPPING operations to be extensive in 1915. Following mines contemplate this work: Rowe, Hill Crest, Cuyuna-Sultana, Quinn, Feigh, Pennington, Armour No. 1. Last named will strip western end adjoining Pennington; owing to presence of caved ground from underground mining east end cannot be stripped.

Mesabi Range

GREAT NORTHERN POWER CO.—Arrangements being made to extend lines from Hibbing to Nashwauk and beyond, on Mesabi range, enabling furnishing of power to mines in district.

GREAT NORTHERN ORE CO.—Reported number of ore contracts already made for delivery this year. Trustees have several mines ready to produce ore on short notice and several more in development stage. Three properties leased to Dean Iron Co., but all other ore lands will be operated direct by trustees. On properties leased, trustees have made extensive advances in the past for development work, to be reimbursed gradually, payments being made on royalty basis on ore mined. On largest mine trustees will be paid royalty on every ton of iron ore taken out during life of lease, in addition to being reimbursed for advances made. On other two mines leased, payments will cease after advances have been repaid. Trustees have cash surplus of about $9,000,000. This sum will be available for nest egg for carrying through further development work on various mining locations where ore is known to exist. Over $3,000,000 advanced to Sargent Land Co., which is opening Keewatin mine, amount to be paid back in royalties

Vermilion Range

SIBLEY (Ely)—Hoisting resumed in shaft which caved in Nov. 9.

MONTANA

Granite County

MONDAMIN (Philipsburg)—Rich strike reported from this mine made on vein believed to be continuation of vein in famous Granite mine which has yielded much silver in years past Shaft on Mondamin mine down 80 ft. At this point vein 7 ft. wide. Holes sunk on surface exposing vein, showed it continuous and in direct line with Granite vein. Shaft will be sunk to 200 ft. before doing exploring or drifting

Jefferson County

CORBIN COPPER (Corbin)—Leasers at Rosalie claim have opened promising vein in tunnel, showing more than 1 ft. of ore of concentrating grade and several inches of rock of higher class, which leasers are sorting for shipment direct to smelter. Bakama claim, in western end of group, expected soon to be operated by leasers. Showing in this claim regarded as favorable. Nothing being done by the Corbin Copper at Gambrinus group in Butte district pending clearing of financial difficulties of company.

Silver Bow County

ANACONDA (Butte)—Extensive improvements being made at Mountain View shaft Shaft straightened and retimbered for great portion of its depth; headframe moved; building of new engine house started, of steel construction, to be one of the finest and most substantial in the district.

BUTTE-BALLAKLAVA (Butte)—Company has announced operations will be resumed by middle of February, when it is expected to hoist in neighborhood of 100 tons per day. This will mean employment of 50 to 100 men. Retimbering of shaft has been progressing steadily in meantime and as soon as conditions warrant, shaft will be sunk below 1600-ft. level, its present depth.

PILOT BUTTE (Butte)—Due to improvement in metal market company has announced following plans for increasing present output: Company will at once begin mining zinc ore at rate of 50 tons per day, shaft will be sunk from present lowest level of 2450 ft. 400 ft. deeper to 2850-ft. level; three distinct zinc veins carrying from 20% to 30% zinc will be opened up and exploited at fastest possible rate in addition to output of copper ore Force of men will be increased at once from 60 to 100 and three shifts put on in place of two During January, 21 cars of first-class and nine cars of second class ore were shipped Estimated that in February output will reach 60 cars.

NEVADA

Esmeralda County

GOLDFIELD SAMPLER of Western Ore Purchasing Co. made first run of ore Jan 20 Plant completely remodeled and capacity increased from 150 tons to 350 tons daily

DIAMONDFIELD MINING & MILLING CO (Goldfield) Company operating lease on Great Bend property West drift on 150-ft. level opened 3-ft shoot of milling-grade ore and 8-in shoot of shipping-grade, shipments to begin at once

GOLDFIELD CONSOLIDATED (Goldfield)—December production 29,851 tons, with net realization of $195,118. Development work 2628 ft. at $5.66 per ft. Principal costs Mining, $2.72; milling, $1.91; general, $0.43. Total cost, $6.03, less miscellaneous earnings $0.36, net cost $5.67.

Humboldt County

ROCK HILL (Mill City)—Force of men began operations recently

Lyon County

NEVADA PROGRESSIVE GOLD MINES CO (Yerington)—New shaft-house built, gasoline hoist installed and new office building completed. Sinking started from 100-ft. level.

Nye County

TONOPAH BELMONT (Tonopah)—Stated company will exercise option on Surf Inlet mine in British Columbia on July 1, and will expend $150,000 in development work

TONOPAH MINING (Tonopah)—Option on property of Nicaragua-Panama Mining Co. exercised and possession acquired Jan. 28. Judgment in favor of Tonopah Sewer & Drainage Co given in suit for $1203.

WHITE CAPS (Manhattan)—Future policy of company to be decided at stockholders' meeting in Tonopah, Feb. 2. If sufficient stock be voted in favor of plan arranged with Tonopah Mining Co., that company will start investigation and sampling of White Caps immediately after meeting. Understood several propositions in regards to future operations have been tentatively submitted, should plan now under consideration by the stockholders fail to carry.

TENNESSEE

TENNESSEE COPPER (Copperhill)—Construction work resumed, according to Pres. James Phillips, Jr. New steel headframe already installed at McPherson shaft and new furnace at smelting plant; additional machinery previously specified only awaits instructions to go forward. Installation of new hoisting appliances with electrification at Burra Burra and McPherson mines at once will double hoisting facilities and enable company largely to increase ore reserve. This will mean, with good fortune in construction plans, beginning copper output of about 20,000,000 lb. annually, by Oct. 1, 1915, a 50% increase, at cost lower probably by 2c. per lb. Life of copper and sulphuric-acid ores, some of orebodies as yet hardly touched, placed at minimum of 25 years.

UTAH

Beaver County

WORK ON PLACERS near Beaver City in progress for two weeks. Good returns indicated by panning in places.

MASTER KEY (Milford)—Company organized to develop five claims formerly owned by Beaver Star Mining Co. Property adjoins Hoosier Boy.

Juab County

SALVADOR (Eureka)—Lease taken by Ferguson, McCune, and Brown, on this property owned by the Knights. Ground lies west of Beck Tunnel, produced some gold ore in past.

CHIEF CONSOLIDATED (Eureka)—Prospecting ore zone with diamond drilling by means of holes up to 200 ft. long resulted in opening of new orebody. Car of ore shipped running especially high in gold.

DRAGON CONSOLIDATED (Silver City)—Prospecting from 1900 level of Iron Blossom by means of diamond drilling in progress; first hole in 175 ft., and will probably be drilled 800 to 1000 ft. to crosscut Dragon ground.

SCOTIA (Tintic Junction)—Development being pushed at this property by Chief Consolidated Co. which has two-year lease and bond. Work to be carried to depth of several hundred ft. Ore followed on beds; about one railroad car of ore hoisted. Shipments will not be made until hauling conditions improve. It is not intention to mine smaller bunches of ore.

San Juan County

CARNOTITE CLAIM survey applied for by Thomas Kearns, formerly senator from Utah. Claims 47 in number in Dry Valley near Moab. Three different groups purchased by Mr. Kearns and associates. Some work done.

Summit County

THOR (Park City)—Control of this company's claims recently taken over by Knight interests. Ground, which is in southern part of camp, will be drained to depth of 3500 ft. by Snake Creek tunnel, which has passed through property for several hundred feet.

VIRGINIA

CRIMORA MANGANESE CORPORATION (Crimora)—Announced that modern treatment plant has been contracted for with Allis-Chalmers

CANADA

Ontario

PORCUPINE PET—New vein cut having 6-in. pay streak of high-grade ore.

VIPOND (Schumacher)—Davidson vein opened on 300-ft. level with good results.

DOME LAKE (South Porcupine)—Mine shipped $5000 gold brick, second for the month.

McINTYRE (Schumacher)—Property examined by engineers representing John T Milliken operating in Colorado.

PORCUPINE CROWN (Timmins)—Company will continue regular [illegible] quarterly dividends for coming year and will build up surplus; $212,124 was carried forward, increase of $61,551.

CANADIAN MINING CORPORATION (Cobalt)—Company, which controls Townsite, City of Cobalt and Cobalt Lake mines and old Northern Customs concentrator, installing cyanide plant to treat slimes from concentrator. Dorr apparatus will be used.

CROWN RESERVE (Cobalt)—Dividend cut from 24% a year to 12%. New rate will be paid 3% quarterly instead of 2% monthly as formerly Mine profits for year $739,177 and revenue from investment $144,000 Surplus $771,411 against $844,615 last year Mining profits for 1913 $578,287. Investment revenue is from Porcupine Crown of which Crown Reserve holds 60%.

The Market Report

Metal Markets

NEW YORK—Feb. 3

Copper, lead, spelter and tin have all been higher.

Copper, Tin, Lead and Zinc

Copper—Continued large buying in the early part of our week record resulted in a further advance in price, 14¾c., regular terms, being realized on Saturday. On Monday the market was firmly on that level and on Tuesday there was talk about 14⅞c. being asked, but we were unable to find that that price had been actually realized for standard deliveries; if it were the quantities involved were insignificant. Later the demand fell off very considerably, the market became rather stale and copper was available from about all quarters at 14¾c., regular terms.

The Anaconda company is going to try shipment of its blister copper from Anaconda to New York by way of Seattle and the Panama Canal, instead of by the all-rail route used heretofore. On paper, shipments in the new way figure more economically, allowing for the loss of the milling-in-transit rate from Perth Amboy to points of consumption at present enjoyed. There are, however, questions in regard to the time of copper in transit, etc., which must be determined by experience. At present, therefore, the new method is to be regarded only as an experiment.

Copper sheets were again advanced ¼c. on Jan. 29, making the base price now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15¾c., carload lots at mill.

Copper exports for the week ended Jan. 23 are reported by the Department of Commerce at 23,057,065 lb. The larger shipments were 11,927,323 lb. to France, 4,114,324 lb. to Italy, and 3,489,437 lb. to England. Copper imports for the week were: Metal, 1,689,614 lb.; in ore and matte, 1,583,846; total, 3,273,460 lb. The larger imports were from Cuba, Peru, Chile and Canada.

Tin—The important rise in this metal was inspired by causes that are as yet unfathomed in the trade. The statistical position does not warrant an advance in price; nor does the commercial situation generally. However, there is congestion on the docks in London, and difficulty in obtaining freight room, and there are disturbances generally which may cause important fluctuations in price here from day to day. Notwithstanding the advance this week, business was quiet and futures were quite neglected.

Lead—Some rather large sales were made at St. Louis on Jan. 28 before the A. S. & R. Co. advanced its price, or before that advance was generally known. After the advance to a basis of 3.80c., New York, business became rather dull. However, the market continued to be firm, the St. Louis price rising above the usual differential.

Spelter—The hysteric advance in the price of this metal continued up to Feb. 1, when a deadlock by exhaustion seemed to be reached. The situation is quite simple. The producers have sold out all of their stocks and all of the metal they are going to make in February, save what is reserved for regular customers and is settled for at the market. Such spelter as remains in the hands of speculators or is going to be made in February and has not been sold is insignificant in quantity. March-April spelter is still available and whatever wholesale market there may be at present is for those deliveries. Of such spelter a moderately large tonnage was sold during the last week, the reported sales during the last three days averaging about 7½c., St. Louis.

The sales that have been made by the smelters up to this time probably do not extend beyond March to any great extent. The smelters find themselves in a difficult position having to take in ore on a high level of price, and being unable to sell the expected product thereof at anything like the current price. There is therefore a good deal of pressure to sell April and later deliveries, which are offered at large concessions. A considerable tonnage for delivery from March to August was contracted at about 7.05c., St. Louis, while deliveries running from May to August were offered at 7c., and that price might perhaps have been shaded. However, consumers do not exhibit much interest in entering into such contracts.

If the present stringency in spelter continues, it is possible that some arbitrage business between New York and London may be done, resulting in the repurchase here of spelter that was previously sold for delivery abroad but has not yet been shipped.

The smelters in all quarters report the firing-up of furnaces that were idle at the beginning of January. There was at that time a good many cold retorts, not including what were in the moribund works in Kansas. The high level of price will, of course, draw out a large supply of ore.

The demand for high-grade, intermediate and brass special spelters continues crazy and unsatisfied. Brass special has been sold at 9½@10c. per lb., while high-grade is reported to have realized 15@17 cents.

American zinc dust, packed in 200-lb. zinc-lined cases, is quoted at 12c. per pound.

Zinc sheets were advanced during the week to 10c., then to 10½c. per lb., and were quoted today at $10.50 per 100 lb., f.o.b. La Salle, Ill. Usual extras charged.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Jan. Feb.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts per Lb
28	4 8507	48¼	14.30 @14.35	35¼	3 70 @3 80	3 50 @3.55	7.17½ @7.42½	7 00 @7 25
29	4 8507	48¾	14 35 @14 45	37	3.80	3.62½ @3 67½	7.30 @7.55	7.12½ @7.37½
30	4 8450	48⅝	14 40 @14 50	37¼	3.80	3 62½ @3 67½	7.42½ @7.67½	7.25 @7.50
1	4 8450	48⅝	14.55 @14.60	37¼	3.80	3.65 @3.67½	7.42½ @7 92½	7.25 @7.75
2	4 8450	48⅜	14.55 @14 60	38	3.80	3.65 @3 67½	7.42½ @7 92½	7.25 @7.75
3	4 8375	48	14.55 @14.60	37¾	3 80	3 65 @3 67½	7 42½ @7 92½	7.25 @7.75

The quotations herein are our appraisal of the markets for copper, lead, speltes and tin based on wholesale contracts; and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Jan.-Feb.	Silver	£ per Ton	Cts per Lb	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts per Lb	£ per Ton	Cts per Lb
28	22[illegible]	62[illegible]	13.67	63[illegible]	68[illegible]	168	157	18[illegible]	3.99	35	7 60
29	22[illegible]	63[illegible]	13.74	63[illegible]		172	160½	18[illegible]	3 99	37	8 04
30	22[illegible]										
1	22[illegible]	63[illegible]	13 82	64		175	162	18[illegible]	4 07	36[illegible]	7 98
2	22[illegible]	63[illegible]	13 88	64[illegible]	69½	174	161½	18[illegible]	4 05	37	8 04
3	22½	63	13 69	63½		173	156	18[illegible]	4 06	37½	8 11

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17⅛c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum remains quiet, with only moderate current business and no change in price. Current quotation is 18¾@19¼c. for No. 1 ingots, New York. **Antimony** is rather active, under demands for export, and for ammunition, with only moderate supplies. Ordinary brands are 16¾@17¼c. per lb., while 19@19½c. per lb. is named for Cookson's—**Quicksilver** is stronger, with an advancing tendency, but only moderate sales. New York price is $54 per flask, with $55 for small lots. San Francisco, $53 per flask of 75lb. London price is £11 10s. per flask—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher.

Gold, Silver and Platinum

Gold—A shipment of $280,000 gold from China was received at San Francisco this week, on its way to New York. This makes a total of $3,430,000 gold received recently from China.

Platinum continues quiet and dull, with no material change, but a rather unusual range of prices. Current quotations are $38@42 per oz. for refined platinum; hard metal is quoted $45@49 per oz., according to quality.

Iridium—This metal is still rather scarce, and no general market price can be named, each transaction standing by itself.

Silver—The market has declined in New York owing to higher war insurance rates, lower London exchange and a slight depression in the London market. The selling has not been free, and the inquiry from the Indian Bazaars has been only moderate.

Silver shipments from London to the East Jan. 1 to Jan. 21, as reported by Messrs. Pixley and Abell:

	1914	1915	Changes	
India.	£281,000	£450,500	I.	£169,500
China ..	10,000		D.	10,000
Total..	£291,000	£450,500	I	£159,500

Silver shipments from San Francisco direct to China in 1914 were $3,676,800 in value.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 30

Blende, high price $67.50; assay base 60% zinc, $58@65; metal base 60% zinc, $60@62; calamine base 40% zinc, $33@37; average, all grades of zinc, $60.62, an increase in one week of $12.22 per ton. Lead, high price $50.50; base price $47 per ton of 80% metal contents; average, all grades of lead, $47.48 per ton.

Approximately one-fourth of the blende shipment was from reserves, indicating a decreasing production. Sales of 1400 tons of reserve for next week's delivery are consummated. Cold weather four days and rain the latter two days cut calamine production to a minimum.

SHIPMENTS, WEEK ENDED JAN. 30

	Blende	Calamine	Lead	Values
Total this week....	8,159,300	369,440	1,246,340	$288,510
Total this year......	49,092,320	3,835,160	7,086,740	$1,469,860

Blende value, the week, $254,220; the month, $1,251,240.

Calamine value, the week, $4,700; the month, $52,650.

Lead value, the week, $29,590; the month, $165,970.

Iron Trade Review

NEW YORK—Feb. 3

Some improvement continues to be made in the iron and steel trades, but it is still rather slow. The mills report operations to between 50 and 60% capacity.

The most important gain reported this week is in structural steel, which for some time has been rather backward. Plates and shapes for shipbuilding show a marked gain. The demand for brass and plates is fair. Warehouse and jobbing business is reported as improving, especially in the West.

An order of 8000 tons of steel billets is to be filled by the Tennessee Coal, Iron & R.R. Co. at Ensley, Ala., to be shipped to England.

Pig iron sales show a small increase, especially in foundry iron. Stocks at furnaces are large, but are gradually working down.

PITTSBURGH—Feb. 2

The Carnegie Steel Co. has increased its output further and is this week operating at about 60% of its ingot capacity. It has reduced its pig-iron stocks by about 100,000 tons and has blown in or ordered into blast a total of 10 furnaces in the past three weeks, giving it 32 active stacks out of a total of 59. The Pittsburgh Steel Co., engaged chiefly in wire manufacture, is operating practically full, partly by reason of export trade and partly through accumulating stocks in expectation of a good spring demand. These instances are exceptional as to the extent of the increase, but all the mills are operating somewhat better than in December, and steel-mill operations in the country at large have probably reached 50% of capacity, compared with less than 35% in December.

The steel trade presents a wide variety of opinions as to the course of the market in the next few months. In some quarters it is thought the improvement is about over and that the market will have a relapse shortly, as it did a year ago after making a somewhat similar start. In other quarters an extremely gradual but continued improvement is expected. In still other quarters the belief is expressed with confidence that improvement will continue until almost normal conditions will be reached by April or May. There are rarely such divergent views expressed as is the case today.

The galvanized sheet market is almost closed, on account of the advance in spelter. Some mills remain out of the market.

Pig Iron—We quote prices unchanged: Bessemer, $13.75; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; gray forge, $12.50@12.75, at Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report their compilation of actual market sales in January at $13.6375 for bessemer and $12.50 for basic, at Valley furnaces.

Ferromanganese—There does not seem to be anything new in the situation. The nominal contract quotation remains at $68, Baltimore, while odd lots can usually be picked up at $75 or $80 per ton.

Steel—The Pittsburgh mills have lately been quoting $20 on billets and $20.50 on sheet bars, delivered Pittsburgh, but these quotations are altogether nominal since there is at least one seller at Youngstown at $18.25 for billets and $18.50 for sheet bars, with only about $1 freight into the Pittsburgh district. The consumers are all covered at lower prices. Rods are $25, Pittsburgh.

COKE

Connellsville—The market continues stagnant, consumers having no occasion to make further contracts. Prompt furnace is $1.55@1.60, and at $1.60 deliveries to Apr. 1 could easily be arranged. Foundry coke for prompt shipment is held all the way from $2 to $2.50, according to brand. The Thompson involvement at Uniontown promises to require a long time, probably years, for anything like a settlement.

Chemicals

NEW YORK—Feb. 3

The general market continues rather irregular, with sales on a moderate scale only and no special activity manifest.

Arsenic—Business has been slow and the market is a shade weaker. Quotations are $3.87½ per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and prices are firmer. Current quotations are $4.50 per 100 lb. for carload lots, and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is improving and prices are firmer, with a better tone to the market. For spot and up to October, 1.95c. per lb. is quoted, with 1.97½@2c. per lb. for later deliveries.

Potash Salts—The German government has placed an absolute embargo on exports of potash salts and manufactures thereof.

Pyrites—Imports of Spanish pyrites in the United States in 1914 were 771,665 long tons from Huelva and 82,767 tons from Pomaron; a total of 854,432 tons. This is an increase over 1913, but a decrease from 1912.

PETROLEUM

Exports of mineral oils from the United States in December were 166,858,557 gal., being 49,117,698 gal. less than in December, 1913. For the year ended Dec. 31 the total exports were 2,108,365,444 gal. in 1913, and 2,224,248,324 gal. in 1914; an increase of 115,882,880 gal., or 5.5%, last year.

The yearly statement of the "Oil City Derrick" gives new wells completed in 1914 as follows: Pennsylvania grade, 5909; Lima-Indiana, 1605; Central Ohio, 768; Kentucky, 179; Illinois, 1583; Texas-Louisiana, 1561; Mid-Continent, 10,559. The total completions were 22,164, with the remarkable new production of 1,471,652 bbl. This is the first year where the production credited to new wells passed the million mark. Of the completions 4012 were failures and 2383 were gas wells.

Assessments

Company	Delinq.	Sale	Amt
Belcher Silver, Nev	Feb 8	Mar 1	$0.10
Blue Bull, Nev	Jan 4	Feb 8	0.01
Booth, Nev	Jan 25	Mar. 1	0.02
Brunswick Con., Nev	Feb 16	Mar 9	0.01
Carbonate, Ida	Jan 28	Feb 28	0.001
Cash Boy, Nev	Jan 15	Feb 15	0.005
Cedar-Talisman, Utah	Feb 8	Mar. 1	0.005
Century, Utah	Jan. 2	Feb. 2	0.01
Clear Grit, Ida (post)	Feb. 9	Mar 3	0.0015
Clearwater Con., Ida		Feb 15	0.001
Darby, Ida. (post)	Dec. 14	Feb 15	0.001
Emerald, Utah (three instal.)		June 9	0.01
Gethin Le Roy, Utah	Feb. 2	Feb 23	0.02
Gypsy Qn., Nev	Jan. 12	Feb. 16	0.01
Idaho-Nev., Ida	Jan 7	Feb. 1	0.001
Indiana, Mich	Feb. 4		1.00
Iron King, Ida	Feb 18	Mar. 19	0.001
Keystone, Utah (post)	Feb. 23	Mar 23	0.02
King Pine Crk., Ida	Feb 12	Mar. 13	0.002
Laclede, Ida	Jan. 12	Feb 3	0.003
Lucky Friday, Ida	Dec. 14	Feb. 11	0.003
MacNamara, Nev	Jan. 12	Feb 3	0.03
Majestic-Idol, Nev	Dec 15	Jul. 20	0.005
Manhattan Con., Nev	Feb 30	Mar 1	0.01
Nor. Bnkr. Hill, Ida	Jan 30	Mar 6	0.002
Ophir, Nev	Feb 11	Mar 5	0.10
Potosi, Nev	Jan. 12	Feb 4	0.02
Reindeer-Queen, Ida	Feb. 15	Mar 8	0.003
Rescue-Eula, Nev	Feb. 11	Mar. 22	0.01
Scranton Ex., Utah	Jan 4	Feb 5	0.00025
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev	Feb. 8	Mar. 2	0.05
Silver Star, Ida	Jan 5	Feb 5	0.002
Sunset Dev., Ida	Jan. 18	Feb 18	0.0025
Tarbox, Ida	Jan. 28	Feb 28	0.0025
Ton. Gip. Qn., Nev	Jan. 12	Feb. 16	0.01
Umatilla, Nev.	Jan. 4	Feb. 8	0.01
Union Con., Nev	Jan 14	Feb 4	0.05
Utah-United, Utah	Feb. 20	Mar. 15	0.01
Verde May, Ida	Feb. 1	Mar. 1	0.001

The actions of U. S. Steel common have furnished most of the interest in the stock market this last week. Following the passing of the dividend on Jan. 26, the stock sold immediately down to 48, the minimum price as established by the Stock Exchange committee and adjourned to the "gutter market," leading to successive reductions to 43, 40 and 38.

Stock Quotations

COLO. SPRINGS Jan. 27		SALT LAKE Feb 1	
Name of Comp	Bid.	Name of Comp	Bid
Acacia	04	Beck Tunnel	07½
Cripple Cr'k Con	‡ 01¼	Black Jack	07½
C. K & N	06¾	Colorado Mining.	10
Doctor Jack Pot	10	Crown Point.	01½
Elkton Con.	49	Daly-Judge	5 00
El Paso	1 25	Gold Chain	10
Findlay	02½	Grand Central	63
Gold Dollar	04	Iron Blossom	99
Gold Sovereign	04½	Little Bell	10
Isabella	17¾	Lower Mammoth	05¾
Jack Pot	‡ 08	Mason Valley	1 10
Jennie Sample	03	May Day	14½
Jerry Johnson	03¼	Opohongo	02
Lexington	‡ 009	Prince Con	25
Old Gold	‡ 01	Seven Troughs	02½
Mary McKinney	30½	Silver King Coal'n	2 80
Pharmacist	01½	Silver King Con.	1 92½
Portland	1 17	Sioux Con	03
Raven B. H	03¼	Uncle Sam	06¾
Vindicator	1 25	Yankee	08

TORONTO		Feb 1	
Bailey	01½	Dome Exten	07
City of Cobalt	‡ 30	Foley O'Brien	14
Coniagas	5 25	Hollinger	22 50
Peterson Lake	22	Imperial	[illegible]
Right of Way	01	Jupiter	30
Seneca Superior	1 00	McIntyre	26
T. & Hudson Bay	30 00	Pearl Lake	01
Timiskaming	17	Porcu. Gold	[illegible]
Wettlaufer-Lor	04	Preston E. D	01
Big Dome	[illegible] 15	Rea	[illegible]

SAN FRANCISCO		Feb 1	
Comstock Stocks		Misc. Nev. & Cal.	
Alta	04	Belmont	[illegible]
Belcher.	28	Jim Butler	[illegible]
Best & Belcher	05	Lone Star	[illegible]
Caledonia	27	MacNamara	[illegible]
Challenge Con	05	Midway	[illegible]
Confidence	‡ 10	Mont.-Tonopah	[illegible]
Con. Virginia	07	North Star	[illegible]
Crown Point (Nev.)	‡ 01	Rescue Eula	[illegible]
Gould & Curry.	02	West End Con.	[illegible]
Hale & Norcross	03	Atlanta	[illegible]
Julia	01	Booth	[illegible]
Mexican	45	C. O. D. Con.	[illegible]
Occidental	84	Comb. Frac.	[illegible]
Ophir	06	Jumbo Extension	[illegible]
Overman	10	Pitts.-Silver Peak	11
Potosi	02	Round Mountain	[illegible]
Savage	03	Sandstorm Kendall	[illegible]
Sierra Nevada	07	Silver Pick	[illegible]
Union Con	22	Central Eureka	‡ [illegible]
Yellow Jacket	‡ 28	So. Eureka	[illegible]

N. Y. EXCH. Feb 1	
Name of Comp.	Clg
Amalgamated	54¼
Am.Sm.&Ref.,com.	62⅞
Am. Sm. & Ref., pf.	102¼
Am Sm Sec, pf B	80
Anaconda	27¼
Batopilas Min	⅝
Bethlehem Steel, pf.	104
Chino	36
Colo. Fuel & Iron.	24
Federal M. & S., pf.	29
Great Nor., ore., ctf.	30⅜
Guggen Exp.	51½
Homestake.	116
Inspiration Con.	18½
Mex. Petroleum	74¾
Miami Copper	18⅜
Nat'l Lead, com	46
National Lead, pf.	108
Nev Consol.	12¼
Ontario Min.	2
Phelps Dodge	‡175
Quicksilver, pf.	2
Ray Con.	17⅝
Republic I&S, com.	19¼
Republic I&S, pf.	74½
SlossSheffi'd, com.	23
Sloss Sheffield, pf.	‡82
Tennessee Copper.	30⅜
Utah Copper	53⅝
U. S. Steel, com	40¼
U. S. Steel, pf.	103½

BOSTON EXCH Feb 1	
Name of Comp.	Clg
Adventure	1
Ahmeek.	255
Alaska Gold M	28¼
Algomah	50
Allouez	41½
Am. Zinc	20⅞
Ariz. Com., ctfs	5
Bonanza	35
Butte-Ballaklava	2
Butte & Superior	47¼
Calumet & Ariz.	53
Calumet & Hecla	399
Centennial	18½
Cliff	‡1
Copper Range	33⅝
Daly West	1⅞
East Butte	9
Franklin	5
Granby	63½
Hancock.	11
Helvetia	25
Indiana	2¼
Island Cr'k, com.	45½
Island Cr'k, pfd.	87¾
Isle Royale	22
Keweenaw	2¾
Lake	6
La Salle	3½
Mass	3¾
Mayflower	4¾
Michigan	60
Mohawk	53½
New Arcadian	5¼
New Idria Quick	‡3½
North Butte	22¾
North Lake	1
Ojibway	.50
Old Colony	4
Old Dominion	42½
Osceola	67½
Quincy	52¼
Santa Fe	1⅞
Shannon	4¾
Shattuck-Ariz.	23
Superior	28½
Superior & Bost.	1⅛
Tamarack.	33½
Trinity	2¾
Tuolumne	23
U. S. Smelting	20½
U. S. Smelt'g, pf.	39½
Utah Apex	2⅛
Utah Con	9¾
Victoria.	1½
Winona.	1¾
Wolverine	37
Wyandot.	50

N. Y. CURB Feb 1	
Name of Comp.	Clg
Beaver Con	26
Big Four.	07
Blue Bell	05
Braden Copper.	6¾
B C Copper	‡ 50
Buffalo Mines	75
Can. Cop. Corpn.	1½
Can G. & S.	04
Caribou	58
Chambers Ferland	13
Con Ariz. Sm	5/16
Coppermines Cons.	‡1⅝
Davis-Daly	1 1/16
Diam'field-Daisy.	08
Dia. Black B	.04
Ely Con	‡ 01
Florence	.71
Goldfield Con	1½
Goldfield Merger.	28½
Greene Cananea.	31½
Kerr Lake	4¾
La Rose	70
McKinley-Dar-Sa	45
Mines of Am	2⅛
Mutual Min., pf	‡2½
Nevada Hills	32
New Utah Bingham	‡ 3/16
Nipissing Mines	5⅝
Ohio Copper.	09
Oro	.12½
Pacific Smelt	1/32
Stand'd Oil of N J	399
Standard S. L.	1⅜
Stewart	1 1/16
Tonopah	7¼
Tonopah Ex	2¾
Tonopah Merger	39
Tularosa	25
West End Ex	03
Yukon Gold	2¾

LONDON	Jan 20
Alaska Tre'dwell	£7 17s 6d
Camp Bird	0 7 9
El Oro	0 9 9
Esperanza	0 8 1½
Mexico Mines	4 2 6
Oroville	0 12 0
Philippine Dr	1 0 0
Santa Gert'dis	0 11 10½
Tomboy	1 1 10
Tough Oakes	0 11 10½

BOSTON CURB Feb. 1	
Name of Comp	Bid
Alvarado	70
Bingham Mines	‡3⅞
Boston Ely	13
Butte & Lon'n Dev	36
Calaveras	95
Calumet-Corbin	18
Chief Con	80
Corbin	‡1
Cortez	25
Crown Reserve	65
Eagle & Blue Bell	90
First Nat Cop	1
Houghton Copper.	1½
Iron Cap Cop., pf.	‡5
Majestic.	14
Mexican Metals	15
Nevada-Douglas.	37
New Baltic	1½
Oneco	60
Raven Copper	07
Smokey Dev	10
So. Lake	4½
Tonopah Victor.	‡ 17
Trethewey	13
United Verde Ext	1 11/16

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506		28.357	26.573	
March	57.870	58.067		26.669	26.788	
April	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344	.....	27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver. London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.71
February	14.491		65.259		70.188	
March	14.131		64. 76		69.170	
April	14.211	...	61.747		69.313	
May	13.990		63.182		67.786	
June	13.603		61.336		66.274	
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year	13.602		61.524		68.168	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.556
February	39.830		181.556	
March	38.038		173.619	
April	36.154		163.963	
May	33.360	.	150.702	
June	30.577	...	138.321	
July	31.707	...	142.517	
August	*		‡	
September	32.675	.	‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301		156.564	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048		3.937		19.606	
March	3.970		3.850	...	19.651	
April	3.810		688	....	18.225	
May	3.900		3.808	....	18.503	
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384	....	‡	
November	3.683		3.585	. .	18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737	..	19.079	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.84
February	5.377		5.228		21.413	
March	5.250		5.100		21.460	
April	5.113		4.963	..	21.569	
May	5.074		4.924		21.393	
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06		14.12		14.08	
March	15.07		13.94		14.10	
April	14.90		13.90	.	[illegible]	.
May	14.90		13.90	.	14.27	
June	14.90		13.90		13.96	.
July	14.90		13.90		13.90	.
August	14.90	.	13.90		14.08	.
September	14.90		13.90		14.03	.
October	14.84		13.75		13.97	.
November	14.59		13.43		13.83	.
December	14.70	.	13.45		13.83	.
Year	$14.88		$13.78		$14.01	

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The Engineering and Mining Journal

VOLUME 99 FEBRUARY 13, 1915 NUMBER 7

Mining Laboratory of the Missouri School of Mines

By C. R. Forbes*

SYNOPSIS—An outstanding feature of the laboratory work at the Missouri School of Mines is the practical work of drilling and blasting at the mine plant: other laboratory courses include work in compressed air, mine rescue and first aid. It is not aimed to make miners of the students but to give them a practical familiarity with mining tools that is not obtainable from books or mere observation.

Student Drilling in the Missouri School of Mines' Tunnel, Rolla, Mo.

One of the greatest difficulties in the teaching of mining is the lack of laboratory equipment to bring out the practical application of theories advanced in the class room. A number of the mining schools in this country are so fortunately situated in mining districts that this laboratory equipment is supplied by the mines themselves, although it is a question whether even laboratories of this kind are entirely sufficient, because the students in most cases can only be permitted occasional brief observations of mining operations and it is not possible to afford them the opportunity of actually carrying on any of the work themselves.

As there are no mines of consequence near the Missouri School of Mines at Rolla, a mining laboratory was deemed essential to supplement class-room work, and for that purpose the equipment herein described has been provided.

Four Laboratories Established

For class-room use there is the usual equipment of models showing mining methods, timbering details, headframe construction, explosive exhibits and a lantern with moving-picture attachment for showing mining operations.

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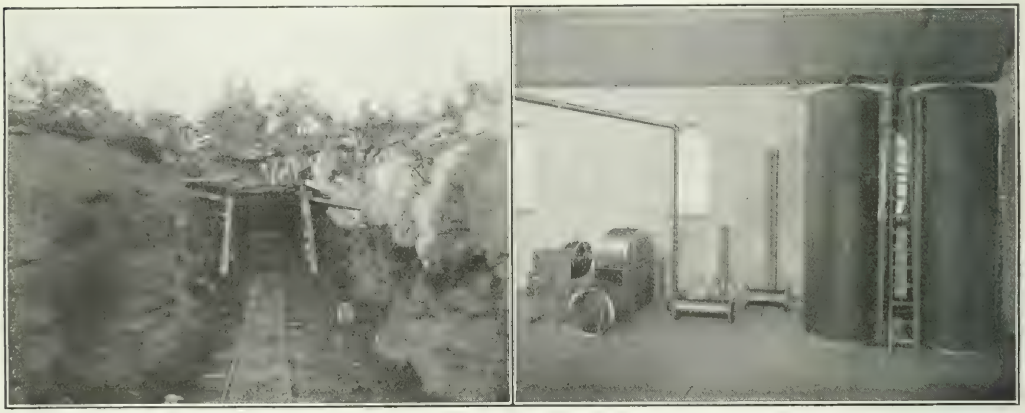
*Professor of mining engineering, School of Mines and Metallurgy, University of Missouri, Rolla, Mo.

It is always a problem in teaching to decide what to give to students and what to leave for them to gain from practical experience. Obviously, in a four-year course which includes the fundamentals and many "culture" subjects, it is not possible to devote sufficient time to cover thoroughly many branches that would be desirable. To meet the needs of some of the more important phases of mining work, four laboratories have been equipped as follows.

Mine-Rescue and First-Aid Laboratory

In accordance with the safety-first movement that has been making such rapid strides in the last few years, it has been deemed advisable to establish a mine-rescue and first-aid laboratory, where instruction is given in the use of breathing apparatus and in first aid to the injured. The equipment consists of three helmets, including a Dräger, Fleuss and Westfalia, a Pulmotor and all necessary first-aid supplies and charts. The time devoted to this laboratory does not exceed one afternoon a week for six weeks, but this is sufficient to familiarize the student with mine-rescue apparatus and to give him a fair knowledge of the principles of first aid.



Part of the Mining Laboratories of the Missouri School of Mines

Opencut and entrance to tunnel being driven by students

Displacement tanks and mine fan in compressed-air laboratory

Rock-Drilling Laboratory

On account of the importance of rock drilling in metal-mining operations, and also because it can readily be carried on in the laboratory, much stress is laid on this branch of the work, for which the following equipment is used: Piston drills: Ingersoll-Rand 2¼-in. auxiliary-arc-tappet drill; Ingersoll-Rand C-110 Butterfly; Sullivan 2¾-in. tappet; Sullivan 2¼-in. differential-valve, with steam and air front heads; Sullivan FF-12 with water attachment; Wood, 2¼-in. spool valve. Hammer drills: Stopers—Waugh 16-V; Sullivan DA-21 with reverse feed; No. 7 Water Leyner; hand hammer drills—Ingersoll-Rand Jackhamer; Hardsocg; Cleveland.

In addition, there are three drills in section showing valve motion and construction, including a Sergeant tappet valve machine, a Sullivan differential and a Murphy valveless hammer drill.

This equipment has been purchased from time to time as improvements have been made by the manufacturers, and although not complete, embraces most of the different types of air drills in use at present. Later it is planned to purchase electric and gasoline drills.

For the work of drilling, large blocks of red granite about 4x4x5 ft. are imported from southeast Missouri. Two drilling frames for supporting the machines on column and arm have been constructed—one under cover in a frame building and the other out of doors. In order to use the stopers, it is planned to place a rock over a concrete-lined pit of sufficient depth to provide head room for operating these machines.

For sharpening steel, besides the usual hand tools, there is a Leyner-Ingersoll 5-A sharpener with a complete assortment of dies and dollies for forming various-shaped bits including the cross, X, Z, bull, five-point, six-point, eight-point, high-center and single- and double-chisel bits, as well as parts for shanking Leyner, Jackhamer and piston steels.

The work done in this laboratory consists in sharpening steel both by hand and with the sharpener, and in drilling with the various machines. No attempt is made to drill a great number of holes, but the work consists in measuring cutting speeds with different bits and air pressures, noting variations in length and number of strokes under varying conditions and measuring air consumption. For this purpose a Sullivan air meter is used and an electrical device designed at the school is used for counting the number of blows of the drills.

The amount of time spent in the laboratory does not exceed 3 hr. a week or one laboratory period for one semester in the regular course, but much use is made of it in thesis work and interesting results have been obtained on the cutting quality of different-shaped bits.

Compressed-Air Laboratory

The use of compressed air is so important in mining operations that the school has deemed it advisable to equip this laboratory with apparatus that would be suitable not only for students' use, but also for purposes of research and investigation.

A Sullivan WB-2 straight-line air compressor of 290-

cu.ft. capacity supplies air for this laboratory as well as the rock-drilling laboratory, and a Laidlaw-Dunn-Gordon compressor used by the school in pumping from a deep well is placed in the same building and furnishes a different type for study.

The principal feature of this laboratory is the two measuring tanks, 15 ft. high and 5 ft. in diameter, shown in the accompanying photograph. With these large displacement tanks accurate measurements of air for the determination of orifice coefficients and various other experiments can be made. The apparatus was designed by Prof. E. G. Harris, head of the civil-engineering department. Another interesting installation in the compressed-air laboratory is the mine fan shown in the photograph. This is a 36-in. single-inlet Sirocco, directly connected to a 35-hp. variable-speed motor, and has a capacity of 20,000 cu.ft. against a 4-in. water gage. Two styles of runners with vanes at different angles are provided for experimental work. The fan is used in the regular laboratory work, where its efficiency is determined under varying conditions, and also for experimental work in air measurements, and the standardization of large orifices.

MINE PLANT

The fourth mining laboratory is perhaps the most interesting in that it is more or less of an experiment and involves features that are radically different from similar laboratories at most other institutions.

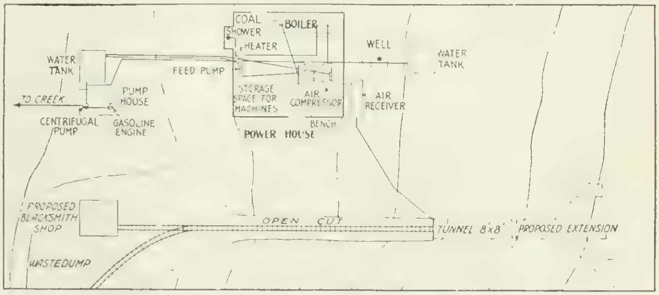
The plant is situated about 1½ miles from the school, which was the nearest point available where rock of a suitable nature could be found. A tunnel is being driven into the hillside, as shown in the engraving. The rock is a pitted dolomite, and although not particularly suited to the purpose, was the best available. At present the tunnel is in about 50 ft., practically all of this distance having been driven by students working one day a week for 12 weeks.

The power plant for running the machine drills used in the tunnel is shown in the accompanying plan and consists of a 50-hp. Erie fire-tube boiler and an Imperial type 10 Ingersoll-Rand air compressor of 100-cu.ft. capacity. Water for the boiler is pumped from a nearby stream with a centrifugal pump driven by a small gasoline engine.

In designing the power plant, an endeavor was made to introduce as great a variety of machinery as possible, as the operation of the power plant is considered one of the most valuable features of this laboratory work, being done entirely by the students. It is the intention to install a small engine and generator for furnishing lights and running an electric drill, in order to increase the drilling capacity of the plant and also to afford a greater variety of machinery.

As before stated, the lack of important mines in the immediate vicinity was the principal reason for installing this plant in the first place, but I am now of the opinion that such a plant would be desirable even though there were mines accessible. However, opinions may differ on this point; it is argued, and with good reason, that the student should not be required to spend a large part of his time at work partaking of the nature of manual labor or of learning a trade, and that he should be taught principles and theories only; also that he might obtain employment and receive pay for similar work and learn more at the same time. This is no doubt true, but the course is elective and is designed to give those students a chance at practical work who for some reason or other have neglected getting it for themselves. It is not the aim in this or in the rock-drilling laboratory to make miners and drill runners out of the men, and it is not claimed that this work should take the place of future practical experience, for the greatest benefit of that work is not gained in the laboratory, namely, the association with men, an insight into the point of view of the laboring man and a knowledge of what constitutes a day's work.

The total time spent in the mine-plant laboratory is about the same as in the rock-drilling laboratory, but instead of working the usual 3-hr. period, from 9 to 12 hr. are put in at a time, as a 3-hr. period is entirely too short for this kind of work.



MINE PLANT OF MISSOURI SCHOOL OF MINES

The work now being done by students consists in drilling, both by hand and with the different machines, blasting, timbering, laying track and operating the power plant. Most of the mucking is done by laborers in the interim between laboratory periods.

At present all efforts are being expended towards driving the main heading, but as soon as a suitable "back" has been obtained, drifts will be turned to the sides as shown in the sketch and then work can be carried on in several places at once. This will permit the assignment of individual places to parties of two or three men, who will be held responsible for their place and will be required to do a certain amount of work therein.

Eventually, it is planned to make the work largely experimental; different explosives will be used and their products of combustion analyzed; different methods of placing holes for blasting will be tried; time studies of drilling operations will be made and cost records of the work will be required. In addition to this the work of sharpening steel, timbering, mucking and track laying, together with the experience of running the power plant, will afford a greater variety of work than could ordinarily be obtained in a reasonable length of time in practice, and it is my firm belief that this work will be worth while if for no other reason than that it will do away to a large extent with that well known contempt of the average miner for the college man who so often is painfully ignorant of all practical details of mining.

Labor and Power Used in Cyanide Mills*

By Herbert A. Megraw

SYNOPSIS—Labor is one of the most variable of factors in ore treatment and depends upon plant location and chronological order, as well as upon the class of labor employed and its position in the scale of civilization. The actual figures vary from 6 to 23 tons handled per day per man employed. Power is also variable, but not so much as labor. It varies from 1 to 2.5 hp. for each ton of ore treated.

The amount of labor required to operate a cyanide mill varies in accordance with a number of different factors, and it is quite probable that there are no two mills, however similar they may be in a general way, that use the same details throughout. The kind of labor available is itself an important factor as may well be imagined, and it is quite clear that mills operating in Latin-America, those in the Orient and those in countries which may be presumed to be supplied with intelligent labor skilled in mining and metallurgical work, will have entirely different experiences with the labor factor.

The difference between the labor output in a community trained to mining and metallurgical usages and in one untrained in them is wider than might be imagined. In the mining camps of the western United States, for example, the ordinary workman is comparatively familiar with the general principles of mining and metallurgy and it is no great effort to him to pick up the particular characteristics of any process he may not already be familiar with. The consequence is that he provides an extremely high-grade labor factor in every way. On the other hand we may consider the labor formerly available in the mining districts of Ontario, such as Cobalt and Porcupine, and also that of the southeastern United States, Virginia, North Carolina, Georgia and Alabama. In all of these localities a class of labor exists that is highly intelligent, quite as much so as in the Western States, but which is by no means accustomed to the usages of mining and metallurgy. This class of labor has to be taught not only the details of the particular process involved, but the general principles of all mining and metallurgical processes, before it becomes efficient enough to compare in any way with the Western supply. The cyanide mills of Cobalt and Porcupine, in particular, have had this difficulty and have had to depend in large measure upon labor imported from the Western United States to form a ground work for the educating of the community. Labor of this class has not the same high factor as the labor in the West and cannot be expected to have until the community in general has grown so used to mining and metallurgical methods that it will have become a kind of second nature to them.

Native Labor a Variable Factor

Handling native labor of different characters leads to an estimation of the comparative value of many different classes. In Mexico, for example, there exists in the mining country a large class of laborers thoroughly familiar with mining and metallurgy of a kind, but in neither case up to modern standards of efficiency. These people have to be educated into the methods used in modern plants, a procedure which is more or less difficult according to the locality in question. The physical quality of the Mexican has a great deal to do with his efficiency, and his methods of living, food supply, etc., tend to depreciate his value. Adding to this the fact that his intelligence is not up to the highest requirements, the total is a labor factor which is of distinctly lower efficiency than that of many other metal-mining communities.

Proceeding south in Latin America, the labor factor is found to vary astonishingly, without apparently vital dependence upon natural conditions. In general, it may be said that tropical labor is less efficient than that in temperate or colder zones, the reasons being that less energy is required to maintain life and comfort in tropical countries, and the natural tendency is toward depreciation. Therefore, it may be generally said that the nearer one approaches the equator, the less efficient is the labor. The altitude also has an appreciable effect, and it may be noted that the laborers of San Salvador, for instance, nearer the equator and in a hotter country, are more efficient than the natives of the lower-central Mexican highlands. Proceeding south, the labor is found to be less and less efficient, possibly reaching a minimum in the extremely high and barren country of Bolivia, where the supply available for the tin-mining industry is said to be extremely inefficient. South of this, as the more temperate zones are reached, the mining country not quite so high, and living conditions better, the labor improves rapidly.

In the Orient, in India, Chosen, and other such countries, the labor is found to be extremely inefficient. There is a theory obtaining among workers in various lands that the unit of labor accomplished costs about the same amount of money wherever it is purchased. For example, a rice-fed coolie, earning perhaps one-eighth of the daily wage of a high-grade, intelligent European or American workman, will perform only about one-eighth of the amount of labor. While this may be true in occupations which demand physical strength and endurance, such as heavy construction on railroads, docks, etc., it does not apply so much to metallurgical plants where the endurance requirement is not high. The work is comparatively easy in a physical sense, and the ordinary unintelligent native laborer can perform the routine operations after he has had suitable instructions. Of course, these people cannot equal the work accomplished by the skilled and civilized workmen, either in amount or quality, but aside from a greater or less amount of increase in actual numbers, the most important effect upon the labor situation is the requirement of more skilled superintendence. The civilized and intelligent laborer is to a great extent his own superintendent, but the low-grade operator requires guiding.

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*This is the nineteenth of a second series of articles by Mr Megraw. It deals with the comparative details of cyanide practice, discussing points of possible improvement. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, 1913; Jan. 31, Mar. 7, Mar. 21, Apr. 25, May 23, June 20, July 25, Aug. 29, Sept. 12, Oct. 17, Oct. 31, Dec. 5 and Dec. 27, 1914. The next and last article of this series will deal with "The Cost of Cyaniding," and will appear in the issue of Mar. 13, 1915.

Large Use of Low-Priced Labor

The greatest increase of labor found in native-operated plants is perhaps largely due to the tendency of managers and designers to make use of unskilled labor in place of modern and highly developed machinery. All over Mexico, and Latin America in general, and in the East, native labor may be found performing the tasks which are usually, in civilized countries, performed entirely by machines. Thus, in Mexico, one sees sands packed around by natives rather than handled on belt conveyors or other labor-saving machinery. There is no hesitation in emptying and cleaning out slime tanks with gangs of native laborers. In India, slimes are excavated from settling tanks and transported by natives in rush baskets, a procedure that could be avoided by the installation of proper machinery, but which is continued with the humanitarian idea of giving work to the largest possible number of people. In view of the fact that it is cheaper than can be accomplished by machinery in many cases, and allows the installation expense to be avoided, there is no economic objection to the procedure. However, when one comes to consider the labor factor in reference to the tonnage handled in a mill, it is quite clear that due consideration must be given to the location of a plant; that is, the country and class of labor at hand.

Influence of Plant Design

Aside from the large factor of labor character, there is the one of plant character. A plant of the old type will naturally make use of a much greater quantity of labor than one equipped in the most modern manner. But before considering this statement as usually true, it might be well to look about and find out just exactly what the facts are. Most operators will be surprised to find that, in reference to the number of tons treated per man employed, some of the older plants are doing much better than some of the most modern and uptodate. It is at this point that it must be realized that the scale upon which treatment is carried out also makes a vital difference in the labor factor. A plant handling ores on a magnificent scale will accomplish the handling of a much greater tonnage of material per man employed than a plant operating on a small scale where the same system is used. This is true even leaving out the factor of superintendence and fixed outside employees, which is, of course, much smaller in the large plant than in the small one.

The Effect of Topography

In addition to the chronological situation of the plant, another factor which has to do with the labor employed is the topographical condition under which it was designed and built. Generally speaking, plants built in flat country require more labor for their operation than do those which are built in a country which supplies convenient grades for gravity operations. It is, of course, not intended to imply that labor is employed in elevating pulp or solutions, but where much of this work is to be done, labor is certainly required to care for the machinery with which the work is performed. Pumps of all kinds require a good deal of attention and so do elevators of the belt, or air-lift types, tailings wheels, and all other kinds of machinery required to raise pulp, solution or dry ore.

In considering the examples which will be mentioned here showing the number of tons handled in the mills per man employed, one or two facts must be borne in mind in order to assure one's self that the conclusions drawn from the facts presented will be properly influenced by a fair estimate of the conditions. These figures reflect data which have been reported from the different plants mentioned, but they have not all been recorded at the same time, as there may be a year, or even two years, of difference, not more, between the earliest and latest of the reports which have been received from the plants mentioned. Naturally, every effort is being always made to improve working conditions and reduce costs, and in some of the plants better results may have been secured since these reports were made. There is no difference of large importance, however, that has been reached in any of the plants, which would tend seriously to alter the figures, and they are, while perhaps not accurate in some cases, so nearly so as to serve very well as bases of comparison.

Tonnage Handled per Day per Man

To begin with, the Homestake mills treat about 4500 tons of material per day. The ore is treated partly as sand and partly as slime, and in the procedure about 275 men are reported to be employed. This gives a total of 16.3 tons per day handled per man employed. Of course, it must be remembered that the Homestake plant is not a homogeneous unit, but consists of various works built at different periods and distributed through a large district. This is a factor which prevents the maximum efficiency, but, on the other hand, there are conditions which tend in the other direction. These are the enormous scale of working, which permits of economies not available to the ordinary small plant, and the system of slimes treatment, which is in Merrill presses requiring very little labor for their operation. These presses, as it is well known, are filled, treated and discharged mechanically, and the only labor required is the careful superintendence of the operation and an occasional cleaning of filter cloths.

Perhaps as an example of what can be done in a plant similarly designed and worked, but of one compact, good-sized unit, we can refer to the Pittsburgh Silver Peak mill at Blair, Nev. This mill treats 520 tons per day by exactly the same system in use at the Homestake mill, with perhaps some minor variations, but in general the same plan. Crushing is in water and sands and slimes are treated separately, sands by leaching and slimes by treating in the Merrill filter press, just as at the Homestake. The Pittsburgh Silver Peak mill employs 22 men. This results in a unit of 23.3 tons treated per day per man. This factor is an extremely high one, and reaches nearly the maximum of ordinary work. One or two of the most modern systems may be able to equal or perhaps slightly exceed this figure, but it is one that is extremely hard to improve.

The Wasp No. 2 mill, in the Black Hills, presents a totally different example of ore handling. As is well known, this mill crushes 500 tons of ore per day through rolls to pass about a ¼-in.-mesh screen, and leaches this product, without further grinding, in large tanks. Twenty-five men are employed, giving a unit of 20 tons per day per man.

An Old Separate Treatment Plant

As an example of a plant of the older type crushing with stamps, regrinding to a certain extent, leaching the sands produced and treating the slimes by agitation and filtration, attention may be called to the Desert mill, at Millers, Nev. This mill has recently been changed into a more modern plant, but reference is here made to the system employed before the change was made. The mill handled 500 tons per day and required 64 men for its operation, resulting in a unit of 8 tons per day per man. It is to be noted that this mill had all the disadvantages of old-type of design, treatment of slimes in mechanically agitated tanks, a vacuum leaf-filtration system, and a flat mill site, which made necessary the use of many elevating devices, such as pumps, elevators and even tailings wheels. Labor was also required in handling the tailings discharged due to the flat nature of the country.

At the Black Oak mill, Soulsbyville, Calif., a modern, all-slime plant built upon an inclined mill site, and treating 85 tons per day, seven men were required, giving a labor factor of 12.1 tons per day per man. At the Goldfield Consolidated mill, which is well known as an all-slime plant, 952 tons are treated daily, with 53 men, giving a labor factor of 18 tons per day per man. This is without considering the concentrates-treatment plant, which of course must be considered as a separate item. If the concentrates-treatment plant is included, the unit is reduced to 13.6 tons per day per man. In keeping with the other plants mentioned, however, it is fair to consider only the mill itself without the concentrates plant, since all the others are considered without accessory or auxiliary institutions, thus giving us the figure of 18 tons.

Effect of Grinding in Chilean Mills

At Stratton's Independence mill, at Cripple Creek, Colo., about 10,000 tons are treated monthly, the grinding being done in chilean mills and the treatment being separate. The sands are given a light leaching and the slimes treated by agitation. Here 35 men are employed in the mill, giving a unit of 10 tons per day per man. At the Liberty Bell mill, Telluride, Colo., the figure was 13.1 tons per man per day before recent improvements were made in the mill treatment-system. At the Montana-Tonopah mill at Tonopah, the factor was 7.4 tons per day per man, and at the Nevada Hills, at Fairview, 6.5 tons per man per day.

The Tom Reed plant, at Oatman, Ariz., had a factor of 9.4 tons per day per man, the Nevada Wonder, at Wonder, 7.33 tons per day per man, and the West End Consolidated, at Tonopah, a factor of 8 tons per day per man.

It may be seen from these figures that, as a rule, the large plant has an advantage over the small one in the number of tons milled per employee per 24 hr. The old-style plant, if it may be typified by the Desert mill before its recent change, may be called one of the most inefficient types from this point of view. Other plants have a somewhat lower factor of labor treatment, but they are much smaller plants and are built without the most modern conveniences.

Amount of Power Used

The matter of labor in cyanide plants is important, but not more so than the question of power consumed for the work accomplished. It should be unnecessary to remark that power requirements are influenced by as many different conditions as are the labor requirements. Plants of the older type usually require more power than the modern ones, but while the plant operated on a large scale may require somewhat less power than the small one, the difference is not so great as might be expected, since about the same amount of power is required to treat a ton of ore whether the plant be large or small, always provided the same system is followed in each case.

The question of mill design does make a very great difference in power consumption. It may be noted that, generally speaking, the mill which uses stamps as crushing machines requires more power than the mill which uses breakers and rolls in series, and chilean mills for grinding. It is also to be noted that the all-slime mill must require more power per unit than the mill making a separate treatment of sands and slimes. The fact that one mill requires more power than another one, or more labor, is by no means condemnatory of the milling practice, since its power and labor expense may be more than offset by an additional recovery which makes the high cost of power or labor quite justifiable.

Some idea of the comparative consumption may be had from the fact that Stratton's Independence mill, Cripple Creek, using chilean mills, consumes only about 1 hp. per ton of ore crushed per day, possibly a little less, while at the Desert mill, using stamps and regrinding, 1.54 hp. was used per ton of ore milled per day. The latter factor is exactly the same at the Black Oak mill, which is much smaller, but is a much more modern type of mill. At the Montana-Tonopah 2.28 hp. was used per ton of ore milled per day, and at the Nevada Hills, 2.12. The Goldfield Consolidated mill required 1.77 hp. for each ton milled, not taking into account the concentrate plant, as has been heretofore explained. The West End mill, at Tonopah, used 2.33 hp. per ton milled, and the Nevada Wonder used 2.09. The Vulture mill, at Wickenburg, Ariz., used 1.6 hp. per ton of ore milled per day.

As has already been mentioned, it must be fully borne in mind that the figures presented, while representing the best available information, must not be taken as absolutely accurate at the present time, since changes may have been made which might alter the factor somewhat. The figures in cases of both labor and power are, however, extremely interesting as affording an indication of what may be expected in the different types of mills, operated in different ways and in different countries. The plants mentioned here are all in the United States but the figures do not differ widely, at least as far as power consumption is concerned, in the plants in Canada and in Mexico. In both these countries, as has already been explained, the labor unit is perhaps quite different, since in Mexico, especially, the native labor is not efficient and will not handle as many tons per day as either that in the United States or in Canada. Should Eastern countries be included in the consideration, it would probably be found that they use much more labor.

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"Mineral Lumber" Sounds Like Coining a New Term, writes Robert N. Bell, but promises a definite realization through a new process that is being applied to an extensive deposit of short-fiber asbestos in the central Idaho pine forests, on state land in Clearwater County, where an ingenious process has been developed for pulping the mineral and pressing it into any shape. Subsequent furnace treatment affords a fireproof material. Shingles are being produced from this mineral which compete in price with ordinary red-cedar shingles, and the use of building material manufactured from it is likely to result in the establishment of a new and important industry.

Chloridizing Blast Roasting and Leaching--II

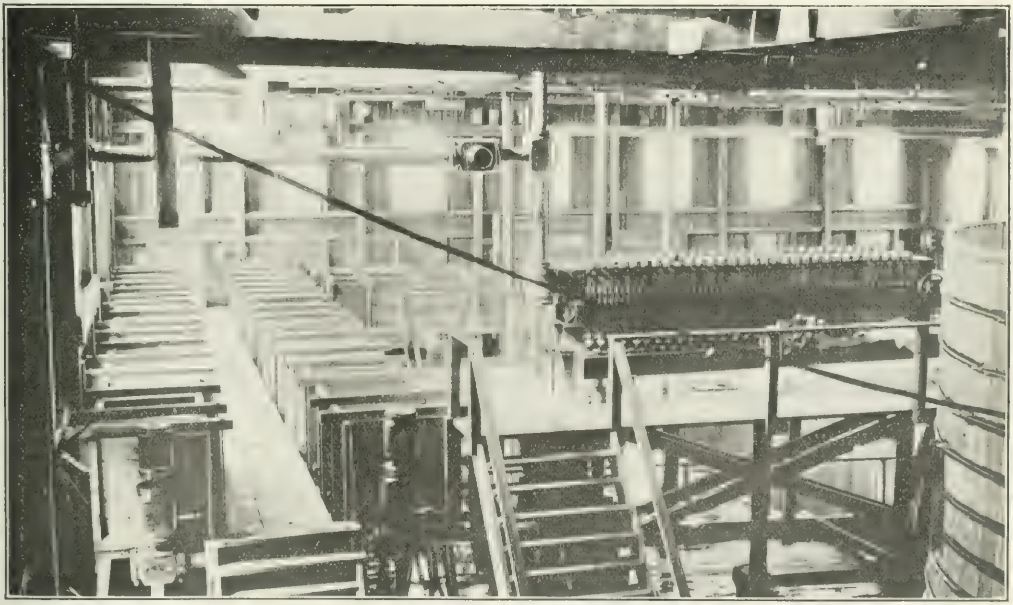
By Glenn A. Keep*

SYNOPSIS—Details of leaching and precipitation at the Mines Operating Co.'s mill at Park City, Utah. Testing ores for chloridizing blast roasting and leaching. A series of curves shows the results of extended experiments on the process at the Utah School of Mines.

Leaching at the Mines Operating Co.'s plant is conducted in six Douglas-fir tanks, each 20 ft. in diameter and 12 ft. deep. The wood was not in the least affected by the mill solution, but care should be taken that no solution is allowed to leak on the iron tank bands as this solution carrying copper, silver and lead quickly attacks iron. Douglas-fir 4-in. wood-stave pipe is used to conduct the solution to and from the leaching tanks. Rubber-lined hose is not affected by the solution, and this hose, fitted with an iron screw clamp, is used to control the flow of solution to and from the tanks. The hose is clamped by an ordinary brass hose clamp to a hardwood nipple fitting into the wood pipe at one end and the hose at the other end. Leaching is done with a sodium-chloride acid solution of a specific gravity of 24° Bé. The Baumé readings are taken with a sugar hydrometer. Experiment and experience shows that a 23 to 24° Bé. solution has the best dissolving effect upon silver chloride. If the solution gets denser, say 27 to 29°, an unknown salt crystallizes out in the pipe lines and at the air inlet of the air-lift pumps. These crystals are nearly insoluble and their formation should be avoided by keeping down the density of the solutions. This crystallization, of course, shows up most where the solution is coolest.

Solution Should Be Warm, 30° C. or Over, and Slightly Acid

The temperature of the solution should be maintained at 30° C. or above in order to do good work, and also must be slightly acid. If the hot roasted ore is sluiced by solution direct from the roasters to the leaching tanks, no external heat is needed to keep the solution at its proper temperature, except during the winter time in a cold climate like that of Park City. Then an ordinary boiler under 5- to 6-lb. steam pressure will have ample capacity for a 200-ton plant. The steam is blown directly into the solution in the "silver tank" and iron boxes. Following are the ordinary solution temperatures at different places in the Mines Operating mill: Temperature of atmosphere, 17° C.; head silver precipitator, 36½°; tail silver precipitator, 35°; silver tank, 37°; head iron boxes,



An Interior View of the Mines Operating Co.'s Mill

Owing to the corrosive nature of the mill solution, metal work is reduced to a minimum; note the extensive use of wood work, including wooden pipe and fittings. The wooden-frame filter press had to be abandoned for silver precipitation because of clogging difficulties and because of brass screws in the filter frames being replaced by silver.

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*Park City, Utah.

35°; tail iron boxes, 35°; barren tank, 32°; barren at leaching tank, 31°; weak-solution tank, 35½°; nozzles at roasters, 31 degrees.

MILL SOLUTION SHOULD BE GREEN

A green-colored solution is the sign of good work and sufficient acid. If the acid is totally neutralized the solution becomes white and clear, and "iron oxide" begins to precipitate out giving the solution a reddish color; a solution of this type will not give the desired results. The precipitate of iron will first be noticeable in the iron boxes and if acid is not added, the iron precipitate will appear in all the solution throughout the mill, but disappears upon the addition of acid. A solution carrying 2 lb. of acid per ton of solution will do good work, but if the ore is basic in reaction, then enough acid must be used to neutralize this effect of the ore and to keep the solution slightly acid and maintain a green-colored solution. For several months, pyrite was added to the mix at the Mines Operating mill and enough tower acid condensed from the roaster fumes to keep the solution acid and in good shape. Later no pyrite was used and 60° Bé. sulphuric acid was bought and added to the solution in the barren-solution tank. The amount of acid added per ton of ore varied from 0.5 to 1%, depending on the amount of lime in the ore treated.

NO TROUBLE FROM FOUL SOLUTION

Tests upon mill solution show that it contains from 1 to 2 lb. of iron per ton of solution, and that this amount is practically constant. The iron taken into the solution in the iron boxes is apparently oxidized and precipitated in passing through the leaching tanks, and then carried out with the tailings. The solution contains a small amount of sodium sulphate which crystallizes out as such when the solution is cooled to a low temperature. As the iron boxes are not long enough to make a complete precipitation of lead, the barren solution still contains about 8 lb. of lead, in the form of chloride, per ton of solution. This lead can be precipitated as white crystals of lead chloride by adding water to the solution. There is a slight tendency for some of the lead chloride to precipitate in the sump tanks, perhaps due to the solution becoming saturated with lead chloride. Upon adding NH_4OH to the barren solution a voluminous white precipitate is obtained, probably aluminum hydroxide, although this was not definitely determined. During continuous operation for a period of two years no trouble whatever has been experienced by fouling of solutions at the Mines Operating mill.

In the leaching operations, "weak solution," i.e., solution low in silver, is first run through the ore until the solution carries 3 to 5 oz. of silver when the solution is pumped through the precipitating system. After treatment by weak solution, "barren solution" containing no silver is put through the tank for about 24 hr., which will give a final effluent of not more than 0.2 oz. of silver per ton of solution. The ore is now ready to be washed and water is accordingly run upon the tank, and with a charge of 10 ft. of ore, should continue until the effluent gives a reading of about 8° Bé., when tested with the hydrometer. The water is then shut off and the tank drained, the final effluent of which should run 3° Bé. The total time of washing will be 3 to 4 hr. for a charge of ore 10 ft. deep. It is apparent that water is thus put into the solution and some salt remains in the ore to be discharged with the tailings. The evaporation about the mill takes care of this extra water, and when using 6 to 7% salt in the mix, enough salt remains undecomposed in the roasted ore to take the place of the salt lost in the tailings. It is evident that a minimum of 6% salt will be required for the continuous operation of the process, in order to keep the solutions at the proper strength. No salt, then, will have to be added directly to the solution, as it will be automatically maintained at the proper strength. In case the strength of solutions does tend to vary, it can be easily regulated either by addition of more or less salt to the mix, or by varying the specific gravity of the effluent solutions with the wash water.

Three sump tanks are required: A "silver tank" containing solution rich in silver which is to be passed through the precipitating system; a "weak tank" containing solution low in silver; and a "barren tank" containing solutions from which all the valuable metals have been precipitated with the exception of some lead, which may remain in solution if the iron boxes are not long enough to catch it all or if some other means of precipitation of lead is employed. To the silver tank are run all effluents carrying enough silver for precipitation. This solution is pumped over the silver precipitator where the silver is precipitated upon scrap copper. From the silver precipitator the solution flows by gravity through the iron boxes where the copper and any unprecipitated silver are first thrown down after which lead is precipitated upon the iron. From the iron boxes the solution flows by gravity into the barren tank and is known as barren solution. This barren solution has been reduced in its passage through the iron boxes and is white and clear in color. If acid is to be added to the solution it should be added to the barren solution at this point. The barren solution is pumped directly to the leaching tank which is to be washed and discharged the following day. If acid has been added to the barren solution, the solution will be oxidized in passing through this tank and its effluent will be a deep green color. This green effluent, together with all other effluents running low in silver, is run to the weak tank from which it is pumped to another leaching tank and returned either to the weak tank or to the silver tank, depending upon its silver content.

BLEACHING POWDER USED WITH GOLD ORES

To make a high recovery upon ores containing gold, 0.25 to 0.5% of bleaching powder should be added to the roasted ore in the leaching tanks as the tanks are being filled. Gold that is not in a soluble form already is dissolved by action of the chlorine generated from the bleaching powder. Liquid chlorine was tried but with unsatisfactory results, it being both hard to handle and dangerous when used in open leaching tanks. If electrolytic precipitation of lead were employed, the chlorine evolved in precipitation would put the barren solution in fine condition for leaching purposes. Probably enough free chlorine would then be carried by the solution to dissolve any gold in the ore without the use of bleaching powder.

METALS QUICKLY DISSOLVED

If the ore has been properly roasted the metals go into solution quickly, and if the roasted ore is sluiced by solution direct from the roasters to the leaching vats, two-thirds of the soluble metals will have been extracted by the time the tank is filled. From 36 to 48 hr. will then be required to finish leaching and washing the tank ready to discharge. If this method of conveying the roasted ore to the tanks is employed, concrete launders must be used. No wood launders should be used for carrying mill solution as the nails or screws will soon be destroyed by the solution, causing the launders to leak. This difficulty cannot be overcome by use of brass or copper nails as the silver in solution replaces both brass and copper.

At the Mines Operating mill, the tailings are discharged by sluicing out with water through a 13-in. round hole in the tank bottom at a cost of 5.6c. per ton. During leaching this hole is closed by a large wooden plug fastened at the end of a 12-ft. piece of 4x4. The plug and its stem are inclosed by a vertical box 2 ft. square and 12 ft. long. This box is fitted with gates at various heights which are removable from the inside, thus making an opening in the box through which the ore is sluiced. In order that the plug may be easily removed, it is set lightly in the hole and caulked with oakum.

Filters made of wood and burlap were used for several months but were discarded in favor of drain-tile filters. This type of filter is made of ordinary 6-in. drain tile having one-half of its surface perforated with small holes. The tile is set in concrete exposing the perforated side to act as a filter. A line of tile is laid through the middle of the tank with four branches extending each way to the sides of the vat. The ends of tile are closed each by a wood plug. These plugs can be removed and a hose used to flush out the filter lines, if necessary. After a vat has been discharged, some of the remaining sand is heaped over the filters and the tank is ready for refilling.

Assay of Solutions

Several methods of assaying the salt-acid solutions for gold and silver were tried and the following adopted as the best: Put 1 a.t. of solution in a 200-c.c. beaker, add 15 c.c. saturated lead-acetate solution and about 50 c.c. water. Heat. Add Al foil and 5 to 10 c.c. HCl. When lead sponge is complete, pour off solution, roll lead into a small ball about ½-in. diameter, dry for a short time and cupel.

Titrating the mill solution for free acid is rather unsatisfactory, because the solution contains iron, aluminum, etc., all of which are precipitated by KOH solution before an indicator will work. The free acid can be approximately determined by titrating with a deci-normal KOH solution until the above precipitates just begin to form. If 10 c.c. of salt-acid solution are titrated with a deci-normal KOH solution, then each cubic centimeter of KOH used will equal approximately 1 lb. of acid per ton of solution.

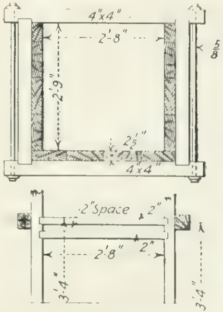
Leaching Cost from 17 to 41c. per Ton

The cost of leaching may vary considerably depending upon whether acid is condensed from the roaster fumes or is bought and added to the mill solution. The cost of leaching operations at the Mines Operating mill, including upkeep and maintenance of pumps, compressor, solution lines, etc., was 40.8c. per ton, which is the average cost for the six months ended Aug. 31, 1914. However, for a period of several months when pyrite was used in the mix and the resulting acid condensed from the fumes, the leaching cost was 17c. per ton in the summer. In the winter this cost was increased to 25c. per ton due to cost of heating the mill solution by steam. Later when no pyrite was added to the mix and no acid made in the mill, 60° Bé. sulphuric acid was bought and added to the mill solution, thus augmenting the cost of leaching 15 to 20c. per ton. About one-half of the 40.8c. cost per ton given above was for acid.

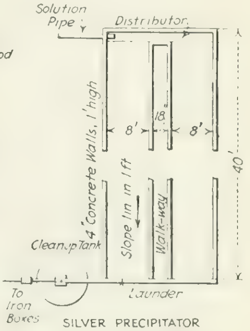
Precipitation

The silver precipitator is an inclined plane surface, 16 ft. wide and 40 ft. long, with a slope of 1 in. per ft. It is walled in on there sides and surfaced with concrete 4 in. thick. The surface is covered with scrap copper such as wire, sheets, etc., and requires only about 3000 lb. of copper, so that it is not necessary to tie up capital in a large supply of copper. The silver solution is distributed evenly across the head end and flows in a wide thin stream over the scrap copper into a concrete launder. This launder leads to the cleanup tank, a small tank 8 ft. in diameter by 10 ft. high. The solution can be run either direct to the iron boxes or to the bottom of the cleanup tank, the overflow then going to the iron boxes.

An advantage of this type of precipitator is the quickness and ease with which it can be cleaned up. The silver precipitate is white in color and extremely fine, but unless disturbed it sticks together and builds upon itself to considerable depth. When disturbed it breaks up into a fine slime and floats away. When a cleanup is to be made, the silver-solution pump is shut off and the silver is sluiced by use of a water hose into the cleanup tank which has previously been drained. Two or three men are employed to rake over the scrap copper with brooms or hoes, the water carrying the silver slimes into the cleanup tank. The whole operation takes only about 20 min. A silver cleanup is made twice each month and additional scrap copper is placed on the precipitator at each cleanup. About 2 lb. of copper are consumed in precipitating 1 lb. of silver. This precipitator will precipitate 90% of the silver from 100 tons per 24 hr. of solution carrying 3 to 4 oz. silver per ton.



IRON BOXES



SILVER PRECIPITATOR

The silver precipitate carries 50 to 60% silver, some sodium chloride and some gases, probably oxygen or chlorine. It is washed with water, dried, and is then easily melted into silver bullion, with addition of about 15% borax glass only. A Case oil-fired tilting furnace is used for melting, and bullion assaying 950 to 980 fine is obtained.

The copper going into solution upon the silver precipitator, together with the copper extracted from the ore, is then precipitated upon scrap iron in the iron boxes. The iron boxes are built similar to the zinc boxes ordinarily used in the cyanide process, but are much larger. There are two rows of iron boxes, each containing 28 boxes; each box is 3 ft. 4 in. long, 2 ft. 8 in. wide, and 2 ft. 9 in. deep. Probably an iron box could be designed which would be easier to clean up than those just described. The iron boxes are cleaned up once each month, the precipitate being washed with water to free it from sodium chloride, then dried, sacked and shipped to smelters.

Melting the copper precipitate in the tilting furnace and making granulated copper for use on the silver precipitator was tried. The granulated copper thus obtained proved satisfactory, but the wear on the graphite crucibles was so great that it is cheaper to sell the copper precipitate and buy scrap copper.

After the copper has been precipitated out of solution, lead comes down upon the iron but the iron boxes are not long enough to make a good precipitation of lead, there being about 8 lb. of lead per ton of solution in the iron-box tails. Cast iron is a much better precipitator of lead than any other iron, probably due to the carbon in the iron. The iron-box tails carry no copper and only a trace of silver. From these chloride solutions 1 lb. of iron is consumed in precipitating 1 lb. of copper.

Electrolytic Action as Precipitate Accumulates

On the silver precipitator and in the iron boxes the precipitate builds upon itself to a depth of 6 to 8 in., precipitation being carried on by electrolytic action, due to a couple set up by two different metals in a slightly acid solution. This is shown conclusively by placing a long copper wire in the iron boxes, one end in contact with the iron and the other end extending into the solution. Copper will be deposited upon the entire length of the copper wire, while the wire itself is not attacked.

To obtain good precipitation the solutions must be kept warm, not less than 30° C., and slightly acid. If the solution becomes neutral, iron oxide will be precipitated throughout the iron boxes, which will, however, go back into solution upon making the solutions slightly acid. If the solution becomes cold, action will slow down, and precipitation will be incomplete.

Lead can be readily precipitated from the barren solution by an electric current, using carbon and lead electrodes. Chlorine is evolved and the solutions put in good shape for use in leaching. However, this was determined only in an experimental way using wet batteries and jars as precipitating vats.

The total cost of precipitation and cleanup including drying and sacking the product is 5.1c. per ton of ore treated. The cost of refining the silver precipitate in the Case tilting furnace is 8 to 10c. per ton of ore treated. Before the silver precipitator was put in operation, the silver, copper and lead precipitates were mixed and sold to smelters. However, the smelters claim that this mixture of precipitates is exceedingly hard to handle on account of its high silver contents. Hence it was decided to separate and refine the silver at the mill and sell the silver bullion, which operation nets about 1c. more per ounce of silver produced.

At the beginning of operation at the Mines Operating mill, precipitation of silver upon cement copper in a wooden filter press was attempted but soon discontinued. The plan was to use the cement copper from the iron boxes in the filter press to precipitate silver. The cement silver, together with the salt in solution, would soon render the filter cloths impervious. Also the solution soon destroyed the brass screws with which the wooden filter frames were fastened together.

Compressed-Air Pumping Adopted

Pumping salt-acid solution containing silver and copper in solution proved a rather difficult problem. Centrifugal pumps made of bronze, in handling a solution rich in silver, have had their casings worn out in less than 40 hr. of continuous pumping. This rapid wear is not due to action of acid, but to silver in solution precipitating and replacing the metals of which the pump is constructed. This precipitation of silver is rapid in a centrifugal pump where the agitating and scouring action of the pump always presents a clean surface upon which the solution can act. Experiments were made with a wooden Cornish pump and a wooden plunger pump. Although both these pumps worked, neither was a success on account of frequent breakdowns and excessive repair work, all of which interfered with smooth operation of the mill. The problem was successfully solved by the use of the ordinary Pohlé air lift. The lifts are made of Douglas-fir wood-stave pipe, using large solid wood ells and tees. Air is conducted from the main air line to each pump by a rubber-covered and rubber-lined hose.

There are five of these air lifts in the Mines Operating mill. Air is furnished by one 12x12-in. compressor, requiring 28 hp. and furnishing air at 25 to 30 lb. pressure. The five pumps are used for the following purposes: One pump pumps the rich silver solution to the silver precipitator; another takes the barren solution to the leaching tanks, and three working in relays pump the weak silver solution either to the leaching tanks or to the roaster for use in sluicing the roasted ore from the roasters to the leaching vats. The first and second pumps are constructed of 3-in. wood pipe and handle 400 to 500 tons of solution per 24 hr. The last three pumps are constructed of 4-in. wood pipe and handle approximately 1000 to 1500 tons per 24 hr. The first two have a submergence of 50% and the others a submergence of 60%. These pumps handle the solution in a satisfactory manner; however, it is well to point out that no solution should be allowed to leak on the iron pipe bands; also, as said before, the density of the solution should be kept near 24° Bé. to prevent crystallization of an unknown salt in the pump lines, but more especially in the air hose at the point where the air enters the pump.

Suction Fans with Concrete-Covered Blades

Trouble was experienced in finding a suction fan to handle the roaster gases especially when pyrite was used in the mix. These fumes are warm and contain much water vapor and small amounts of chlorine, sulphur fumes, hydrochloric and sulphuric acids. Fans with both iron and brass runners were discarded on account of the corrosive action of the gases on these metals. If the gases were hot, as from Dwight-Lloyd sintering machines, it is possible that iron would then resist this destroying action. However, this is doubtful on account of the chlorine present in the fumes from a chloridizing roast. A fan made entirely of hardwood, fastened together by wooden pins, did good work for six weeks. Then the wood runner became soft and rotten and was consequently wrecked by centrifugal force.

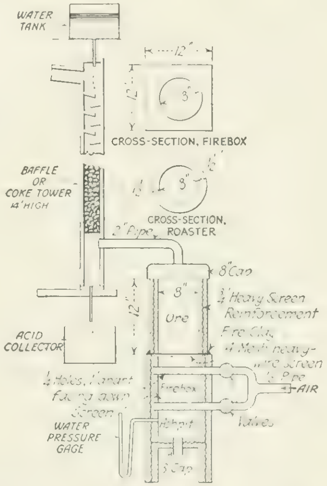
A fairly satisfactory fan was then designed and put in operation. The housing of this fan is built of 4-in. fir. The ends of the housing are constructed of 4x12-in. lumber and are dapped into the circumference which is made up of 4x6-in. lumber. The housing is held together by two ¾-in. iron bands encircling the circumference. The runner which is 52 in. in diameter has five blades, each fastened to two 3-in. T-irons, which are cast into two cast-iron hubs. The blades, 29 in. long by 19 in. wide, are made of ¼-in. sheet steel, and are drilled with $\frac{3}{16}$-in. holes spaced 4 in. apart. When the runner has been assembled, the shafting inside the housing, the cast-iron hubs and the T-irons are all incased in concrete. Rainbow-gasket sheet rubber, ⅛ in. thick, is bolted to the face of each blade. This rubber facing lasts from four to six months when it begins to stretch and bulge and finally cracks, due to air getting between the blade and the sheet rubber. The rubber, however, seems to have its usual toughness and appears in good condition. The rubber facing is replaced and the fan is again ready for use. Heavy wood blades, 1½ in. thick, were given a trial on this type of fan, but soon became water-soaked and soft. Several acid-proof paints were tried but none proved satisfactory. A promising material for fan blades is a rubber-covered sheet iron to which the rubber has been vulcanized. A set of five blades with ⅛-in. rubber cover, vulcanized on both sides, will cost $45, and would no doubt wear a long time, although no trial has yet been made. The fan now in use requires 6 hp. when running 300 r.p.m., and will handle satisfactorily the fumes from three 10x10-ft. blast roasters, using a ¾-lb. blast of air on a 6-ft. bed of roasting ore.

TESTING ORES

A small roaster for testing purposes can be easily constructed where air under pressure is available. The accompanying drawing shows such a roaster and is self-explanatory. The reinforcement for the concrete is heavy wire screen with ¾-in. openings, which should be lapped and thoroughly wired together to prevent both the roaster and firebox from cracking.

In conducting a roast, pieces of wood 3 or 4 in. long, are placed upon the lower screen to a depth of 8 to 10 in. The wood is ignited and a small amount of air turned into the lower blast pipe. The upper screen and empty roaster are then put in position, a little fireclay being used to cement the crack between the roaster and firebox. More air is then turned into the lower blast pipe, and some air in the upper pipe. When the upper wire screen is heated to redness, the air blast is turned down slightly and 3 to 4 in. of the prepared mix of ore, fuel and salt are charged into the roaster on top of the red-hot screen. When the ore has been evenly ignited and is roasting satisfactorily, the remainder of the mix is charged into the roaster, the lower air blast is shut off and the proper amount of air admitted through the upper blast pipe. A U-shaped glass water-pressure gage can be used to determine the amount of air pressure, about 1 in. of water pressure being required after the roast has received a good start. However, with a little experience the proper amount of air can be readily regulated by noticing the fumes coming off the top of the ore. At first the fumes will be dense due to the wood smoke, but after the wood has ceased burning, the fumes may be hardly noticeable. However, the ore is roasting, which fact can be tested by feeling the heat coming up through the ore. If the ore contains sulphides, some of the sulphur will be distilled off ahead of the roasting zone and sublimed in the green ore near the top. Therefore when the zone of roasting nears the top the fumes will become dense and smell strongly of chlorine and sulphur gases. The rate of roasting should be about 1 ft. per hr. With a little experience the temperature of the roast can be judged closely by noticing the red glow of the ore as the roast breaks through on top. The roast should be left to cool in the roaster to allow as much time as possible for chloridization to take place.

In preparing ores for roasting tests it is well to begin by crushing the ore through an 8-mesh screen. As the roast is on a small scale, it is well to crush pyrite and salt finer than 8-mesh, say through a 20-mesh screen. When no fuel is present in the ore itself, such as pyrite, run the following series of tests, using 10% of sodium chloride in each roast:



TEST ROASTER FOR CHLORIDIZING-LEACHING

TEST ROASTING CHARGES

Ore, Lb.	Coal, %	Pyrite, %	NaCl, %
20	3.0	0.0	10.0
20	2.8	1.0	10.0
20	2.6	2.0	10.0
20	2.2	3.0	10.0
20	1.8	4.0	10.0

The various reagents should be weighed on a set of scales and thoroughly mixed dry; then 7 to 10% water added and again thoroughly mixed. The amount of moisture required will vary with different ores but should be enough to make the mix feel damp and so that it tends to stick together when squeezed in the hand. As the bottom 3 to 4 in. of the roasted ore are never well chloridized, this part of the roast should be discarded before taking samples for leaching tests. The above proportions will give good roasts upon most ores, but the temperature may have to be regulated by cutting down on the percentage of coal added. Also care should be exercised in regulating the air pressure, the tendency being to force the roast by using too much air.

The series of tests outlined ought to give an indication of what extraction is to be expected. It is well to supplement these tests with a series showing the effect of coarser and finer crushing. If the ore is to be leached with a 24° Bé. salt-acid solution, then roasts should be made with varying percentages of salt, from 6 to 12%, to determine the amount of salt required. If the test is upon a copper ore to be leached with a weak acid solution or upon an ore which is to be treated with cyanide after roasting, then a series of roasts containing 2 to 10% salt should be conducted, as 2 to 5% salt will likely give the desired results.

However, in doing the roasting on a commercial scale in a roaster containing a deep bed of red-hot ore, chloridizing conditions are much more favorable than in the experimental roaster. Consequently the amount of fuel required is less, the crushing can be considerably coarser, and the amount of salt needed is 1 to 3% less than the experimental tests indicate. Where a 24° Bé. salt solution is used for leaching, a minimum of 6 to 7% salt in the roast will be essential in order to keep the solution at its proper density without adding any salt to the solution itself, the strength of solution being maintained by the undecomposed salt in the roasted ore. In the amount of acid produced by the roast is not determined, the test roaster can be run with an open top and the progress of the roast readily inspected.

The acid in the fumes can be condensed by passing the roaster gases through a baffle or coke tower in which water equal to twice the weight of the roasting ore is slowly passed and returned through the tower twice during the time of roasting. The amount of acid thus produced is determined by titrating with a deci-normal KOH solution using a phenol indicator. Of course, the condensation of the acids in the fumes is imperfect, but will compare favorably with similar work on commercial scale.

LEACHING TESTS

Leaching tests are made in glass percolators, using a wood-and-cloth filter bottom. One kilogram of the roasted ore is charged into a percolator and leached with 6 kg. or liters of salt-acid solution. This solution is a 24° sodium-chloride solution with 7½ c.c. sulphuric acid added to each liter of solution. If the ore assays high in copper, 1 to 1½% acid should be added in making the solution, which in all cases should be heated in a glass or porcelain dish to at least 40° C. before using for leaching.

The ore is percolated slowly for 6 to 8 hr., the solution being used once and not returned through the ore a second time. After leaching, the ore is washed with 1 to 2 liters of water. The rate of extraction is extremely rapid, and the first liter of solution through the ore will likely contain 50% or more of the metals. In leaching an ore containing gold, use 0.25 to 0.5% bleaching powder (chloride of lime), one-half of which is mixed with the ore in the percolator and the other half with the solution. The time of leaching for gold should be extended to 16 to 24 hr. if a good extraction is not obtained upon a short-time leach. The roasted ore loses from 5 to 10% in weight during leaching, which loss should be taken into consideration in computing the extraction of metals. If the testing work is to be extensive, the solution used in the leaching tests should be saved and its metals precipitated on iron, thus making a barren solution which, after addition of acid, should be used in all subsequent leaching tests. This barren solution containing some iron will give better results than a freshly made salt-acid solution. For the same reason mill solution used for testing work gives better results than a newly made solution.

In testing a copper ore containing only a small amount of silver, a dense salt-acid solution is not necessary as the extraction of copper depends upon the acid in the solution and not upon the salt. After a chloridizing roast in a blast roaster, all the soluble copper is soluble partly in hot water and the remainder in a very weak acid solution, but none is soluble in a hot salt solution after the ore has first been treated with hot water. The total copper extraction can, therefore, be determined by leaching with a hot weak-acid solution containing 1 to 1½% acid. If desired, the amount of water-soluble copper can be determined by leaching with hot water before the weak-acid leach. Enough salt remains undecomposed in the roasted copper ore to extract a small amount of silver if such be present in the ore.

EXPERIMENTS AT UTAH SCHOOL OF MINES

The curves shown in the accompanying charts are taken from experiments conducted in 1911 by Robert J. Goodwin under the School of Mines fellowship, and by me, working under the Col. E. A. Wall fellowship at the research station of the Utah State School of Mines at Salt Lake City, Utah. This station is at present conducted jointly by the U. S. Bureau of Mines and the State of Utah, and research work is now being done there upon chloridizing and leaching zinc and lead, so some definite results upon these metals should soon be obtained.

TOWER ACIDS

A series of tests were conducted to determine the character and amount of acids resulting from chloridizing blast roasting of ores containing varying percentages of pyrite and chalcopyrite. The ore was roasted in a small roaster similar to the one which has been described and the fumes condensed in a 4x4-in. coke tower. The ore was prepared by adding different percentages of 60-mesh pyrite and chalcopyrite to quartzite which had been crushed through a 10-mesh screen. In each roast 10% salt was used.

Plate I shows the strengths of the acids in terms of pounds of acid per ton of tower acid produced by roasting one ton of ore. The amount of sulphuric acid in the tower acid was determined by weighing the precipitate obtained upon addition of barium chloride to the tower acid. We found that the amount of sulphuric acid produced was nearly constant for the different percentages of sulphides in the ore. Accordingly the percentage of sulphuric acid, as compared to the total acid produced, rapidly decreased with increasing percentages of sulphides from 13.5% H_2SO_4 in case of 2% pyrite to 2.5% H_2SO_4 when the ore was roasted with 10% pyrite. This fact indicates that sulphuric acid produced in the roasting zone reacts with the salt to give hydrochloric acid and salt cake in the tower acid. It was found that gangue material has much to do with the amount of acid produced by a chloridizing roast and that porphyry gangues, especially a clayey gangue like a decomposed porphyry, are better producers of acid than quartzite. In some cases the acid

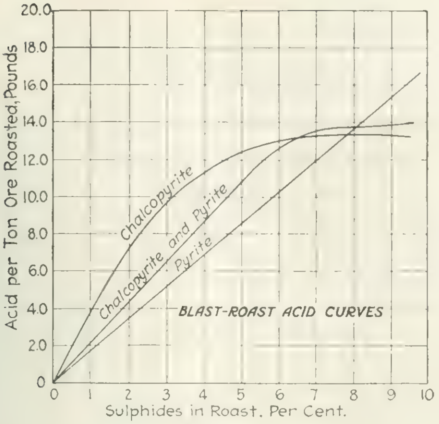


PLATE I

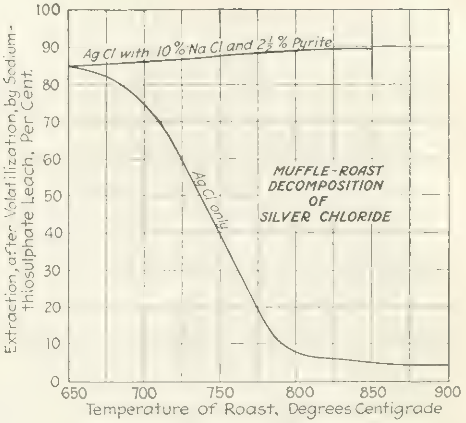


PLATE II

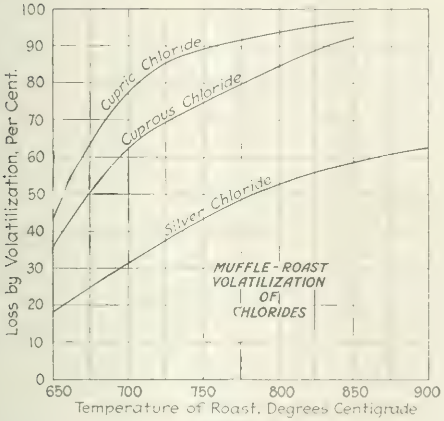


PLATE III

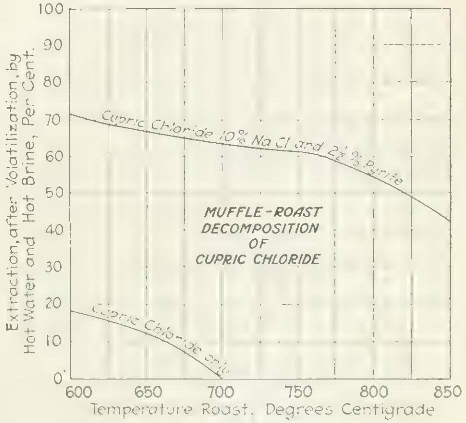


PLATE IV

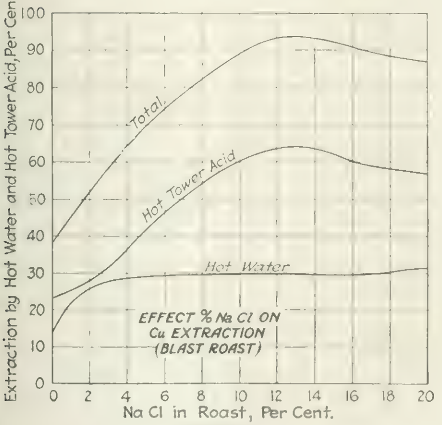


PLATE V

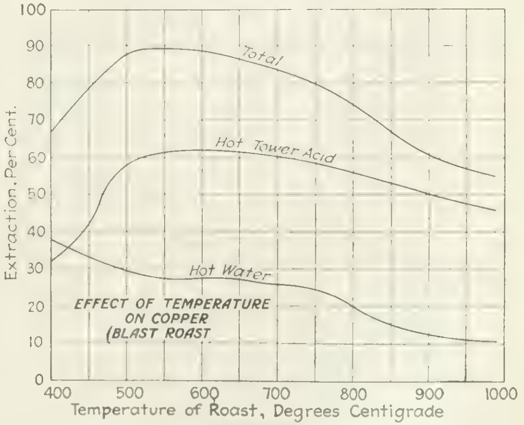


PLATE VI

Curves Showing Results of Chloridizing-Leaching Tests at Utah School of Mines made from such gangues would be three to four times the amount indicated by Plate I.

Volatilization and Decomposition of Chlorides

A series of tests was conducted upon silver and copper chlorides to determine the rate of volatilization and decomposition of the chlorides. These tests were made in roasting dishes placed in the assay muffle for 30 min. The temperature of each roast was taken by a pyrometer, the points of which were placed directly in the roasting ore. Plates II and IV show the condition of the silver and copper remaining in the ore after loss by volatilization. The silver curve indicates that silver chloride decomposes rapidly between 700 and 800° C., when a chloridizing atmosphere is not maintained in the roasting ore. Therefore a chloridizing roast to be successful must contain enough salt not only to chloridize the silver but to maintain the chloridizing conditions throughout the time the ore is heated to a high roasting temperature. The silver curve based on roasts containing 10% salt and 2½% pyrite shows forcibly the effect of maintaining a chloridizing atmosphere. In this case 90% of the silver remaining in the ore after volatilization is in the form of silver chloride at the high temperature of 850° C. From Plate IV it may be seen that cupric chloride at temperatures above 600° C. decomposes even in a chloridizing atmosphere, and that this decomposition is rapid for temperatures over 700° C. This plate also shows that cupric chloride alone is completely decomposed at 700° C. into copper compounds insoluble in either hot-water or hot-brine solution. The feature of Plate III is the rapidity and completeness of volatilization in cases of cupric and cuprous chlorides.

Chloridizing Copper

Tests were made to show the condition of copper after chloridizing the ore in a blast roaster. A typical copper porphyry ore was roasted in the test roaster, temperatures being taken by a pyrometer, the points of which were placed in the center of the roasting ore bed. The ore from each roast was leached first with hot water, and then with tower acid produced in the roasting process and condensed in the coke tower. For each pound of ore roasted 3 lb. of tower acid were made, varying in strength from 3 to 12 lb. of acid per ton of tower acid. Special attention is here called to the very weak acid solutions, containing in most cases less than ½% acid, which were employed in these leaching tests. Referring to Plates V and VI, it can be seen that approximately 30% of the copper is soluble in hot water. Addition of more salt to the ore being roasted did not increase the percentage of copper soluble in water. High temperatures reduced the amount of copper soluble in water. The copper which is soluble in water is evidently in the form of cupric chloride and copper sulphate. After leaching with hot water, no further extraction of copper could be obtained by a hot-brine solution which indicates that no cuprous chloride is formed in the ore during roasting. However, it is possible that cuprous chloride would be extracted by the hot-water leach as there always remains in the ore after roasting some undecomposed salt which would make a very weak salt solution. The copper which is soluble in the very weak acid solution is probably in the form of copper oxide and oxychloride of copper. A fact of importance is that practically no iron was extracted from the ore by the hot-water and weak acid solutions, and, therefore, these solutions are in ideal condition for precipitation upon scrap iron. It has been proved by commercial operations that 1 lb. of iron will precipitate 1 lb. of copper from these chloride solutions, and that there is no tendency for the solution to become foul by accumulation of iron in solution. The tests just outlined were not made with the intention of obtaining high extractions as no pyrite was added to the ore and the weak tower acids were in each case employed for leaching. Tests made upon this ore and other similar ores, using 5 to 8% salt in the roast, and leaching with a 1 to 1½% acid solution, have repeatedly given extractions of 96 to 98% of the copper contained in the ore on 8-mesh crushing.

A Copper Discovery in Norway

By A. D. Udhany*

A discovery of copper ore, which promises to be of considerable importance has been recently made on the island of Karmoen, which is on the southwest coast of Norway, in the neighborhood of the town of Stavanger. The discovery of the deposit was made by George Hopkins, an English mining engineer, who has lived and worked in Norway for 15 years past. So far five lodes have been located, running nearly parallel to each other in a hill which rises from the water edge rather sharply to a height of 400 meters. Near the surface these lodes vary from 4 to 15 meters in width.

Samples taken over a considerable range have been assayed at Christiania and found to carry from 4 to 8% copper, with about 50% sulphur. The ore is also free from zinc and from arsenic. The showing so far made is quite sufficient to warrant an expenditure for further exploration. It is intended to carry this out at once by running in an adit to cut the lodes at varying depths. This can be done at moderate cost, as cheap water transportation is available for all materials. The deposits are close to the sea and there is a good harbor. The owners of the mineral claims have secured sufficient land for the location of docks, storehouses and other buildings.

These deposits are in the neighborhood of the Vigsnaes mine, formerly the most noted copper mine in Norway; and it is not improbable that the deposits are continuations of the Vigsnaes orebody.

In connection with this discovery some account of the neighboring Vigsnaes mine will be of interest. Work in that mine was started in 1865. The original owners were English, but the mines were afterwards sold to a Belgian syndicate for £2,000,000. From 1870, when the mine was fully opened, to 1880, work was carried on upon a large scale, as many as 600 men being employed. From 1880 to 1890 it was actively continued, but with a smaller force. From 1890 the force was gradually decreased, and in 1894 the mine was closed altogether. The reasons for this were the depth of the workings, which was then 735 meters vertically, and the fact that the copper contents of the ore were found to diminish with increased depth. Thus the cost of mining increased while the return was lowered and the mine ceased to be profitable.

During the 29 years of its life about 900,000 tons of ore were taken out, which averaged 3.75% copper. It was estimated by the engineer that about 700,000 tons more could be taken out if the work was continued down to 1000 meters, but the return in copper would be much less.

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*Christiania, Norway.

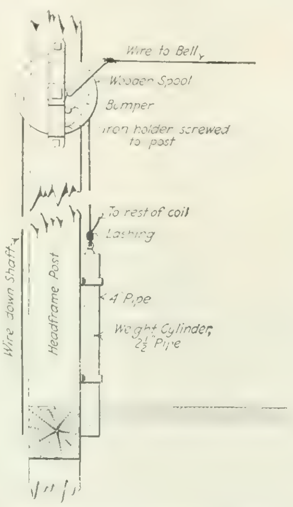
Details of Practical Mining

Bell-Wire Arrangement in Sinking

By Clinton P. Bernard*

In shaft sinking it is necessary to carry down the signal-bell wire or rope as depth is gained. In shafts over 200 to 300 ft. deep, it is common to use a heavy wire or wire rope from the surface to a point about 50 ft. from the bottom, and a rope for the rest of the way. There are numerous ways of arranging the wire and bell at the surface, but the one described here is simple and has many advantages.

The wire is wrapped three or four times over a wooden spool attached to the post of the headframe, then passed through the handle of the weight cylinder, lashed, and the rest of the coil hung in some convenient place. The weight cylinder is a piece of 2½-in. pipe with a cap on the bottom, filled with scrap to give the desired counterweight. This weight cylinder moves in a 4-in. pipe, outside the collar set and extending, for convenience, about 3 ft. above the ground. A bumper on the spool permits it to revolve just enough to actuate the bell through a wire fastened to an arm on the spool. The shaft wire may be lengthened as desired, by unfastening the lashing above the weight cylinder, and allowing the required length of wire to slip over the spool, thus doing away with splicing. No springs are required and there are no weights to dislodge and fall into the shaft. By adjusting the counterweight, the pull on the wire need be but a few pounds through 3 or 4 in. The entire outfit can be made in a short time, at small expense.



Arrangement of Signal Pull-Wire at Shaft Collar

Burning Empty Dynamite Cases†

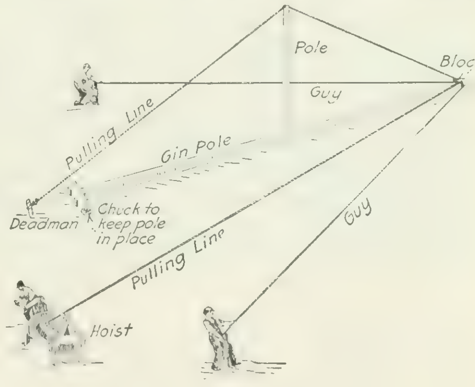
Dynamite, when spread out on the ground so as to expose as large a surface as possible, and ignited, generally burns up peacefully without exploding. The presence of metallic articles, like wire, nails (and of course blasting caps), etc., makes an explosion likely. It is therefore wise when destroying dynamite to take it out of its wooden case, on account of the presence of the nails in the latter.

The cases should be burned separately, since when they become saturated or stained with exuded nitroglycerine they almost always explode when burned, but if no dynamite is mixed up with them there is generally not enough of an explosion to do any great damage. To set fire to them, soak a little excelsior or waste in gasoline and put one end of a piece of fuse in this, being careful to light the outer end first. Have the fuse 2 or 3 ft. long and the waste or excelsior under the empty dynamite cases. Or lay a train of excelsior and light one end with a match and run.

Dynamite cases showing any signs of being stained should never be used for fuel but should be promptly destroyed in the manner described. If they blow up in the open with everybody at a safe distance they will do no harm, but if they blow up in the kitchen stove, somebody will probably be badly hurt or killed and the house burned down.

Raising a Gin Pole

In Alaska they use from 40- to 60-ft. gin poles in placer-mining operations and raise them off the ground without masts, writes Edward M. Keys, Jr., of Chatanika, in *Power*. Only three men are required, two at the guys and one at the hoist.



Layout for Raising Pole

When the pole is laid in place, the guys are put on, a block of wood or a cable at the butt keeping the pole from moving along. A single pulley block is fastened at the top. The pulling line runs from the hoist through the block back to a fixed point or dead-man in line with the gin pole. A pole about 15 ft. long, having a small notch cut in one end, is placed vertically under the pulling line about midway of the gin pole. When power is applied and the pulling line tightens, the gin pole is raised off the ground. After it is up some distance, the pole under the cable is released and falls, but the hoist keeps on pulling until the gin pole is erected. The illustration does not show the fixed points in their true relative positions on account of lack of space.

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*34 Herriman Ave., Jamaica, N. Y.
†"Colliery Engineer," January, 1914.

Staking Out Mineral Claims in Ontario

By J. A. MacDonald*

In the Province of Ontario any one over 18 years of age who takes out a miner's license may prospect for minerals upon Crown lands or lands of which the mining rights are reserved to the Crown, and may take up work and acquire title to a specified area by making a discovery of valuable mineral, staking out and recording a claim, performing and filing proof of the prescribed development work, obtaining a survey, if in unsurveyed territory, and paying a small price per acre. Patent is given in fee simple upon the completion of these requirements.

All Crown lands, and all lands of which the minerals are reserved to the Crown, are open to prospecting and staking out if not already taken up. But there are a few exceptions. In all cases where only the mining rights are in the Crown, the prospector and miner must compensate the surface owner for all injury or damage to the surface rights.

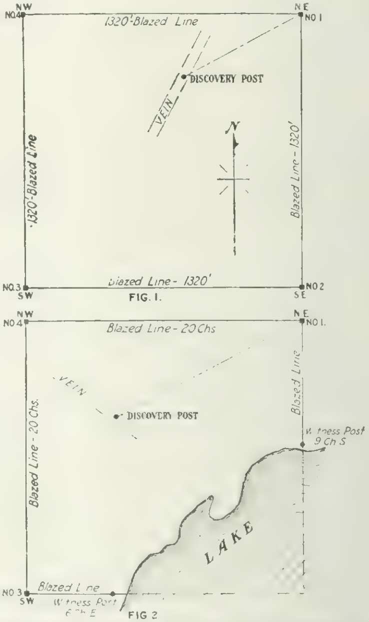
A mining claim in unsurveyed territory shall be laid out with boundary lines running north-south and east-west astronomically, and the measurements shall be horizontal. In a township surveyed into lots, or quarter-sections, or subdivisions of a section, a mining claim shall be such part of a lot, or quarter section, or subdivision of a section, and the boundaries of all mining claims shall extend downwards vertically on all sides.

Except in a special mining division, a mining claim in unsurveyed territory shall be a square of 40 acres, being 20 chains (1320 ft.) on each side.

In a special mining division, however, a mining claim in unsurveyed territory shall be a rectangle of 20 acres, having a length from north to south of 20 chains (1320 ft.) and a width from east to west of 10 chains.

A mining claim shall be staked out by: (1) Planting or erecting upon an outcropping or showing of mineral in place, at the point of discovery, a discovery post upon which shall be written or placed the name of the licensee making the discovery, the letter and number of his license and the date of his discovery, and if the discovery is made on behalf of another licensee, for and in whose name the claim is to be staked out and recorded, also the name of such other licensee and the letter and number of his license; (2) planting or erecting a post at each of the four corners of the claim, marking that at the northeast corner "No. 1," that at the southeast corner "No. 2," that at the southwest corner "No. 3," and that at the northwest corner "No. 4," so that the number shall be on the side of the post toward the post next following it in the order named; (3) writing or placing on No. 1 post all the particulars required to be upon the discovery post, and also plainly marking thereon the distance and direction therefrom of the discovery post; (4) writing or placing on No. 2, No. 3 and No. 4 post the name of the licensee making the discovery; (5) plainly blazing the trees on two sides only where there are standing trees, and cutting the underbrush along the boundary lines of the claim and plainly blazing a line from No. 1 post to the discovery post, clearly indicating the outlines of the claim, and marking a line from No. 1 post to the discovery post by planting durable pickets, not less than 5 ft. in height thereon at intervals of not more than 2 chains (132 ft.) or by erecting at such intervals monuments of earth or rock not less than 2 ft. in diameter at the base, and at least 2 ft. high, so that the lines may be distinctly seen.

Where at a corner of the claim the nature or conformation of the ground renders the planting or erecting of a post impracticable, such corner may be indicated by planting or erecting at the nearest practicable point a witness post which shall bear the same marking as that prescribed for the corner post at that corner together with the letters "W. P." and an indication of the direction and distance of the site of the true corner from the witness post.



Illustrations of the Manner of Staking Claims

Every post shall stand not less than 4 ft. above the ground, and shall be squared or faced on four sides for at least one foot from the top, and each side shall measure at least 4 in. across where squared or faced.

The diagrams, Figs. 1 and 2, illustrate the method of staking out a claim.

A prospector after a discovery of valuable mineral in place, if he desires to stake out a claim thereon, shall at once plant or erect his discovery post and proceed as quickly as is reasonably possible to complete the staking out of the claim, and if he is in fact the first licensee to make a discovery of valuable mineral in place and plant a discovery post thereon, no other licensee shall be entitled to stake out or interfere with the property while he is so completing the staking out, but if he fails to proceed with the staking out with such diligence and speed, he shall be liable to lose his rights in case another licensee makes a discovery of valuable mineral in place upon the property and completes the staking out before him.

Until a discovery post is planted or erected all licensees shall have equal rights in Ontario upon the lands open to prospecting except that where a licensee has found what he believes to be a vein or deposit of mineral or to be an indication thereof, he may plant or erect not more than 150 ft. apart two pickets at least 4 ft. in height to be known as prospecting pickets, each marked with the letters "P. P." and his name and license number and letter, and may dig a trench not less than 6 ft. long and 6 in. deep from each of such pickets along the line running toward the other picket, or where that is impracticable may erect a monument of rock or earth not less than 2 ft. wide at the base and at least 2 ft. high extending 6 ft. from each picket toward the other picket, and may also blaze the standing trees, if any, along the line between the pickets, and after he has so done, so long as he is diligently and continuously prospecting or following up indications on the block of land extending 25 ft. on each side of a straight line between the pickets, he shall be entitled to the exclusive right to prospect and to make a discovery thereon.

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*Box 83, Ottawa, Ont.

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Bagley Scraper for Road Making*

A great many attempts have been made to use machinery on mountain roads, but these have generally ended in failure. The most successful machine in use probably is a Bagley scraper with a logging donkey engine. The donkey is first used to clear the right-of-way of logs, stumps, etc., and when this is done the scraper is attached to the same line. The accompanying illustrations show the manner in which this is done.

To work these scrapers successfully their limitations must be recognized. They are useless in mucking out solid rock. They handle all kinds of loose earth, gravel, and boulders containing from 1 cu.ft. to ½ cu.yd. The material must be loose. When conditions are favorable they handle from 500 to 1000 cu.yd. per 10-hr. day.

A Bagley scraper can under favorable conditions handle excavation at 7c. per cu.yd., wherever a large fill is to be made with a short haul and the material is sandy or gravel. On general road work where time is lost in moving up, splicing lines, removing large boulders, etc., the average cost for handling material is from 15 to 20c. per cu.yd. to which must be added from 3 to 5c. per cu.yd. for finishing, as the scraper leaves the work in rough shape.

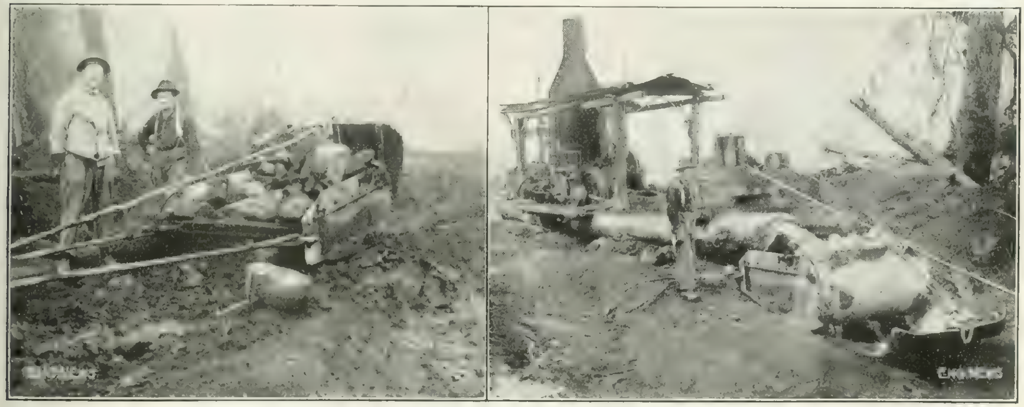
On the particular work shown in the illustrations two Bagley scrapers were in use, each having a capacity of 2½ cu.yd. One donkey engine was 11x13 in. in size; the other 10¼x10½ in. The advantage of the large size is that there are no delays waiting for steam pressure. The wire cables had the following dimensions: Main line, 1⅜ in.; haulback, ⅞ in.

Daily costs may be tabulated as follows:

Foreman	$6.00 per 10-hr. day	
Engineer	3.50	
Fireman	2.75	
Hook tender	4.50	
Pump man	3.00	
Two rigging men at $3	6.00	
		$25.75
One team hauling fuel, or two men cutting fuel on right of way		6.00
Fuel		10.00
Use of donkey, including depreciation of lines, etc.		10.00
Finishing gang:		
Two teams and teamsters at $6		12.00
Four laborers at $2.50		10.00
		$73.75

Assuming 400 cu.yd. for an average day's work the cost was 18½c. per cu.yd.

The scraper is only a money maker in good digging. Its use requires a competent foreman and a first-class crew to handle the lines; a green outfit could not earn its board. With plenty of fuel and water, with a short haul for the material not exceeding 100 ft., the scraper should average at least 400 cu.yd. per day.



Bagley Scraper on Mountain Road Construction in Washington

The steam shovel is not adapted to mountain work, since it cannot pull itself around as a donkey engine can and the handling of cars is both difficult and dangerous. If it is impossible to avoid bad slides or swamps, these can be handled with a scraper at the minimum of expense. The donkey-engine boiler can also be equipped with an oil burner to cut down haulage still further.

In light earth and gravel cuts a 2½-cu.yd. scraper will push another ½ cu.yd. of material ahead with a 200-ft. haul; it can easily move 1000 cu.yd. in 10 hr. It may not be amiss to add that the scrapers do efficient work on channel changes and in loading gravel into bunkers from river beds. In channel-change work the hitch should be placed so that the scraper is pulled upstream.

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*Taken from an article in "Engineering News," by F. W. Harris, recently locating engineer of the Washington State Highway Commission.

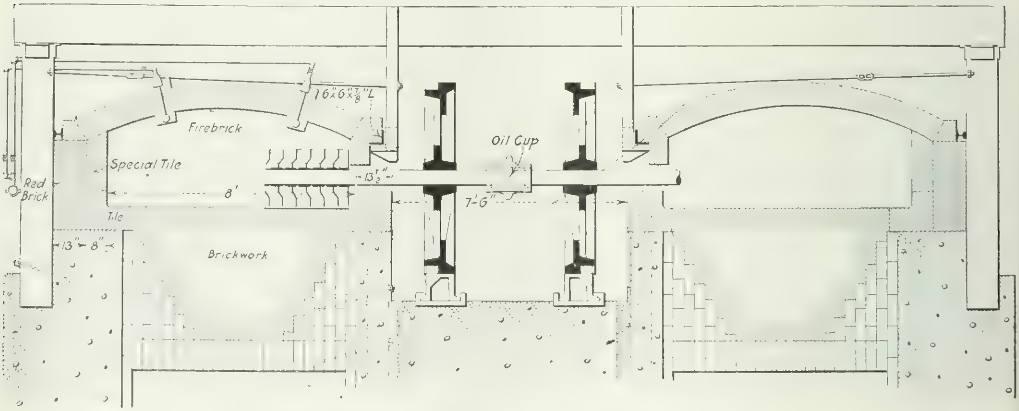
Details of Milling and Smelting

The Rissmann & Ruebel Roasting Furnace

The Rissmann & Ruebel roasting furnace, which is in use at the works of the National Zinc Co., at Bartlesville, Okla., was designed for avoiding the extremely high arch necessary in the Zellweger furnace, and consequently the excessive gas consumption of the latter.

The Rissmann & Reubel furnace consists of two separate parallel hearths, the stirring device being carried on a carriage running on a track between the two sections. The arch of each section is supported on the outside by the wall of the furnace, while on the inner side it is suspended from cross I-beams as shown in the accompanying engraving, which gives a correct idea of the construction of the furnace, except the carriage carrying the rabble.

The rabble is of the ordinary Zellweger type, except that the shaft is carried on a carriage running on a smooth track. The carriage consists of a framework of I-beams carried by four standard railway carwheels. The rabble shaft turns in two bearings on this carriage and is revolved by being geared to the axle of one of the trucks. The rabble shaft extends into the furnace through a slot which is closed by swinging cast-iron doors, opened and closed by a device on the rabble carriage.



Cross-Section of Rissmann & Ruebel Roasting Furnace

The furnace is 150 ft. long. Each section has a hearth width of 8 ft. in the clear. The aims of the designers were partly accomplished, the gas consumption per ton of ore roasting being less than in the standard type of Zellweger furnace. The weak point about the Rissmann & Ruebel is that no satisfactory method of closing the slot, through which the rabble arm extends into the kiln, has been found. The doors in use for closing this slot permit too much cold air to enter the furnace and allow fumes and flames to escape at some places.

The Manufacture of Sponge Iron as a Precipitant for Copper*

Sponge iron was first used as a precipitant for copper in England in 1837, although Gossage, in 1859, was the first to use it in connection with the wet extraction of copper from ores. It was made by heating a mixture of finely crushed iron ore and coal in a reverberating furnace, with a reducing flame.

Since then a great deal of sponge iron has been produced by iron manufacturers, and a number of furnaces have been invented for its production, all of which are described in books on the metallurgy of iron and steel. It is now produced commercially at Hoganas, Sweden, by heating a mixture of fine magnetic iron concentrates and coal in pots or retorts by means of producer gas.

According to Sir I. Lowthian Bell, oxide of iron is easily reduced by solid carbon, but carbon-monoxide gas is greatly preferred as a reducing agent. The reduction of Fe_2O_3 begins at 420° F. The reduction of FeO begins at 1300° F. and is complete at 1475° F.

Sponge iron readily combines with oxygen when exposed to the air at a red heat. It is also capable, at certain temperatures, of splitting up the carbon dioxide formed by its own reduction.

The necessary reaction for the reduction of iron oxide by carbon monoxide seems to be

$$Fe_2O_3 + 9\,CO = 2\,Fe + 3\,CO_2 + 6\,CO$$

or, that there is as much oxygen in the CO escaping as in the CO_2 formed. This reaction is not so simple as it appears, however, for carbon monoxide gas is split into carbon dioxide and carbon in the presence of iron oxide or metallic iron, thus:

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*Excerpts from a paper by Stuart Croasdale, on "Experimental Leaching at Ajo" read at the Salt Lake meeting of the A. I. M. E.

$$2\,CO = CO_2 + C$$

Hydrogen greatly assists in the reduction of iron oxide.

Dr. Frankfurter, of the University of Minnesota, found that finely pulverized iron ore begins to reduce at about 300° F. in an atmosphere of hydrocarbon gas and is completely reduced below 1000° F. S. H. Stupakoff, in a paper read before the Engineering Society of Western Pennsylvania, states that carbon monoxide begins to reduce precipitated iron oxide at 285° F., roasted carbonate at 390° F., and is active on all ores at 750° F. It is most active at 1000° F. Solid carbon begins to reduce iron oxide at 800° F. The reverse action, of CO_2 being reduced to CO by metallic iron, begins at 800° to 1100° F., depending upon mass action, and is most active at 1475° F. A mixture of 3 CO_2 and 2 CO is oxidizing at 1000° F., and a mixture of 1 CO_2 and 2 CO is oxidizing anywhere above 1500° Fahrenheit.

My plan for the production of this precipitant was to manufacture sulphuric acid at the leaching plant, from the low-grade Bisbee pyrite, and then reduce the iron oxide in the calcines to sponge iron for precipitating the copper. The Bisbee pyrite contains about 38% iron and 1.5 to 2% copper. The copper would pay for the mining.

The calcines from this pyrite would be in ideal condition for the production of sponge iron. They would contain a finely divided, porous, artificial oxide of iron which could easily be reduced at low temperatures. The product obtained from the reduction of these calcines would contain 60 to 65% metallic iron in a finely divided, porous condition that would present the greatest possible surface for the rapid precipitation of copper and the copper contained in the original pyrite would all be recovered.

Laboratory experiments were made by mixing iron ore with 30 to 35% coal, both crushed to 16 mesh, and heating in a closed clay crucible in an assay muffle for 1 hr. at a temperature of 1600 to 1800° F. From 75 to 77% of the iron in the ore was reduced to metallic iron.

These experiments were repeated by mixing calcines with 25 to 30% coal and heating in the same manner; 98% of the available iron was metallized. Calcines were then placed in an iron tube and heated to a low red heat in an atmosphere of hydrocarbon gas for 1 hr. Over 90% of the available iron was metallized.

This experiment was repeated and the tube was heated to incipient redness for 90 min.; 93% of the available iron was metallized. The gas used for heating the tube in this experiment was the impoverished gas coming from the reduction of the calcines. The available iron in these experiments was the iron existing as oxide and not that existing as sulphide. These experiments were again repeated on calcines from Bisbee pyrite crushed to ½-in. mesh instead of 16 mesh. At the end of 1 hr., 76.6% of the available iron was metallized, and at the end of 2 hr., 88.3% was metallized.

The idea of using calcines as a source of iron is new, so far as I know, and was first proposed by me during the course of these experiments in the summer of 1912. The advantages of using this material are at once apparent from every viewpoint.

My efforts, therefore, were not to determine if sponge iron can be produced commercially, but to devise a furnace that will receive the calcines hot from the roasting furnaces, reduce them continuously and deliver the metallized product or sponge iron to the precipitating department of the leaching plant. The problem is simply one of mechanical construction with no impossible or prohibitive features. The production of sponge iron is surprisingly easy, when the conditions are right.

After trying several small furnaces of different designs, I erected a Wedge double-function roasting furnace of special design to meet my conditions. This furnace was 9 ft. 9 in. in diameter, had six roasting hearths, one drying hearth and one cooling hearth. The three upper hearths were of the ordinary type for coasting sulphide ore. The three lower were muffle hearths heated with oil from outside fireboxes. The two sets of hearths were sealed from each other by automatic cast-iron valves. The entire furnace was sheathed with sheet iron except the top and bottom. Luting rings were placed around the center shaft, and every effort was made to make the furnace as air tight as possible. Each hearth was connected with the flue so the gases could be controlled as desired. A screw feeder was attached to the side of the furnace to deliver pulverized coal on the upper muffle hearth.

I expected to be able to roast Bisbee pyrite on the three upper hearths and deliver the red-hot calcines on the top muffle through the automatic valves, where they would be mixed with powdered coal from the feeder. In this way, no heat would be lost and reduction would begin at once. I soon found that I had made a serious mistake in trying to put two furnaces into one, for I had neither a roasting nor a metallizing furnace. With all six hearths for either purpose, I would have obtained better results.

The spaces for the passage of hot gases under the muffles were too small. In order to maintain the temperature that was desired on top of the muffle, the heat directly opposite the fireboxes was high enough to soften the clay tiles and cause them to warp. This allowed the calcines, already reduced to ferrous oxide, to drop into the joints and form a fusible slag which soon made a hole through the muffle and admitted air and products of combustion just where I wanted a reducing atmosphere.

My greatest trouble probably came from air leakage through the bottom or cooling hearth and around the central shaft. The bottom hearth was made of brick arched in the usual manner. It was plastered on the under side with cement, but with the constant contraction and expansion of the furnace, it was impossible to make the air tight. I would frequently get metallization well started on the middle muffle hearth, and the iron would oxidize again before discharging. The luting rings around the central shaft, which were supposed to seal by dipping into the ore on the hearth, were not satisfactory for this purpose.

I endeavored to overcome these difficulties by producing a gas pressure inside the furnace from the combustion of the coal. In this I was partly successful, and, for short periods of time, until something broke or temperatures fell, I got encouraging results.

The highest temperatures I was able to obtain on the muffles were as follows:

	Deg. F.
Top muffle	1000
Second muffle	1320
Third muffle	1460
Cooling hearth	1040

but these were maintained only a short time before a muffle gave way.

When reducing with coal, I should have had higher temperatures, or at least 1400°, on all the muffles. The soft coal used I thought had a tendency to deposit soot on the calcines at low temperatures, which retarded the reducing action. I tried lignite coal, but with so many other adverse conditions to contend with, I could not notice any difference. I also tried powdered coke, but at that time other conditions were unfavorable, and the test was not completed.

I was anxious to use producer gas, but had no opportunity to do so. My own laboratory experiments and those of all other investigators have proved that iron oxide can be reduced much more easily with gas than with solid carbon, and producer gas made from lignite or oil would contain the most active reducing agents known for this purpose.

I regret that my work in this direction was stopped before it was carried to a conclusion, but enough was learned to satisfy myself that it will be entirely feasible to metallize calcines for copper precipitation at a cost of not over $5 per ton of metallic iron.

I believe a muffle type of furnace can be made practicable for metallizing calcines continuously, but it must be made gas tight. The top and sides should be sheathed with iron and the calcines fed through a double bell as on an iron blast furnace or through a screw feed that would always be kept full. The bottom of the furnace should be made of cast iron, or preferably, water-jacketed segments. The central shaft should be water sealed top and bottom.

Other material than the 3-in. thick clay tiles used in the Wedge furnace could no doubt be found for the floors of the muffles. It should be of some basic material. If producer gas is used for reduction, it might be possible to make these floors of cast-iron sections, because the temperature of reduction is much lower with gas than with solid carbon.

Producer gas should be used for reduction and the impoverished gas used for heating the furnace. The Mond Nickel Co. has been reducing nickel oxide by means of carbon monoxide for years in a similar type of furnace, without accident or difficulty of manipulation. Subsequent experiments lead me to believe that a shaft furnace can be developed that will also do the work with much less complicated operation.

In any case the metallized product must be cooled in air-tight hoppers that will seal the furnace, or discharge from the furnace directly into water. The fine iron oxidizes immediately when exposed to the air at a red heat, but if cooled in a reducing atmosphere or in absence of air and kept dry, it will remain unaltered for months. If it is discharged from the furnace into water, it must be kept under water until used. It is difficult to take it from the water and dry it without some oxidation but it will not oxidize under water within any reasonable time.

Method of Cleaning Bags

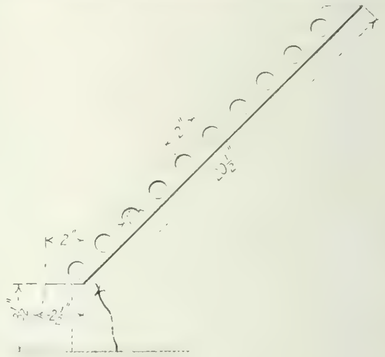
A new method of dislodging dust from baghouse bags has been patented by Willard E. Playter, of Collinsville, Ill. (U. S. pat. 1,118,044). In his construction a flexible tube attached to an air reservoir hangs down in each bag from the thimble by which it is suspended. When it is desired to clean the bags, air is turned on in these tubes, which causes their ends to thresh about in the bags, effectually dislodging all dust.

This air, carrying the dust, is allowed to flow out through large settling chambers in which the dust is deposited. The current of air through these chambers must, of course, be slow.

U. S. pat. 1,118,045 has also been granted Mr. Playter covering electric regulation of the valves controlling the flow of the gas to be filtered and the gas or air used in cleaning.

A Handy Tray for Annealing Cups

A simply made and convenient tray for holding annealing cups used in the parting of silver-gold buttons, may be made from an old piece of galvanized iron. Holes are punched with a 1-in. nipple sharpened at one end. Ends of the piece of galvanized iron may be turned down to make a rest, or the plain strip can be nailed to two pieces of wood, which will serve the same purpose. If it is required to use a double row, or more, of cups, the sheet of iron is widened correspondingly and the additional holes punched.



Annealing Cup Tray

Stamp Milling at the Consolidated Gold Fields of South Africa

The stamp mills of the Consolidated Gold Fields of South Africa, Ltd. put through a total of 3,218,310 tons during the year ended June 30, 1914. The accompanying table shows the number of stamps and tube mills working in each of the plants, and the work accomplished by then.

MILLS OF THE CONSOLIDATED GOLD FIELDS OF SOUTH AFRICA

	Stamps Running	Tube Mills Running	Tons Milled	Tons per Stamp per Day	No Days Operating
Simmer & Jack Proprietary	320	7	760,800	6.902	344.472
Robinson Deep	118	9	580,370	15.465	318.037
Knights Deep	400	11	1,113,300	8.635	322.305
Simmer Deep	180	9	644,300	13.683	261.565
Jupiter	120	6	61,550	13.985	36.677
Sub Nigel	25	1	57,990	6.672	347.684
	1163	43	3,218,310	9.554	......

On the basis of tube-mill days, it appears that one tube mill is required per 275 tons of daily stamp capacity.

The Cost of Doing Things

Cost of Conveyors at the Arizona Copper Co.'s New Smeltery

The following figures relative to the cost of conveyors at the Arizona Copper Co.'s new smelting plant, Clifton, Ariz., were taken from *Bull.* 91 of A. I. M. E., "Unit Construction Costs from the New Smelter of the Arizona Copper Co." by E. Horton Jones. The following table gives the cost per ton of capacity of the conveyors. These costs do not include any steel supporting structure for the conveyors. Capacities are taken from the designer's drawings:

CONVEYORS—COST PER TON OF CAPACITY

Conveyors	Capacity, Tons per Hour	Total Cost Amount	Total Cost per Ton
No. 1	100	$ 3,258	$32 58
No 2	150	2 853	19 02
Nos. 7-1, 7-2	250	6,938	27 75
Nos 8-1, 8-2, 8-3	450	9,929	22 07
Nos 9-1, 9-2, 9-3, 10-1, 10-2	500	11,668	23 33
No. 12	100	969	9 69
No. 13-1, 13-2	200	3,948	19 74
No. 15	100	2,674	26 74
Nos. 3, 4, 5, 6, 11, 14	700	13,716	19 59

The total length of conveyors 3, 4, 5, 6, 11 and 14 from center of head pulleys to center of tail pulleys is 1284.9 ft. and their total cost including steel structure was $44,290 or $34.47 per lin.ft. All the costs that follow cover the entire labor and material connected with the installation of the conveyors. They do not include the steel frame to which idlers are attached, but do cover the cost of installation of traveling feeder with the necessary ties, rails, wire and motor. All conveyors were furnished by the Robins Conveying Belt Company.

Conveyor No. 1 is a 30-in. belt, making a 97-ft. conveyor with a 3-ft. rise, operating at a speed of 150 ft. per min., capable of handling 100 tons an hour. It is supplied with 12-in. material from the bins above it through a speeder feeder (see page 330). The total cost of this conveyor was $3258 made up of $311 for labor and $2947 for material. The total cost per linear foot was $33.49. The material account is segregated as follows:

	Cost	Freight
202 ft 30-in belt	$893.80	$46 45
Feeder belt	59 75	
Conveying idlers, etc	1,197 12	185 09
Cent switch	34 00	2 20
Broken pulley	44 00	
Miscellaneous material	397 73	
One 5-hp motor	87 05	
Total	$2,713.45	$233 74

Conveyor No. 2 has a 20-in. belt, making a conveyor 117 ft. long, with a 3-ft. rise, operating at a speed of 200 ft. per minute with a capacity of 150 tons taking 3/8 in. concentrates through a speeder feeder. The labor cost on this conveyor was $355 and materials, $2498; total, $2853 or $24.33 per lin.ft.

Conveyor 7-1 has a 20 in. belt, 180 ft. 3 in. from center line to center line of head and tail pulleys with an 8-ft. 9 in. rise, operated at a speed of 300 ft. per min., with a capacity of 150 tons per hour. It takes 3/8 in. material which it unloads through a 20-in. automatic tripper. It brings the fines from conveyor 5 to the bedding conveyors. Conveyor 7-2 has a 20-in. belt, 200 ft. long from center line to center line of head and tail pulleys, with a 9-ft. 2-in. rise, operating at a speed of 400 ft. per min. and capable of handling 100 tons per hr. It takes 2½-in. material from conveyor 6 which it unloads through an automatic tripper. The original installation here called for a bedding tripper at $950, which was superseded by an automatic one. Both charges are in this account. For a proper unit cost this charge should be deducted. The total cost of these two conveyors was $6938, of which $6374 was for material and $564 for labor. The total length is 380 ft. and the cost equals $18.24 per ft. The principal materials were: Belts, $1434; freight on belts, $102; total, $1536; conveyor material, $1451; two automatic trippers, $3998, which includes $369 for freight. Other material consisted of motors, lumber, drive belts, painting material, etc.

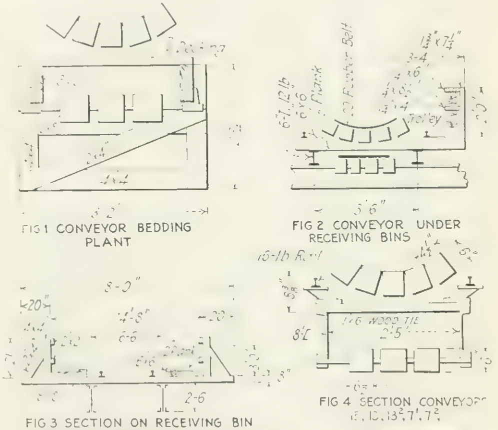


FIG 1 CONVEYOR BEDDING PLANT

FIG 2 CONVEYOR UNDER RECEIVING BINS

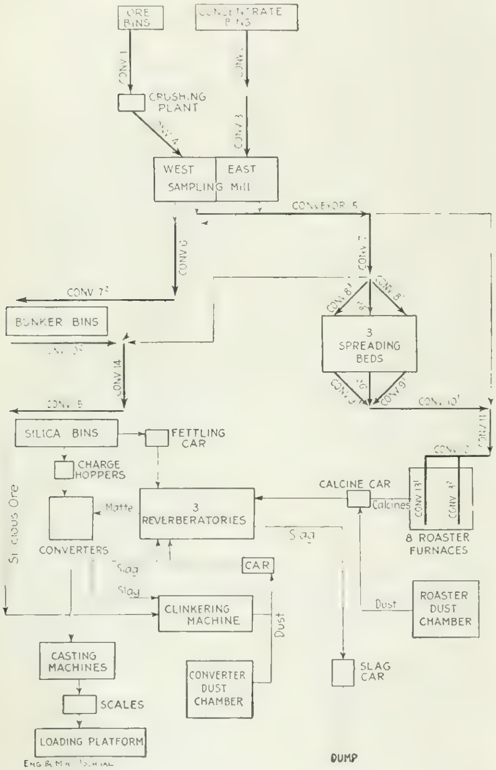
FIG 3 SECTION ON RECEIVING BIN TRESTLE AND CALCINE TRESTLE

FIG 4 SECTION CONVEYORS 5, 10, 13^2, 7^1, 7^2

CONVEYOR DETAILS, ARIZONA COPPER CO.

Conveyors 8-1, 8-2 and 8-3 are practically identical, running out over the three beds. The exception is that 8-3 has a 6-ft. in place of a 3-ft. rise at the start and is 5 ft. longer. In general, the three belts are 20 in. wide, 186 ft. 9 in. long, from center line to center line of head and tail pulleys, with a 3-ft. rise, operating at a speed of 400 ft. per min., with a capacity of 150 tons per hr., taking ⅜-in. material and distributing it through a bedding tripper onto the beds below. The total length of these conveyors is 562 ft. and the cost, $9929, of which $1211 was for labor and $8718 for material. The cost was $17.67 per lin.ft. Details of material costs follow: Belts, $2277; conveyor material, $1793; three ore-bedding trippers, $2850; freight on trippers and conveyor material, $570; lumber for walkways and decking, $237; three 15-hp. motors, $570; centrifugal switch, $109; drive belts, $72; electrical supplies, $116; painting material, $31 and miscellaneous, $63.

Conveyors 9-1, 9-2, 9-3, 10-1 and 10-2 are on wooden supports, the material for which and the cost of walkways are included. Conveyors 9-1, 9-2, and 9-3 are identical. They take the material from the beds to 10-1. They are 20-in. wide belts, 198 ft. 4 in. from center line to center line of head and tail pulleys, operate at a speed of 300 ft. per min. and have a capacity of 100 tons per hr. Conveyor 10-1 takes the feed from these conveyors to conveyor 11. It is 145 ft. 3 in. from center line to center line of head and tail pulleys, perfectly flat, operates at a speed of 300 ft. per min, and has a capacity of 100 tons per hr. Conveyor 10-2 takes material from the bunker-bin gates to conveyor 14. It has a 20-in. belt, 165 ft. from center line to center line of head and tail pulleys, is flat, operates at a speed of 300 ft. per min., and has a capacity of 100 tons per hr. The total cost of these five conveyors was $11,668 and their length, 905.5 ft. Cost per ft., $12.88. Of the total cost, $1912 was for labor and $9756 for material. The cost of some of the materials follows: Belt, $3529; conveyor material, $2178; feeder conveyor for 10-2, $925; freight on conveyor material and feeder, $586; lumber for walkways, decking and framework, $755; five 5-hp. motors, $435; electrical supplies, $243.



Conveyor Layout, Arizona Copper Co., Clifton, Ariz.

Conveyor No. 12 takes the material from conveyor No. 11 and delivers it to 13-1 and 13-2. It is a 20-in. belt, 51 ft. 3 in. from center line to center line of head and tail pulleys, has an 8 ft. rise, operates at a speed of 300 ft. per min. and has a capacity of 100 tons per hr. The total cost was $969 or $18.93 per ft. Of the total cost $164 was for labor. The principal materials were: Belt, $223; conveyor material, $416; 5-hp. motor, $87 and $31 for lumber.

Conveyors 13-1 and 13-2 are identical. Both are 20-in. belts running flat, 109 ft. from center line to center line of head and tail pulleys, operate at a speed of 300 ft. per min., and have a capacity of 100 tons per hr. The total cost of the two was $3948 or $18.17 per ft. This cost was composed of $476 for labor and $3472 for materials. The principal items of material cost were: Belt, $896; conveyor material, including $236 freight, $2150; two 5-hp. motors, $174, and lumber, $123. Other charges for material were for drive belt, switches, spouts and miscellaneous supplies.

Conveyor No. 15 is a 20-in. belt making a conveyor 165 ft. long running flat, operating at a speed of 300 ft. per min. and capable of handling 100 tons per hr. The total cost was $2674 or $16.21 per ft. Of this cost, $423 was for labor. Of the material cost, $664 was for belt and $1231 for conveyor material and $138 for a 7½-hp. motor. The following table gives data on conveyors 3, 4, 5, 6, 11 and 14:

Conveyor No	Width of Belt in Inches	Length of Conveyor in Feet	Rise in Feet	Speed in Feet per Minute	Capacity in Tons per Hour
3	20	182.5	46	250	150
4	20	220.7	64	250	100
5	20	127	26.3	250	150
6	20	113.6	25.5	250	100
11	20	369.7	87	300	100
14	20	271.4	71	300	100
		1284.9			

The total cost of these conveyors was $13,716 or $10.68 per ft. Materials made up $12,505 of the total cost, of which $5716 was for belt, $1821 for conveyor material and $1309 for one 10-, one 15- and four 20-hp. motors. These costs include the freight on materials.

⁂

Cost of Steel Headframe

By Percy E. Barbour

A Bisbee mine with a two-compartment shaft was supplied with a steel headframe 50 ft. high to the center line of the sheave, for ¾-in. hoisting rope, for $1400, erected ready for service. The frame weighed 18,340 lb. and cost $1110, f.o.b. Bisbee, equivalent to practically 6c. per lb. The erection cost $290, a little over 1½c. per lb. Total cost erected, 7⅝c. per lb. The steel company furnishing this headframe always figures the structural members for the full breaking strength of the hoisting rope, so that the frame will not fail in any event before the rope does.

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Coniagas Mines, Ltd.

The Coniagas Mines, Ltd., at Cobalt, Ontario, produced 2,497,395 oz. silver in the year ended Oct. 31, 1914. Mining and concentrating cost 12.444c. per oz., as compared with 8.776c. per oz. for the previous year. Other costs, including royalty, amounted to 3.585c. per oz. as compared with 4.321c. for the previous year. Average price received for silver was 56.75c. per oz., as compared with 60.55c. for the previous year. The total ore milled was 51,522 tons for the year, or 2.93 tons per stamp per day. Profit, after adjustments, amounted to $968,387 for the year.

Tuberculosis in the Joplin District[*]

SYNOPSIS—Prevalence of tuberculosis and fibrosis in southwest Missouri closely related to excessive dust in sheet-ground mines. Dust caused by various practices, chiefly that of drilling dry holes. Recommendations offered for abatement of dust and elimination of other unsanitary practices. Legislation suggested.

The miners of the Joplin district, and their families are practically all native American stock. Many of them are but one or two generations removed from the Tennessee mountains and the Arkansas farming country and as they drift into mining work are most often fresh from Missouri farms. These people are intelligent, independent and industrious; as a rule they marry young and large families are frequent. Their efficiency, so far as labor in the mines is concerned, is high. Many of them prosper in mining and it is a common saying in southwest Missouri that every miner is a prospective mine operator. While the sanitary environment of their homes often leaves much to be desired, from a public-health standpoint their faults are essentially due to lack of knowledge of the effect of certain practices. It is probable that sanitary education would not only be well received in the communities in the Joplin district but would work a great deal of good.

Efforts to Combat Tuberculosis

In recent years there has been an unusual prevalence of pulmonary tuberculosis and a high death rate therefrom among the metal miners in southwest Missouri. Various efforts have been made to ascertain and abate the causes of the trouble. This movement resulted in the formation of the Jasper County Anti-Tuberculosis Society, and of various committees of mine operators. The Anti-Tuberculosis Society, besides gathering statistics, established in October, 1913, a visiting-nurse service, which has proved valuable. The mine operators have succeeded in the last two years in making many substantial improvements in working conditions underground. The state mine inspectors have also made this work one of their especial functions, although handicapped by the lack of any laws on the subject. As regards improvement of sanitary conditions in miners' homes, action by local health officials is necessary. Few if any of the miners live in company homes so that the operators have little direct control of sanitation in dwellings.

Appearance of Tuberculosis and Its Causes

It seems to be the general opinion in Jasper County that lung diseases became more prevalent after the beginning of active operations in the sheet ground, and that the flint dust occasioned by drilling and other mine operations is largely responsible for this condition. Although the connection is not definitely established and the available records are not satisfactory, nevertheless the figures both of the state board of health and of the Jasper County Anti-Tuberculosis Society demonstrate an unusual prevalence of tuberculosis in that county. Furthermore, allowing for various differences of opinion, inaccuracies, errors and exaggerations, all unavoidable, an impartial investigator cannot but conclude that when working conditions in any region are such as to expose the workers to a hard, flinty, insoluble rock dust, and when among those workers there is a high death rate from tuberculosis, there is a definite connection between the dust and the disease and the dust is largely responsible for the disease—not entirely responsible for all pulmonary disease but a prime factor in its causation.

Physical Examination of Miners

Physical examination of miners was made on several occasions in Webb City and Carterville and 93 miners presenting themselves for examination. Of these 93 men, 64 showed plain and definite evidence of pulmonary disease, 3 were suffering from nonpulmonary disease, and 26 were apparently well. Of the 64 sick men, 22 had stopped work on account of their health, the remaining 42 still working underground. Of these 64 men, 39 had the classical symptoms, nightsweats, cough, hemorrhage, loss of weight, fever, and signs of pulmonary tuberculosis. The physical signs of the other 25 men were not such as to justify a diagnosis of tuberculosis on one examination. All of these 25 had noticeable short wind, cough, and lessened ability to work; 11 showed signs of lung injury, while 14 in spite of marked symptoms presented nothing tangible on physical examination, their condition resembling silicosis, or miners' consumption, rather than tuberculosis.

Causes of Dust

There was little or no rock dust to be found in mines other than those in the sheet ground. For this reason the investigation of rock-dust conditions was confined almost entirely to sheet-ground mines. The chief causes of rock dust in these mines are the blowing of dry holes, squibbing and boulder popping. Among other causes may be mentioned shoveling, drilling without water, pillar and roof trimming, tramming and the dumping of the bucket on top.

Where the face is comparatively dry, as in most of the sheet-ground mines, the blowing out of the drill holes produces great quantities of dust. This practice is entirely unnecessary and its elimination will do much toward keeping the mine air clear of dust. The popping of boulders during the time when the men are in the mine is also entirely unnecessary and should be prohibited. The only time when there is a valid excuse for squibbing is when the drill refuses to work in a hole that is well along toward completion and the abandonment of the hole would result in a great loss of time. It seems to be the common practice, instead of trying to overcome this difficulty by lining up the machine, to withdraw the drill immediately and resort to powder to remove the obstruction. In most cases the difficulty could be overcome by a proper alignment of the drill.

Various types of drills in which water is caused to pass through the core of the drill steel have been tried with success in a few of the mines. While it might work a hardship on many of the operators if they were compelled to change their equipment from drills working without water, now commonly in use, to those using water, the tendency should be in securing new equipment to procure some type of water drill. It is of course possible, however, to equip any drill with a water spray directed into the drill hole and make these sprays effective in preventing dust, but such equipment is not recommended as superior to drilling machines which provide for water passing through the core of the drill.

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[*] Condensed from an abstract of a report made by A. J. Lanza, passed assistant surgeon, U. S. Public Health Service, and Edwin Higgins, mining engineer, U. S. Bureau of Mines, entitled "Sanitary Conditions in the Zinc-Lead Mines of the Joplin, Mo., District, and Their Relation to Pulmonary Diseases among the Miners."

A certain amount of dust is made in shoveling but the quantity may be either great or small depending on whether the dirt is wet or dry. A thorough wetting of the broken rock at the face by means of water hose would be effective in abating such dust. The dust produced by other operations such as tramming, pillar and roof trimming, and the dumping of the bucket on the surface need not be discussed at length. Dust from these causes will doubtless be abated as a result of the free use of water at the working faces.

A total of 39 dust samples were taken. These were secured under all conditions that commonly arise during the progress of mine work. It should be borne in mind that nearly all drill holes bored in these mines are practically horizontal. In the Joplin district, unlike metal mines in which operations are conducted on various levels, dust when produced permeates the whole mine. The greatest quantity of dust, however, is found at the working faces. The men at the face, constituting a large majority of the men underground, are subjected to a dusty atmosphere during their entire shift.

Measures in Use for Rock-Dust Abatement

About two years ago the three mine inspectors of the Joplin district began a campaign for the abatement of rock dust. Although a few of the operators adopted recommendations for spraying the working faces and wetting dry holes it was found a difficult matter to bring about a general adoption of precautionary measures. Even in cases where the operator piped water to the face, the miner himself showed little tendency to use the water thus provided. The mine inspectors have been insistent in their efforts, with the result that some of the mines are in fair condition so far as the prevalence of rock dust is concerned. During the present investigation is was found that many of the mines have either separate water lines to the face or provision for introducing water into the air lines. Many of the operators also were making efforts, through their ground bosses, to cause the miners to use water and to refrain from excessive squibbing and blowing of dry holes. However, it may be said in general that these efforts have not gone a great way toward eliminating rock dust in the mines.

Effect of Rock Dust

The influence of rock dust in the sheet-ground mines as a factor in the prevalence of tuberculosis can hardly be overestimated. While the general causes that tend to produce high incidence of tuberculosis, such as housing, alcoholism and poor working conditions, are fairly well defined and while these causes are more or less in evidence in Jasper County, the flint dust constitutes an unusual element of danger not found elsewhere, so that it would seem reasonable to attribute to it the unusual prevalence of tuberculosis in that district. Dust is nearly always injurious to the lungs to a certain degree regardless of its nature, as statistics of dusty trades will show. The properties of the rock dust in sheet-ground mines as regards hardness, sharpness and insolubility, are sufficient evidence of its ability to harm lung tissue. These minute, sharp flinty particles irritate the lung tissues, injure it, and render it susceptible to attack by the tubercle bacillus. It can hardly be believed that men constantly working in such dust can escape with uninjured lungs.

It is possible for a miner to have his lungs injured by rock dust, so as to produce a condition that is not tuberculosis, and that this occurs in the Joplin district is the opinion expressed by various physicians who treat miners there. This also would appear to be the condition of the 25 men previously referred to, who were examined and in spite of marked symptoms offered little or nothing on physical examination. Irritation by rock dust produces a fibroid or thickened condition of the lungs, leading to dyspnea (short wind), with cough, expectoration, lessened working ability, impaired general health and sometimes loss of weight. If a tuberculous infection has not accompanied this condition, undoubtedly in most cases it follows it and that before a long time. The state board of health does not recognize miners' consumption as a cause of death on death certificates. The question of the relative incidence of the two diseases is a scientific rather than a practical one. From a public-health standpoint the fact that a condition of miners' consumption may precede actual invasion by the tubercle bacillus, influences in no way the sanitary picture of the district as a whole. It helps to establish rock dust as a contributory factor in the causation, it does not influence the ultimate effect nor does it influence the application of remedial measures. Clinically, where the lungs have been injured by rock dust, the consequent tuberculosis is prone to be of the fibroid type, and the medical superintendent of the state hospital for tuberculosis states that these patients do not respond so readily to sanitarium treatment as the average run of patients and that the outlook for them is nearly always bad. This is but natural, as lungs substantially injured by mechanical means would have less chance of withstanding a tuberculous infection than otherwise.

It is not to be expected that there will be any immediate improvement in the vital statistics of the county following a reduction in the quantity of rock dust in the mines. There is far too much tuberculous infection spread throughout the district for quick results, but such good results will be apparent in time. When the mine operators of the Joplin district coöperate to devise methods of allaying rock dust, and, so far as practicable, put these methods into effect, they will free themselves from any liability to reproach that, insofar as working conditions are concerned, they are responsible for a menace to the health of their employees.

Recommendations

The following recommendations are offered as a result of the investigation:

(1) Means should be employed for the abatement of rock dust in the mines as follows: Provide a water supply for every working face, preferably by the laying of separate water lines; as rapidly as may be without too great cost, equip all miners with some type of drilling machine which provides for water passing through the core of the drill into the drill hole, although results almost as good may be obtained by equipping the present type of dry drill with a water spray; make and strictly enforce rules

against squibbing and boulder popping during the time that the shift is underground; and against the blowing of dry holes at any and all times; thoroughly wet the working faces and the broken rock every morning and again at noon if necessary; improve ventilation by the sinking of new shafts whenever practicable.

(2) Do away with common drinking cups and kegs, and water pipes which allow the miner to bring his lips in contact with the orifice.

(3) Do not employ as shovelers, men under 20 years of age.

(4) Through coöperation among the operators provide a maximum daily tonnage for shovelers so that they cannot injure their health through overwork.

(5) Provide a warm, dry and clean place in which the miners may change their clothes.

(6) Through intensive educational campaigns in the public schools and among the miners themselves, disseminate information as to the harmful effects of unsanitary practices and conditions, such as crowded living quarters, overwork, exposure, dissipation, the breathing of air polluted by powder fumes and rock dust, the use of common drinking devices, etc.

State Laws

It is believed that certain legislation would be of value in abating rock dust and other evil conditions in and about the mines. If such legislation is undertaken by the State of Missouri, it is suggested that it be made operative against the miner as well as the operator, and that penalties be provided, in the form of fine or imprisonment, such as will insure a minimum number of infractions. The following regulations are offered for consideration in this connection:

(1) That all operators of dusty mines be compelled to run a water line, in addition to the air line, to each working face, and to provide water for said line.

(2) That every miner be compelled to make use of the water so provided, for the purpose of wetting down the broken ore, the working faces, and the drill holes from which dust may be spread.

(3) That the practice of breaking boulders by means of powder or dynamite be prohibited except when the shift has left the mine.

(4) That the blowing of drill holes without first thoroughly wetting them with water be prohibited at all times.

(5) That managers or operators of mines be prohibited from maintaining common, unsanitary drinking devices.

In addition to these suggested laws, it is believed that a workman's compensation act would go far toward improving safety and sanitary conditions in the mines of the Joplin district.

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Copper Production in Russia

Special Correspondence*

The copper production in Russia from Jan. 1-Sept. 1, 1914, was 47,152,986 lb. against 50,740,618 lb. for the same months in 1913, a loss of 3,587,632 lb. less or 7.7%.

	1913, Lb.	1914, Lb.
Ural	25,474,510	23,519,578
Caucasus	14,519,718	13,313,258
Siberia	8,106,951	8,283,748
Chemical factories	2,149,345	2,000,381
	50,740,618	47,152,986

The works of the Caucasus Copper Co. and the Kwarzchana works of the Siemens Copper Co. have been since Nov. 4 (old style) in the hands of the enemy. The first ones were producing 18,000 to 28,800 lb. daily, the last one was in course of construction and expected to start operation at the beginning of 1915.

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Improvements at Lena Goldfields

At the recent meeting of the Lena Goldfields, Ltd., in London, the directors announced several important recommendations made by Consulting Engineer C. W. Purington to the Lenskoi board in Russia. These were: (1) That in the working of the Feodosievsky claims a considerable economy, involving a large increase of profit, is possible; (2) that the provision of change houses at shaft heads ought to lead to a great reduction in the loss of gold by stealing; (3) that by the use of improved riffles in the sluices, and of quicksilver, a great loss of gold could be obviated. Mr. Purington, from an examination of the present field and the surrounding area, is satisfied that there are such reserves of gold to be won at a profit by methods other than drift mining as will insure to the Lenskoi company a long life, but to secure much of this gold, further capital expenditure would be necessary.

Some extracts from Mr. Purington's report, regarding the technical practice, are of interest: Following representations made to the Lenskoi board, it is now planned to introduce modern gold-saving methods. Alaskan sluices, introduced during the last fiscal year for the first time, recovered from 96 to 98% of the gold as compared with a recovery of 88 to 93% by the trommel machines and other Siberian methods employed. It has therefore been decided to supplant all washing machines and Siberian sluices (*kulibinas*) by Alaskan type sluices as fast as possible. Quicksilver cannot be used until the arrival of adequate retorting appliances on the property.

Details of operating costs were not available at the time of the report but some reduction of the 1912-13 working expenses, which amounted to 29s. 7d. per cu.yd., will be shown in the account for the year 1913-14; for the month of May last, the figures show a marked reduction over those of the previous year; it is evident that at least 150,000 rubles have been saved to the company in 1913-14 by the introduction of improved methods of surface transport and gravel washing at a few places on Feodosievsky and Nizhni; overhead and construction charges were far less than in the previous year. The gravel washed in 1913-14 amounted to 873,635 cu.yd. which yielded an average of 29s. 4d. per cubic yard.

Many recommendations of an urgent nature have been made to the Lenskoi board, with a view to reducing both working and overhead costs. Mr. Purington has been assured that in so far as possible the larger percentage of changes recommended by him will be carried out. These changes include the introduction of the "longwall and caving" system of underground mining, systematic recovery of timber, electric underground transport of gravel, improvements in hoisting, the installation of "all-the-year-round" sluicing plants of the Alaskan type for washing gravel, improved riffles, the use of quicksilver and the closing down, so far as possible, of the unprofitable portions of the property. The company has secured as chief assistant to the general manager on the property, R. E. Smith, an American placer engineer, who is personally superintending many of the proposed changes that have been authorized.

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*Dated Dec. 8, 1914, received Jan. 27, 1915.

The drilling practice on the property has undergone some improvement. As a result of temporary depletion of the force, following mobilization, all drilling was suspended during August and September, though it has since been resumed; during 1913-14, a total of 581 holes were drilled aggregating 37,877 ft., the average cost being 7.86 rubles ($4.04) per ft. The usefulness of some of the sampling was vitiated, however, by the fact that inaccurate methods and sampling instruments were in use. It is planned to place all the Keystone and other prospecting work in the hands of a competent sampling engineer.

It is expected that to a great extent drift mining will eventually be replaced by hydraulicking. On the Bolshoi Chanchik, Mr. Purington estimated that by means of hydraulic giants and mechanical elevation of the tailings the profitable ground amounts to 10,000,000 cu.yd. of an average tenor of 1s. 9d. per cu.yd. with a total gold content of 8,430,000 rubles; this ground would yield a profit on working of £520,000 in 10 years by hydraulicking, as against £34,000 per annum for four years on the drifting basis. In the Bodaibinsky ground, on the basis of hydraulicking a certain area instead of working by drifting, the following calculation was made: On 1,270,000 cu.yd. of a tenor of 21s. 9½d. per cu.yd., the result by drifting would be a loss in working of £307,000; by the adoption of the hydraulic method and treating 12,700,000 cu.yd. of a tenor of 2s. 2d. per cu.yd., the operations would show a profit of £852,000. Further, as regards hydraulicking possibilities of the Bodaibo Valley generally, Mr. Purington came to the conclusion that practically 75% of the creek-bed gravels of the lower 33 versts of the company's holdings on the Bodaibo River below Bolshoi Chanchik, down to the Agripinsky claim, as well as the lower part of the Nakatami, are so far as physical conditions are concerned capable of being worked by the above method. At this time no specific statements can be made, except that all conditions are favorable and that four blocks of ground afford a total on the hydraulic basis of approximately 56,000,000 cu.yd., having an estimated recoverable value of £5,113,000 and a probable profit on working, of £2,759,500. More definite estimates cannot be made until supplementary systematic sampling has been carried out. There are, besides, extensive areas of bench gravels bordering the Bodaibo Valley which can be worked hydraulically without elevating the tailings, and which it is planned to prospect extensively during the next few years. It is stated that the conditions of water supply are superior to the well known placer districts of Alaska and the Klondike. Investigations are in progress with a view to the establishment of a central hydro-electric plant on the Mamukan River. An investigation of a quartz vein in Bodaibo Valley is also being made and it is recommended that a competent assayer be sent to the property so that the vein can be systematically sampled and assayed. The vein has been traced for about 20 miles and has been located by the Lenskoi company. On Sept. 30, 1914, there were 7636 men on the mines' payroll, though a considerable reduction was made during 1913-14 in the man power per cubic yard handled in certain operations. The gradual amelioration of technical methods is expected to bring about a corresponding reduction in working costs.

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Searles Lake Patent Protest

The applications of the California Trona Co. for mineral patents for certain potash lands of Searles Lake, California, have been protested by Victor Barndt, of Tonopah, in papers filed with the General Land Office at Washington, D. C., on Feb. 1, 1915. The bases of the protest are unusual by reason of the peculiar conditions resulting from the extended search for potash, and the "locating" campaigns at Searles Lake. Mr. Barndt opposes the granting of the patent applications on the following grounds: (1) Attempt to establish monopoly; (2) failure of locators to make discovery; (3) that locations were not made in good faith.

At present, three applications are filed in the U. S. Land Office at Independence, Inyo County, Calif., by the California Trona Co. for patents to certain trona placer claims at Searles Lake. Each of these three applications, Mr. Barndt regards as a test case intended to secure to the California Trona Co. title to substantially all of the known potash deposit at Searles Lake. He states:

> The first application is for six association placer claims of 160 acres each, located during July, 1910, by C. E. Dolbear and seven others. Against this application an adverse has been filed by contesting claimants and the matter is now in the California courts.
>
> The second application is for one association placer claim of 160 acres located in July, 1910, by C. E. Dolbear and seven associates. No adverse claim covers any portion of this ground. The claims located by C. E. Dolbear and the same seven associates during July, 1910, comprise 257 association claims of 160 acres each, covering a total of more than 41,000 acres. All were conveyed to the California Trona Co. immediately after location.
>
> The third application is for four placer claims of 20 acres each, located in May or June, 1912, by S. W. Austin, being a portion of 1392, more or less, 20-acre claims located by Austin during May and June, 1912, and by him conveyed to the California Trona Co. on Nov. 12, 1912. No adverse claim covers any portion of this particular 80 acres.
>
> The Austin locations are on lands embraced within the Dolbear locations, and include the entire known commercial deposit of potash, borax and soda at Searles Lake, excepting the small percentage embraced in lands patented to the San Bernardino Borax Mining Co.

Mr. Barndt, in his protest against the proposed monopoly of Searles Lake, suggests that this could be obviated by the establishment of a Federal leasing system, such as now before Congress, and that the California Trona Co. should be given the first choice of such leases as a recognition of its important and useful work in developing this deposit. Mr. Barndt is president of the Railroad Valley Co., which spent over $100,000 in prospecting for potash in Railroad Valley, Nevada, and other places in the West. He says that a large amount of money and effort has been expended by various private parties and by the Federal Government in the search for commercial sources of potash; Searles Lake is the only known commercial deposit of potash in the United States and is likely to remain so. To allow one party to obtain patent upon substantially all of this deposit would, he thinks, establish a dangerous monopoly in a necessary commodity. In protesting the patent on this ground, he says:

> If the present applications are allowed and patent is granted to the lands now applied for, the California Trona

> Co., by making additional separate applications for patent, could ultimately control substantially all of the potash deposit at Searles Lake and thereby control and monopolize the future potash industry of the United States.
>
> I respectfully submit that the mineral laws and the practice of the General Land Office, as well as the rules and customs of the mining districts of the United States, do not contemplate and never have contemplated that any one person could acquire by location an unlimited area of the public domain, especially if this area include substantially all of the known national resources in a necessary mineral. The attempt of the California Trona Co. to accomplish this end is without precedent in the mining history of the United States. I submit that it is entirely without justification and that in justice to other citizens and to the welfare of the country, it should not be allowed. The laws of the United States provide that the public mineral lands shall be open to location and entry by all of the citizens of the United States. The attempted location by one party of large areas of mineral lands containing the entire known national resources of a valuable mineral would, if permitted, destroy the rights of other citizens to locate portions of these lands.

Anent "failure to make discovery," preceding location of the claims, Mr. Barndt says:

> With the possible exception of a few bordering claims not of great value, no discovery of potash, borax or soda was made by C. E. Dolbear and his seven associates upon any of the 257 association claims when the locations were made in July, 1910, or prior to Aug. 11, 1910, when the locations were transferred to the California Trona Co. Between Aug. 11, 1910, and the Federal withdrawal of these lands on Feb. 21, 1913, discovery was made upon a portion of these claims. But even the claims upon which discovery was made after transfer are invalid and void except as to 20 acres each, and no selection or segregation of 20 acres out of any of the said association claims has been indicated.
>
> Upon the great majority (probably nearly 90%) of the Austin locations, no actual discovery of mineral other than common salt had been made at the date of the Federal withdrawal of these lands, Feb. 21, 1913. Upon the majority of these claims, no discovery has been made even at this date. A discovery after the Federal withdrawal does not validate a location. The finding of common salt or of noncommercial traces of other minerals does not constitute discovery in this case.

Regarding Dolbear's 1910 locations, the protest states:

> The records indicate that Dolbear and seven associates, each of whom at that time was a stockholder of the California Trona Co., were, in making the locations in 1910, not locators in good faith as they pretended to be, but were dummy entrymen who located solely in the interest and on the behalf of the California Trona Co. I submit that these locations are therefore fraudulent and void.

Through supplementary statements of Mr. Barndt's attorneys, it is presented that in each of the three layers or series of locations with which Searles Lake is plastered, most, if not all, of the claims are void or voidable on grounds of nondiscovery or of dummy entries. It appears that the California Trona Co. has not applied for patent, under any of the 1908 Dolbear locations, but, as already noted, has filed two applications on certain 1910 Dolbear locations and a third application on 80 acres located by Austin, on which there were no adverse claims.

American Institute of Mining Engineers

The program for the annual meeting in New York shows that on Feb. 15 in the morning there will be a technical session on safety and sanitation, under the auspices of the committee, with papers as follows: Frank H. Kneeland, "Safeguarding the Use of Mining Machinery." Howard N. Eavenson, "Safety Methods and Organization of United States Coal & Coke Co." S. Le Fevre, "Housing and Sanitation at Mineville." J. Parke Channing, "Enlarging the Worth of the Worker and the Perspective of the Employer."

Throughout the meeting an exhibition of safety and sanitation will be maintained by the committee in one of the meeting rooms on the fifth floor.

In the afternoon two separate sessions will be held, one on nonmetallic minerals, at which the papers presented will be: Edward G. Norton, "The Origin of the Louisiana and East Texas Salines." W. B. Phillips, "Investigation of Sources of Potash in Texas." Thomas L. Watson and J. Sharshall Grasty, "Barite of the Appalachian States." N. B. Davis, "The Plasticity of Clay and Its Relation to Mode of Origin." Charles H. MacDowell, "German and Other Sources of Potash Supply." Joel H. Watkins, "White-Burning Clays of the Southern Appalachian States." Joseph Hyde Pratt, "Minerals Used in Manufacture of Lighting Apparatus."

The other session will be on iron and steel; the program will be given in next week's JOURNAL.

On Feb. 16 in the morning there will be held the annual business meeting. Following this there will be a technical session, at which the following papers will be presented: David Cole, "Development of the Butchart Riffle System." R. H. Richards and Boyd Dudley, Jr., "Experiments on the Flow of Sand and Water Through Spigots." Arthur B. Foote, "An Improved Form of Cam for Stamp Mills." L. W. Bahney, "Method for the Determination of Gold and Silver in Cyanide Solutions." Paul Billingsley, "The Boulder Batholith of Montana." Basil Prescott, "The Main Mineral Zone of the Santa Eulalia District, Chihuahua." Noel Cunningham, "Metallurgical Practice in Porcupine District." W. H. Corbould, "Cloncurry Copper District, Queensland." C. A. Heberlein, "Mining and Reduction of Quicksilver Ore at Oceanic Mine, Cambria, California."

In the afternoon there will be a technical session on fuels, under the auspices of the Committee on Petroleum and Gas and the Committee on Coal and Coke.

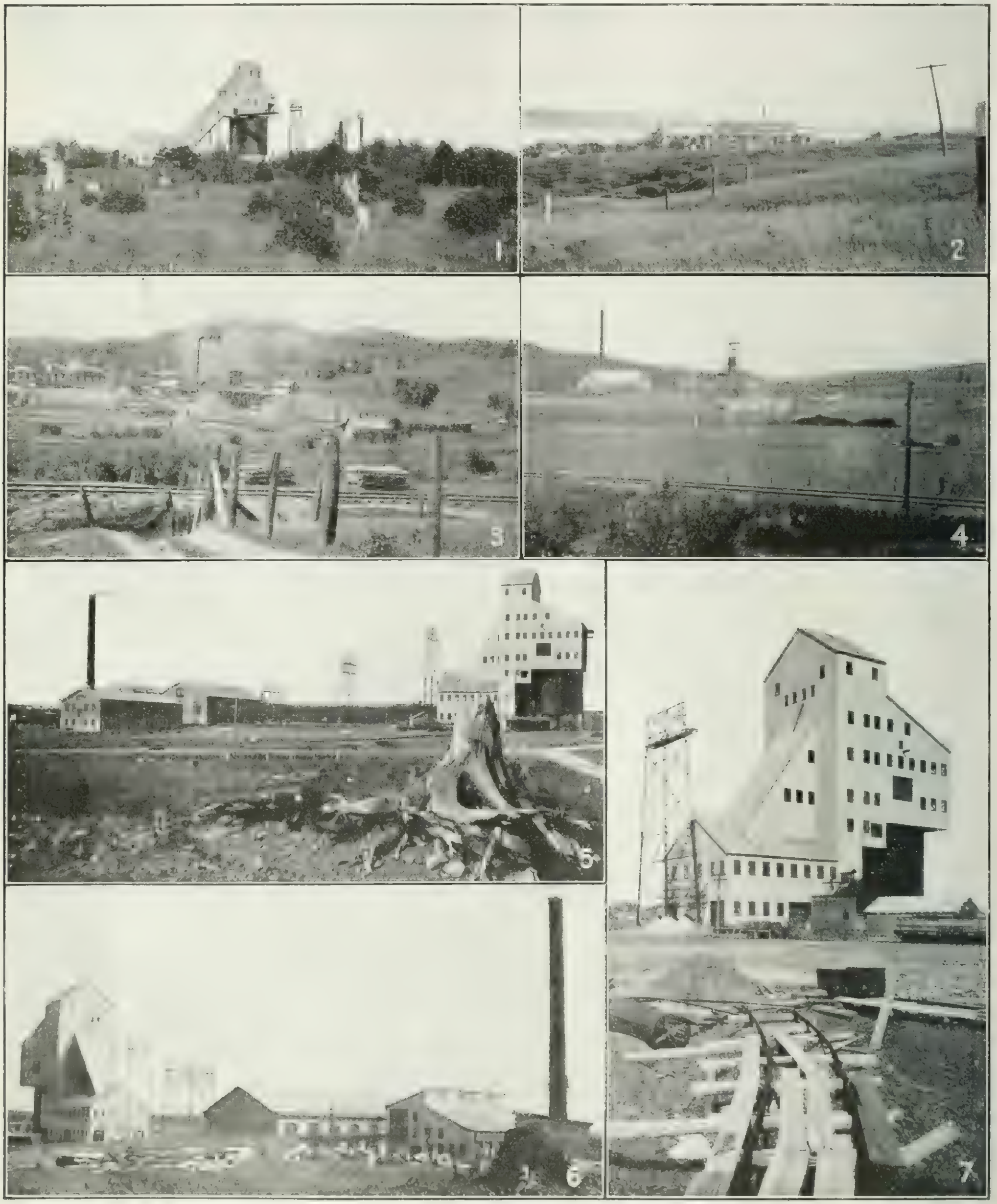
The annual dinner will be held at the Hotel Astor in the evening.

On the morning of Feb. 17 there will be a technical session on nonferrous metallurgy, at which the following papers will be presented: Manuel Eissler, "Copper Smelting in Japan." Boyd Dudley, Jr., "A Study of the Chloridizing Roast, Etc." Louis V. Bender, "Coal-Dust Fired Reverberatories at Washoe Reduction Works." David H. Browne, "Coal-Dust Fired Reverberatory Furnaces of Canadian Copper Co." F. C. Newton, "Effect of Zn_3Ag_2 upon the Desilverization of Lead." R. E. H. Pomeroy, "Reverberatory Smelting Practice of Nevada Consolidated Copper Company."

In the afternoon there will be a technical session on electricity in mines and on mining, at which the following papers will be presented: Charles V. Seastone, "Hydro-Electric Development of the Peninsular Power Co." J. W. Gwinn, "Underground Haulage by Storage-Battery Locomotives in the Bunker Hill & Sullivan Mine." B. F. Tillson, "Testing and Application of Hammer Drills." P. B. Scotland, "Mining Methods of the Arizona Copper Co., Ltd." James Humes, "Mining Methods at Park City, Utah." Courtenay De Kalb, "Some Defects of the United States Mining Law."

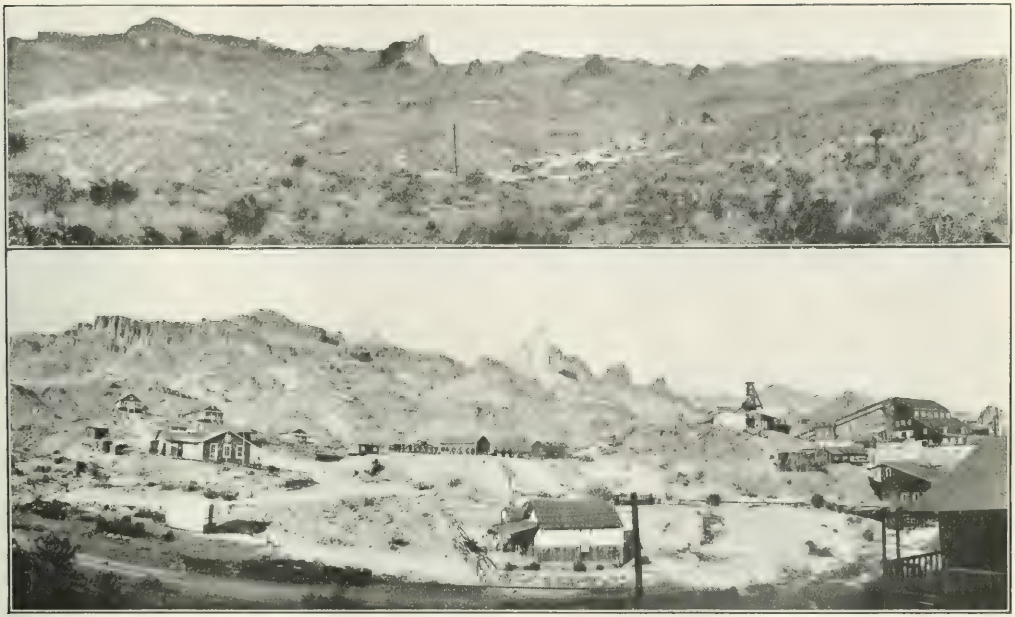
A special feature of the meeting will be reunions of graduates of a number of colleges and technical schools who may be present. Preparations have also been made for the entertainment of the ladies.

Photographs from the Field



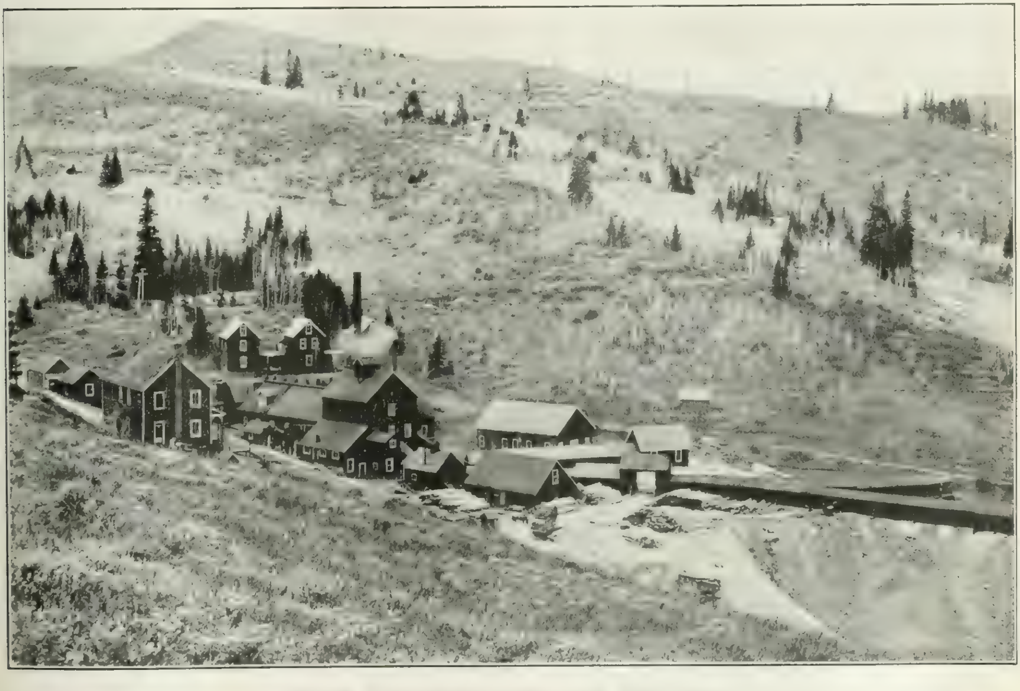
SOME MICHIGAN COPPER PROPERTIES

1. No. 6 shaft, Mohawk copper mine, Mohawk, Mich. 2. The Ahmeek stamp mill, Hubbell, Mich. 3. Old Breitung Hematite mine. 4. New Breitung Hematite equipment. 5, 6 and 7. North Ahmeek shaft, in the Superior copper district



THE TOM REED CAMP, OATMAN, ARIZ.

The distant view gives an idea of the extremely rugged character of the country The closer view shows the mill and buildings of the Tom Reed company



SILVER KING CONSOLIDATED, PARK CITY, UTAH

Surface plant and improvements, including shafthead, mill, dump tramway and company buildings

Editorials

The Situation in Lead

The curtailment of lead production by the Southeastern Missouri and Coeur d'Alene mines continues upon a drastic basis. Judging from the receipts of ore by the smelters the rate of production in the last quarter of 1914 was only about 55% of the rate in the first and second quarters of that year. The Missouri curtailment is probably not so large as in Idaho, but it is large enough to be no half-way measure. A reliable estimate is that the present rate of production in Missouri is about 70% of what it was last summer.

The principal lead miners of the United States are therefore in about the same position as the copper miners, although the basic causes are different. The copper miners had to curtail because they lost their principal customer. The lead miners gained new customers but wanted to produce too much anyhow, wherefore they had to be restrained. When the price for lead went down to 3.50c., New York, they did not like it and curtailed, but when later it rose to 3.90c. they became somewhat restive and meditated putting on a little more steam.

It would appear therefore that the lead market might be fairly stable around 3.70@3.80c. until some new determinative condition develops. At present the backbone of the market is the foreign demand. An increase in domestic demand is ardently desired but is slow in coming. Some persons are looking for the high price for spelter to be reflected in an increased use of lead, but that hardly seems likely, at least not to any large extent. The zinc-white business of the United States is quite distinct from the spelter business and the manufacturers of zinc white are hardly likely to give away hard-earned ground to the white-lead manufacturers. Nor is there much opportunity for lead-covered metal to displace galvanized. Our zinc-sheet business is relatively too small to allow any leeway.

The thing that stands out most clearly is that our present capacity for producing lead is very large. If the output of the United States increased upward of 100,000 tons in 1914 after a curtailment in the third quarter and a further curtailment in the fourth, bringing us down to a basis of 55 to 70% of the maximum, what would have been the production if there had been no curtailment?

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Modernizing the Lena Placers

One of the world's great gold placers is in the Irkutsk Government of Siberia. Its operations are now being modernized under the direction of an American engineer, C. W. Purington. The production by the Lenskoi company since its formation to date has been approximately $100,000,000; besides this, the gold production on the Industrial claims, before their purchase by the Lenskoi company in 1910, was more than $100,000,000, making the production from these properties about $200,000,000 up to date. For several years, however, Lena Goldfields' shares have not been so popular; the great labor strike in 1912, combined with the exhaustion of some of its richest drifting gravel, caused a serious examination into the affairs and operations of the Russian company.

Old operations, especially in an isolated country, are apt like old people to get into ruts from which it is difficult to stir them until financial considerations compel a change. The high gold content of the Lenskoi gravel was not conducive to great efficiency, as a good profit could be obtained by almost any method. With the exhaustion of much of its richest ground, however, the company has been inspired to look into the question of a more efficient handling of the gravel. Conditions are now improved, and the directors in London have put themselves on record as approving the recommendation of their engineer for the establishment of modern methods.

Among the technical improvements recommended by Mr. Purington are the introduction of the "longwall and caving" system of underground mining, systematic recovery of timber, electric underground transport of gravel, improvements in hoisting, the installation of Alaskan sluicing plants, improved riffles, the use of quicksilver, and better methods of surface transport and washing. Another urgent recommendation made to the Lenskoi board was for the establishment of change houses at shaft heads, whereby a great reduction in the loss of gold by theft is anticipated.

From a preliminary examination of the present field and the surrounding area, Mr. Purington is satisfied that the Lenskoi company would be assured a long life by installing other forms of mining; hydraulicking, assisted by mechanical elevation of the tailings, and straight hydraulicking will permit the treatment of much gravel too low in grade for drift mining and the water supply is reported to compare favorably with that of "well known placer-mining districts of Alaska and the Klondike." However, to secure this gold by new methods will require an important capital expenditure and the directors wisely suggest that for the moment this development be deferred and operating attention be directed to the profitable economies that lie immediately in sight through the application of modern methods in lieu of wasteful and antiquated practices.

A company operating in an isolated section has many problems besides the ordinary technical and commercial ones. Routine and surreptitious practices that develop under such circumstances become almost traditions; the long established customs of the workmen, the trade of the region, and in some instances the religion may have a handicapping effect on efficiency. It is interesting to note the care taken by the Lena Goldfields' directors in suggesting operating changes. Commenting on the recommendations made by their engineer, the Lena directors state that they "feel confident that the Lenskoi board will not allow a preference for what has become customary nor a misplaced leniency toward vested interests to interfere with the company's legitimate rights."

Germany's Foreign Interests in Metals

The animosities created by the war have resulted in many inconsistencies and many losses of common sense. This refers especially to our British friends, but some of the absurdities that are entertained in Great Britain are beginning to find currency here. We have especially in mind some hypotheses respecting the German control of the world's business in metals, other than iron and steel, that recently have been advanced.

Soon after the outbreak of the war, the Australian government raided the offices of the principal mining and metallurgical companies and of the metals merchandizing companies in Melbourne; and while no evidences of trading with the enemy were discovered, high Australian officials, speaking formally for the government, professed themselves shocked to find to what extent German interests controlled the markets for lead and spelter.

This was taken up in Great Britain as a surprising revelation of how the three great metal houses of Frankfurt am Main and Halberstadt had pulled the wool over the eyes of unsuspecting Britishers, Australians, Americans, and in short of about everybody who does not speak German; it was charged that the Frankfurt and Halberstadt houses masqueraded in foreign countries under assumed names; and finally, it was shouted that Britons, who ne'er were slaves, must promptly emancipate themselves from the bonds. This may have been the right kind of talk to address politically to the populace, but to persons of intelligence and information it has been disgusting. The principal facts are well known matter of historical record.

Nobody supposes that the right honorable gentlemen who sit in Westminster, or the Solons who grace Washington, or the political luminaries who shine in Ottawa and Melbourne, are acquainted either with the intricacies or the simple threads of the mining, metallurgical and metals merchandizing business, but among those concerned with that business there has never been any secret that the American Metal Co., in New York, and the Australian Metal Co., in Melbourne, were associated with the Metallgesellschaft of Frankfurt am Main; nor that other local firms, agencies and companies were related to Beer, Sondheimer & Co. of Frankfurt am Main, and Aron Hirsch & Sohn of Halberstadt.

It is also well known that the great mining companies of Australia, such as the Broken Hill Proprietary, the Zinc Corporation, the Sulphide Corporation, the Mount Morgan, the Mount Lyell, etc., are full-grown concerns, opulent and excellently managed, which are well able to look out for their own interests.

Some years ago, when the Broken Hill mines began to be large producers of zinc concentrate, the marketing of the immense tonnage that was foreseen immediately became a matter of great concern. The whole world had an equal opportunity to bid upon this business, but nobody could offer so good terms as the Germans, who had more experience in smelting lead-bearing zinc ore than anybody else. It was necessary for the Frankfurt and Halberstadt houses which entered into the contracts to provide additional smelting facilities, even building several new smelting works, and in view of the large outlay of capital they had to make, the contracts were drawn up to run for a long time. Previous to the war satisfaction with those contracts were emphatically expressed by the mining companies.

Let it be noted that the mining companies were in no way dragooned into the contracts, and were entirely free to do otherwise if they saw fit. Thus the Broken Hill Proprietary Company did erect a zinc smeltery at Port Pirie in Australia, and the Sulphide Corporation built a zinc smeltery at Cockle Creek in Australia, and through a subsidiary, the Central Zinc Co., erected a large plant at Seaton Carew on the northeast coast of England. If the British zinc smelters did not go after the Australian business, and if the Broken Hill companies did not, on their own account, go more extensively into smelting, it was their own fault.

With respect to the control of metal prices by the German houses, the international zinc convention was organized especially for that purpose, and the British smelters went into it along with the French and Belgian, for the reason that they expected thereby to get a better price for spelter than they would if there were unrestricted competition. This convention consisted of three groups, viz., the Zinkhüttenverband, comprising the German and certain of the Belgian smelters, a Franco-Belgian group and a British group. The Franco-Belgians and the British had the chief advantage, inasmuch as they were obligated only to regulate their production, otherwise being free to sell their product, the Zinkhüttenverband holding the umbrella, as we should say in our vernacular. Thus, there was no doubt rejoicing in England a year ago that the immense unsold stock of spelter was being lugged in Germany, although after the war began the Englishmen were very sorry they did not have it.

Similarly, the international lead convention was an undertaking in which the Australians, Spanish and other producers participated for the avowed purpose of getting a better price for their products than they would otherwise.

We are not defending the wisdom or equity of these price-regulating conventions. We are simply pointing out that although they were managed under German auspices, and perhaps were inspired in Germany, the British, and British Colonials, and Americans, and Spaniards, and the foreigners of almost all descriptions welcomed the chance to go into them, and neither then nor now had they any idea that they were innocents who might be misused.

The present great concern of the Australian zinc producing companies is that upon the outbreak of the war the market for their products was cut off, this resulting naturally in great loss to the producers, and great distress among their employees. Steps were immediately taken by certain of the companies to place their ore wherever they could, but there were no great possibilities. American smelters, in the main, were not situated geographically so as to take the Australian ore. The Central Zinc Co. promptly inaugurated plans to increase the capacity of its works at Seaton Carew, but otherwise the English and Welsh smelters do not appear to have been enterprising. In the meanwhile, certain of the great Australian companies made up their minds that they would have to pocket their losses, but that they would never let themselves be caught again in such a fix, and would immediately prepare to provide their own smelting facilities, even if it should take two years (which was reckoned as the minimum time) to do so. This involved the expenditure of a vast amount of money, and for the sake of its financial assistance and smelting experience, the American Smelting & Refining Co. was invited to participate in the new plan.

The plan for the new smelting program was regarded as all but consummated when we said something about it several months ago. It fell through for several reasons. We understand that the A. S. & R. Co. insisted that the works should be on this side of the Atlantic. Some of the important British interests thought that America was the better locus for the business and that it ought to be here; but others was averse to letting the plants be erected anywhere outside of Great Britain. The great obstacle, however, was the intimation by the German houses to the A. S. & R. Co. that it would be going into a lawsuit and would be held responsible for the breaking of the ore contracts. We have good reason to suppose that the A. S. & R. Co. was quite innocent of any malevolence, but it might have been easier to strike than the foreign interests. The belief of the Australian companies had been that their contracts were automatically broken by the war. The Frankfurt and Halberstadt houses claimed that they were merely suspended. Efforts have been made to obtain a judicial pronouncement respecting this, but so far that has not been found possible to obtain.

The entry of the American Smelting & Refining Co. into the business in the first place was not another attempt of a devilish foreigner to rob the guileless Briton of his own, but was because the projected smelting plans required millions and millions of money, and American assistance, both financial and technical, was desired and was invited.

The latest absurdity about the lead and spelter business is the intimation that "the fine Italian hand" of the "German agencies" in New York is responsible for the recent extravagant rise in the price for spelter. It is all so very simple, thus: "England wants to buy spelter to keep it out of the hands of the Germans, who might make bullets out of it. The Germans, who monopolize the selling of spelter in New York, cornered the supply so as to make the British pay 'through the nose' for all they had to purchase in order to keep the Germans themselves from getting it." More fallacies are crowded into these few sentences, which are attributed to a "spelter interest," than can often be found in the same space.

Spelter is not used for making bullets. Spelter is the one metal whereof the Germans have more than they know what to do with. England had to buy her supply of spelter in America, because her previous supply from Belgium and Germany had been cut off. The zinc business of the United States is not controlled by the Frankfurt and Halberstadt houses, nor by Germans, nor by German-Americans.

We have not offered these comments because we hold any brief for the Germans in these days of controversy and hard feelings. But our sense of fairness caused us to think that something ought to be said on this subject. What we have said herein relates wholly to matters that are of historical record in our own files and in those of other reputable publications. It is quite time that common sense should once more begin to prevail.

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The meeting of the American Institute of Mining Engineers to be held in New York next week promises to be very well attended. These mid-winter meetings at the headquarters of the organization are becoming an appreciated feature in the life of the Institute.

BY THE WAY

This may sound like a joke, but it is not. A certain zinc smelter reports that he is now getting everything out of his ore but the "squeal." Asked to explain what he meant, he said that he is now putting up in barrels the residuum from his retorts and selling it as a specific against hog cholera. There is active demand for the substance for that purpose. It is said that the zinc residuum spread over the hog yard stamps out the germs of hog cholera and the hogs experience no further trouble. Nobody offers any explanation. This is simply reported as a thing that is so.

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The absence of authoritative quotations for the price of lead in London during August-October, 1914, produced a complicated question between the miners and smelters of British Columbia in connection with the Dominion bounty which is based upon the London price for lead. The arbitrator, C. R. Hamilton, of Nelson, decided that inasmuch as quotations had practically been forbidden after the outbreak of the war no data of any kind for the period in question should be officially recognized and certain pending settlements were ordered made at the average for the first seven months of 1914.

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Metall und Erz gives a list, comprising 104 names, of the members of the Gesellschaft deutscher Metallhütten und Bergleute who have gone to the front. In characteristic German fashion, the full titles of each individual are given, so that the items are very long, six or seven lines being required in some cases, although all possible abbreviations are used. They are serving in various capacities; for example, William M. Guerthler, Ph.D., is driver of a motor truck. The following members well known in this country are included in the list: Alexander Becker, director of the Metallbank, Frankfurt; Ernst Gellbach, director of the Hohenlohehütte; Theo Goldschmidt; Wilhelm Goetzke; Julius Grillo; Prof. F. Jungst, of Clausthal; Max Mehler; Wilhelm Schulte; Walther Selve; and Doctor Vogelsang, of Eisleben.

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When men of primitive instincts search for gold in remote regions, rivalry often leads to bloody strife. One rather ludicrous instance of somewhat reversed conditions is revealed by a study of the history of Brazil. During the seventeeth century adventurers from Sao Paulo roamed about the headwaters of the Maranhao River, in what is now the State of Goyaz. They sought gold with such success that Pedro Cesar de Menezes, governor of Para, resented what he considered trespass upon his domain. In 1673 he sent an armed expedition against Pascoal Paes de Aranjo, the leader of the "*paulistas.*" The expected battle did not take place, because the attacking soldiers went into the mining business on their own account, under the kindly guidance and tuition of Pascoal Paes de Aranjo.

PERSONALS

Wilfred Bancroft, secretary and treasurer of the Mass Consolidated Copper Co., visited the mine near Houghton, Mich., last week.

George Howard Ferguson is now Minister of Lands, Forests and Mines of the Province of Ontario. He is a lawyer, a graduate of Toronto University and has been a member of the Ontario Parliament for nine years.

Robert Walker for a number of years underground superintendent for the North Star Mines Co. at Grass Valley, Calif., has been retired on a pension. He is the first employee retired under a system adopted by the company. He has been in poor health.

Allen Hoffer, Jr., who has been assistant superintendent of the Warwick furnaces of the Eastern Steel Co., Pottstown, Penn., has been made superintendent of the blast-furnace department of the Worth Brothers Co., Coatesville, Penn., and has taken charge of his new work.

H. C. Felver, who has been in charge of the Worden-Allen interests in the Michigan copper country for the past six years and has built practically all of the steel construction work for mining interests there, has been promoted to an important executive position with the company at its Buffalo branch. Mr. Felver has just returned from an extended visit to France in the interests of the Worden-Allen corporation.

OBITUARY

David Carlyle Reed died at Barranca, Peru, Jan. 6, aged 41 years. He was born at Jamestown, N. Y., and graduated from Columbia School of Mines, New York. He went to Peru in 1904 as chief engineer to Frank Klepetko. He remained with Mr. Klepetko for seven years and during that time gathered an immense amount of information respecting the mineral resources of the country, in connection with Mr. Klepetko's extensive prospecting operations. Later Mr. Reed was given the contract to make the necessary surveys and estimates for the proposed railway from Huancayo to Ayacucho, the contract of which was being considered at that time by the Eddy Construction Co. Although Mr. Reed completed this work, the Eddy bid was finally rejected by the Government. Consideration, however, has recently been given to the project and it is very probable that Mr. Reed's recommendations will be carried out. Last year, Mr. Reed secured the contract for the construction of the Cuzco-Sta. Ana railway and the work was proceeding in a satisfactory manner, when the financial crisis precipitated by the European War caused its suspension. Since the war Mr. Reed had spent part of his time in the South endeavoring to arrange for the continuance of the work. He returned from Cuzco to Lima about the end of December suffering from heart disease caused by work at high altitudes. He left a widow and four boys.

SOCIETIES

Mining Society of Nova Scotia—In view of the unusual conditions prevailing the Council has decided not to hold the usual annual meeting and dinner this year. A formal annual meeting will be held, as directed by the charter, to elect officers and transact necessary business.

Institution of Mining & Metallurgy—His Majesty, the King of England, signalized the opening of the new year by conferring a Royal Charter of Incorporation upon the Institution of Mining & Metallurgy. This organization is to be congratulated on the success which has finally attended its efforts to obtain official recognition.

Canadian Mining Institute—The seventeenth annual meeting will be held in Toronto, March 3, 4 and 5. The headquarters will be at the King Edward Hotel. A. J. Young, Traders' Bank Building, is chairman of the Toronto local committee.

The business will include the report of the Council and financial statement for the year 1914; the election of the Council for 1915-16, and consideration of the proposed amendments to the by-laws.

Among others the following papers will be presented for discussion:

"The Zinc Industry in America," by J. A. Van Mater, New York.

"The Hall Sulphur Process," by H. F. Wierum, New York.

"The Stimulation of Prospecting," a symposium, by H. E. T. Haultain, Toronto; J. M. Bell, Montreal; and J. E. Hardman, Montreal.

"Safety Engineering at the Canadian Copper Company's Works and Mines, Copper Cliff, Ont.," by E. T. Corkill, Copper Cliff, Ont.

"Recent Developments in the Gold-Dredging Industry in the Yukon," by O. B. Perry, New York.

"The Economic Possibilities of the Yukon," by D. D. Cairnes, Ottawa.

"The Ore Deposits of the Copper Mountains, Similkameen, B. C.," by Frederic Keffer, Greenwood, B. C.

"The Smelting of Titaniferous Ores in the Blast Furnace," by Bradley Stoughton, New York.

"The Oxygen Torch," by David H. Browne, New York.

"The Weedon or McDonald Mine, Weedon, Que.," by L. D. Adams, Weedon.

"Certain Canadian Minerals for which a Demand has been Created as a Result of the War," by R. A. A. Johnston, Ottawa.

"Some Notes on Modern Hoisting Machinery," by J. B. Porter, Montreal.

"Some Recent Developments in Metallurgy," by A. Stansfield, Montreal.

"Gold on the North Saskatchewan River," by J. B. Tyrrell, Toronto.

"The Beaver Lake Gold District," by E. L. Bruce, Ottawa.

"The Conservation of our Mineral Resources," by F. D. Adams, Montreal.

"The Alberta Oil Fields," by D. B. Dowling, Ottawa.

"The Ore Deposits of the Ainsworth Mining Camp," by S. J. Schofield, Ottawa.

INDUSTRIAL NEWS

J. H. Dougherty, formerly with the International Steam Pump Co., has been engaged by the Northern Equipment Co. to take charge of centrifugal pump design and the improvement and development of the Erie line of centrifugals.

Guy E. Marion, secretary-treasurer of the Special Libraries Association, has severed his connection with Arthur D. Little, Inc., and will devote himself to the organization and development of special libraries or information departments, in business houses, industrial plants, etc. Mr. Marion will have offices after Feb. 1, in the Tremont Building, Boston, Massachusetts.

The International High Speed Steel Co., of 478 Pearl St., New York, has acquired a tract of nine acres of land at Franklin, near Rockaway, N. J., on which it will erect a large plant for the manufacture of its Bulldog brand of hollow and solid mining drill steel, and also of high-speed, tool and automobile steels of every description. It is expected that the plant will be in operation by April.

The Industrial Works of Bay City, Mich., has added to its extensive line of locomotive and wrecking cranes a small locomotive bucket crane operated by a gasoline engine. Such a crane is especially adapted for light or intermittent work, such as handling coal, ashes, etc., or for service in places where the use of steam is objectionable. A crane of this type has a further advantage in that it is always available for immediate use without waiting to get up steam. In operation it should be very economical, as there is no waste of fuel when the crane is not actually working.

One of the new industries of Chattanooga is the shovel factory of the American Manufacturing Co. This firm, which for many years has been manufacturing hardware specialties, recently purchased the plant and equipment of the Owensboro Shovel & Tool Co., of Owensboro, Ky. The equipment has been installed in the Chattanooga plant and will be ready for operation in a few weeks. The company expects to start modestly at first with an output of perhaps 75 dozen shovels a day, including long and "D" handle shovels, spades and scoops, gradually increasing the output as necessity demands it. In the manufacture of shovels in Chattanooga, the American Manufacturing Co., expects to do much of the work electrically as it is expert in this line of endeavor. It was among the first to purchase an electric welding machine in the general manufacturing business 12 years ago, and it has been instrumental in developing the uses of these machines and increasing their possibilities. Many of its improvements have been adopted by makers of these machines.

Editorial Correspondence

SAN FRANCISCO—Feb. 3

In Southern Eldorado County the outlook for the gold-mining industry on the Mother Lode for the coming year is exceedingly bright. Both the Nashville-Montezuma group of mines and the Church-Union mine, which have been under bond to Errol MacBoyle of San Francisco, are to be reopened. The Nashville-Montezuma mines were taken over by Bewick, Moreing & Co. of London, operators of the Plymouth Consolidated mine at Plymouth, about six miles south of Nashville. The Nashville mines were equipped and unwatered last summer but were closed in August on account of the European financial situation. An extension of the option, however, has been secured by Bewick, Moreing & Co. and development will again be undertaken in the spring. The Church-Union or Springfield mine, which is credited with a production of $6,000,000, was one of the well known Mother Lode mines in the '70s when it was owned by Hayward & Hobart who then controlled such famous mines as the old Eureka-Hayward mine, the Plymouth, and the Utica mines. The Union mine has now been acquired by John A. Finch of Spokane, who, with H. H. Lang and Mr. MacBoyle, has recently been in Eldorado completing arrangements for the reopening of the property. Mr. Finch is an owner of the Standard Silver-Lead mine in British Columbia and is one of the largest mining operators of the Northwest. With the Church-Union and Nashville mines again in the hands of operators having ample capital for systematic development work, and with interest being shown in a number of the smaller mines and prospects, southern Eldorado County seems to be on the eve of rejuvenation and it is confidently expected that this district will become as prolific a producer as any portion of the Mother Lode in Amador County adjoining.

Legislation affecting deep mines, introduced in the present legislature, will receive more careful attention from state officials and metal producers than formerly. The California Metal Producers' Association has undertaken an important duty relative to the safety of workmen by its purposed coöperation with the Industrial Accident Commission. It has been agreed between the association and the commission that a committee shall be appointed composed of three metal-mine operators, three skilled miners employed in deep mining, and H. M. Wolflin, mining engineer, in charge of the mine safety department of the commission. This committee of seven should be found more competent to formulate rules for safe operation of deep mines than could be provided in a legislative bill. The compensation law provides for mine inspection, but does not prescribe a system or rules of inspection. That is left to the mine-safety department, which in turn holds the mining engineer of that department responsible. Any system of inspection or rules prescribing the duties of the inspectors may be adopted and put into operation by the commission under the provisions of the compensation law. There have been introduced in the legislature five bills purporting to benefit the miner. One of these provides for the regulation of drilling and is known as the "dust law." Another provides for the elimination of foreigners unable to speak and understand the English language. Another is known as the "bank-to-bank law," providing for the regulation of the beginning and ending of a shift of labor underground. There is a hospital bill, and a bill for the examination of persons who handle steam-driven machines.

DENVER—Feb. 4

The Cresson shipment sampling has encountered difficulties. About 162 tons of the bonanza stuff was sacked as two lots. These lots were first delivered to the Copeland sampling works in the Cripple Creek district where they were crushed, rolled and automatically sampled, four pulps being thus prepared from each lot. It is claimed that the assays of these control samples checked up closely, the average result for the first-class being about [illegible] oz. gold per ton, the average for the second-class being about [illegible] oz. per ton. The stuff was next shipped to the Globe plant of the A. S. & R. Co., Denver, where the utmost [illegible] was exercised in resampling; the ore was rerolled and [illegible] mechanical methods [illegible] distinct sample was [illegible] from each lot. Upon [illegible], the four samples [illegible] checked up among themselves within [illegible], a result somewhat remarkable for such ore. Still, there is an apparent discrepancy of about $35,000 between the gross values determined in Victor and in Denver, the latter result being the lower. At this writing, the lots, which are intact at the smelting plant, are to be again completely rolled and sampled in a final effort to reach a settlement satisfactory to all concerned. The Copeland plant is presumed to have purchased the ore on its own samples and is naturally standing out against an indicated dead loss of about 7½% on the transaction. There are no metallics in this rich ore.

SALT LAKE CITY—Feb. 4

The Hercules Powder Co. is expected to begin production in March, having nearly completed its plant at Bacchus, half way between Bingham and the Magna mill of the Utah Copper. A tract of 2500 acres has been acquired, and cottages for employees, boarding house, club, golf links, etc., built. The plant will have a monthly capacity of 1,250,000 lb. of dynamite and 15,000 kegs of black powder. The buildings in which the powder will be made are isolated and surrounded by earth embankments. The site of the factory is on the west bench overlooking Salt Lake Valley, on the line of the Bingham & Garfield road.

The Daly-Judge at Park City on Feb. 3 laid off 50 miners, on account of efforts on the part of a deputy state labor commissioner to enforce the eight-hour state law. Owing to the winter shortage of water it had not been possible to work two shifts at the mill to advantage, and the men were being worked an additional two hours. Wages were being paid for overtime. During the last week in January 30 women applied to the superintendent of the mine for work for their husbands. In order to take in such men and to relieve the present situation somewhat the mill was running a little overtime. The mine was running at the regular eight-hour rate. The overtime at the mill was introduced to take care of surplus ore which could not be treated in the eight-hour shift. On account of the present low metal prices, no effort is being made to crowd production. The 50 men laid off had been producing the ore treated in the overtime. A canvas among the men at the mill showed that, without exception, they were well satisfied with the overtime arrangement and glad to earn the extra money. The working force at the Daly-Judge amounts to 250 to 275 men.

JOPLIN—Feb. 6

Numerous New Mills are being built, old mills started up, new shafts sunk and old ones cleaned out and repaired, preparatory to opening up new mines and starting up old ones. Outlying districts such as Sarcoxie, Wentworth, Aurora and a number of other small camps are feeling the effects of the good market. Many good new strikes are being reported from these camps recently; the most noticeable is that made at the Boyd mine which after a number of years of varied luck has at last opened a good body of pay ore; a mill of 350 tons capacity is now running on full time and turning out two carloads of zinc concentrates each week. The Prosperity Camp is a scene of much greater activity than formerly, the last two months marked the erection of two new 350-ton mills and the starting of another. The McDonald company having just completed its mill will begin operations in a few days, the F. C. Wallower mill has been running for about 30 days; while the Jasper County Milling Co. will be ready for operation in a short time. These mills are all handling the deep sheet-ground ores which can be mined profitably, only when zinc ore is selling above a $40 base. With the present high prices excellent profits can be made and it is to be expected that a large number of new companies will get into the sheet-ground district.

ISHPEMING—Feb. 6

The Oliver Company, it was frequently stated last year, would push its mining operations on the old ranges after the first of the present year, when the leases on the Hill lands expired. It was thought that many properties which have been idle for years or which have been carrying on operations on a small scale would be greatly benefited because the Steel Corporation would lose a number of mines on the Mesabi. At the present time it does not look as if such would be the case, since the Corporation can purchase ore in Minnesota at about the same figure that it can be mined from some of its own mines in Michigan. Most of the Michigan properties are held in fee and the ores are being held as reserves, while more activity is shown at the mines that are held under lease and upon which royalties have to be paid annually. The Steel Corporation owns several mines in the Ishpeming field, about half of which have been idle for a number of years. The mines at Champion and Section 21 at the Winthrop are good examples. The reserves of these properties are known to be large but the company does not show any disposition to mine the ore. If the demand for ore were brisk and the price high, some attempt might be made to place these ores on the market. Right now it is difficult to see how the old ranges are going to be benefited because the Hill leases have expired. The Arthur Mining Co. has been formed to take over the Hill lands and operate the mines relinquished by the Corporation. Many new mines are also being developed by this concern and the company will have a large tonnage within a year or two to place on the market for sale. Some persons feared that the entry of the Arthur would have some effect on prices but all such talk has ceased since M. A. Hanna & Co. took a contract to sell the ore. The Hanna company has its own ores to sell and could not afford to try and dispose of the ores of the Arthur at a lower figure. Just now all of the iron-mining companies are wondering what the demands of the furnaces will be this year and what the prices will be. Only a few sales have been reported thus far and the price per ton has not been made public. Most of the ore contracts are usually made in February and March, although last year they came in later.

HOUGHTON—Feb. 6

Full Time operations are now being carried on by every copper-producing mine in the Lake Superior district. The net increase in the output of refined mineral is likely to show over 2,000,000 lb. in February and 2,500,000 lb. in March. This additional copper will not, of course, reach the market before April and will not have any appreciable effect on the supply until later in the spring. The following table shows the total monthly rock output at every mine in the district with the approximate net refined output in copper. The estimates are conservatively figured, based on the past performances in the returns per ton:

Mine	Monthly Rock Tonnage	Refined Output Pounds of Copper
Calumet & Hecla	208,000	5,625,000
Ahmeek	62,500	1,500,000
Winona	5,200	101,000
Quincy	104,000	1,560,000
Superior	19,000	350,000
Mass Con.	21,000	420,000
Centennial	13,000	170,000
Wolverine	44,200	800,000
Osceola Con.	105,000	1,600,000
Isle Royale	57,200	940,000
Allouez	41,600	637,500
Mohawk	60,000	1,300,000
Victoria	7,800	93,600
Champion	70,200	1,479,000
Trimountain	34,000	550,000
Baltic	37,000	730,000

In the case of Mass, the figures apparently show a net return of 20 lb. to the ton on the tonnage. That is not true, for the Mass does not run so high. The unusual amount of solid mass stuff that is smelted direct brings up the average of the Mass return on the mill material appreciably. Calumet & Hecla and all its subsidiaries were the last mines to return to normal working time. Wolverine and Mohawk kept up full time all through the slump. Baltic, Champion and Trimountain went on half time and just a few weeks ago resumed full time. Quincy has been working full time but operating three shafts only. Other smaller mines worked full time.

TORONTO—Feb. 6

The Hollinger annual report which was presented at the annual meeting of the shareholders in Montreal, Feb. 2, was satisfactory, and shows that the property will have a great future. It is now numbered among the great gold mines of the world, and in another year or two, when further work has been done, it should stand near the head of the list. During the past year the mill treated a total of 208,936 tons and recovered bullion to the value of $2,688,254, an increase of $222,134 over the preceeding year. The net profits for the year were $1,786,679 or practically 60% on the $3,000,000 issued capital. Dividends of $1,170,000 were paid. The surplus carried forward was $1,126,713, and of this amount $664,603 represents cash and gold bullion. Expenditures for plant amounted to $305,621, and when the present additions to the mill are completed, the capacity will have been raised from 500 to 1600 tons a day. The average value of the ore treated during the year was $13.67 as against an estimated value for the reserves given in last years' report of $13.71. Operating costs were reduced to $1.50 a ton, and at the present time are lower than this average. Further reductions will be made. The ore reserves are estimated at 1,162,960 tons, having an average value of $11.49, giving an estimated gross value of $13,358,420. This represents an increase in gross value over the preceeding year of approximately $2,000,000. In addition to this there are a large number of known veins on the property some of which have been found by diamond drilling, on which no work has been done and on which no tonnage estimates could be made. Out of a total of 54 veins located, so far only 12 have been reached by underground workings. One of the most interesting sections of the report was that dealing with the deep diamond-drill exploration. An incline hole was bored to a depth of 2000 ft. and reached a vertical depth of 1450 ft. In the course of drilling 13 mineralized zones were passed through, the last, at a depth of 1424 ft., being 7 ft. wide and assaying $8 a ton. Of the 13 orebodies cut by the drill, six were 5 ft. or more in width, and nine sampled $6 or more to the ton; one at a depth of 710 ft. averaged $23.60 a ton. The information furnished by the diamond drilling shows that there is no change in the formation to a depth of 1425 ft., and also that at that depth there is no change in the vein characteristics. The content shown is such as might be expected if the hole had been bored at any random point below the 200-ft. level. As a result of this drilling, it is considered reasonable to assume that operations can be carried to a depth of at least 1500 ft., and there is nothing yet to indicate that a much greater depth may not be obtained.

The Nickel export question will come prominently before the Canadian Parliament which opened Feb. 4. W. F. MacLean, M. P. for South York, has given notice of a bill to be introduced next week to regulate the exportation of nickel and combinations thereof. It entirely prohibits the export of nickel ore, nickel matte, nickel oxide and all compounds of nickel during the present war or at any time when the Empire is at war. It also provides that the export in times of peace shall be subject to regulations made by the Governor-in-Council, under which authority the government might easily compel the producers to refine all nickel in Canada. The last clause of the bill permits the shipment of nickel and nickel compounds to the United Kingdom for use in war times. Mr. MacLean is an independent Conservative and an ultra-protectionist, and through his newspaper, the "Toronto World," has been the leading promoter of the agitation, which though studiously ignored by both the Government and the Liberal press appears lately to be gathering strength. A large number of petitions asking Parliament to prohibit the export of nickel are being received by members. Several boards of trade including those of Ottawa, Berlin, and Owen Sound have taken up the question and while not favoring so drastic a measure as the prohibition of nickel exports, have passed resolutions to the effect that the Canadian and provincial governments shall be asked to take measures providing for the refining of nickel in Canada, and that a commission be appointed to investigate the matter of the erection of a refining plant in Ontario, thereby reserving to Canada complete control of all nickel mined in the country. So far nothing has happened to indicate any change of policy on the part of the government, and in view of the strength of the administration and the strictness of party discipline, coupled with the evident indisposition on the part of the Opposition to identify itself with the movement, it is altogether improbable that Mr. MacLean's action will result in any serious interference with the industry. It is pointed out by those opposed that the immediate result of its adoption would be to increase greatly the opportunity of the Germans for obtaining nickel from the United States, since, were further exportation prohibited, the International Nickel Co. would naturally seek to dispose of the large stocks now on hand to the best advantage and would have no object in refusing to sell to Germany. This is a consideration which the government is not likely to overlook.

The Hon. G. Howard Ferguson, Minister of Mines for Ontario, has announced that a commission will be appointed to investigate the situation. This commission, the members of which have not yet been appointed, will deal largely with the question as to whether or not it is economically feasible to refine the nickel matte in Canada. It will also take up the question as to whether the nickel companies are paying a fair rate of taxation. The majority of mining companies in Ontario, pay 3% of the profits over a certain exemption, but the nickel companies pay on the value of the nickel in the matte, and this value is much lower than the published quotations for nickel even allowing for the cost of refining. Mr. Ferguson considers that while a few years ago the refining of nickel in Canada would not have been economically feasible, the rapid advances in metallurgy demand a complete investigation, to decide whether or not the time has arrived when such a step should be made. Unfortunately for this side of the matter, the recent advances in metallurgy do not seem to have helped the nickel refiners to any extent.

The Mining News

ALASKA

IN HEALY RIVER DISTRICT no real pay yet found. Owing to litigation, Lawrence & Albrecht, who took in a large plant from Tenderfoot district last fall, have been unable to start work.

BROAD PASS district reports, probably exaggerated, state two lodes, 200 to 250 ft. wide, have been traced for several miles. One lode runs $15 clear across, has streak 14 ft. wide assaying $250. Wells Bros., reported to have sold out for $150,000, had known of veins for several years. Under present conditions this not poor man's camp.

KOYUKUK DISTRICT reports unusual activity this winter. Camp consistent producer for 20 yr. Corbett Bros. working on lower Hammond River; Averill & Trail on Jennie Creek; Gilbert & Ellingson on Discovery, Hammond River; Dow & Collins, Butler & Hastings, Siverly & Brown, Kelly & Geegan and Vern Watts all on Hoosier Association claim, Hammond River; Smith & Ellingson on No. 4; Crawford on No. 5; Martin on No. 6. Wild Creek district looking good. Joe Matthews, on Discovery, Joe Creek, took out $5000 last fall before freezeup, in seven box-lengths (84 ft.). Jack Sullivan, on No. 1 Below, panned 83 oz. of gold dust from drain 3 ft. wide, 4 ft. deep, and 16 ft. long. Larsen and partners, on Nos. 1 and 2 Above, recovered $3500 from five box-lengths.

JANOFF & CO. (Fairbanks)—Boilerhouse on No. 14 Goldstream destroyed by fire. Total loss, $1000. Thought caused by candle left burning.

TREADWELL GROUP (Treadwell)—Treadwell mills crushed 61,341 tons in December recovering free gold $73,912 and concentrates $53,802. Corresponding figures for United, 39,361 tons, $51,861 and $42,327; for Mexican, 19,040 tons, $20,521 and $22,292.

BITTEL & OSBORN (Ruby)—While prospecting for gold on Poorman Creek, operators discovered coal seam at bottom of 60-ft. shaft. Coal much crushed; bed appears to dip about 45°; thickness not determined. Said to be of good quality, possibly semi-anthracite.

NO. 4 BELOW, GOLDSTREAM CREEK (Fairbanks)—Gleason & Sawyer, laymen, have blocked out 20,000 sq.ft. of pay that they expect to hoist this winter. Operators have novel type of plant, using gasoline engine situated underground for hoisting, in conjunction with Fairbanks overhead carrier. Bucket dumps automatically, doing away with necessity for top man and for expensive surface equipment during cold weather.

HOT SPRINGS DISTRICT—Fred Jorgensen, layman on Bock ground, reported to have found good pay. Has enough ground blocked out to assure full summer's work. Three churn drills being used in prospecting at Hot Springs, two on Bock's ground, other on ground controlled by Howell & Cleveland. More prospecting for quartz deposits, both gold- and tin-bearing, than in former years. Some promising discoveries made, but nothing to arouse undue enthusiasm.

BERRY DREDGE—Nels Rasmussen has contract to move new Berry dredge from steamboat landing at Circle City to diggings on Mammoth Creek, distance of about 35 miles. Work of moving progressing satisfactorily, dredge will be ready to start digging when water runs in spring. William McDonough, who has contract to deliver wood to dredge, recently left Fairbanks with 14 head of horses to commence work.

ARIZONA

Cochise County

MASCOT (Dos Cabezas)—Reported railroad will be built to connect with Southern Pacific at Wilcox instead of with El Paso & Southwestern at Kelton. Great joy in Wilcox; free barbecue announced to celebrate beginning of work;—and Arizona has a prohibition law.

Gila County

INSPIRATION (Miami)—Now stated production should begin in April. Final decision not made as regards some machinery. Minerals Separation process to be used on royalty agreement.

Greenlee County

SHANNON (Clifton)—Reported orders given for immediate resumption, after about five months' shutdown. Shutdown calculated to have cost about $10,000 per month. Production now should be about normal, 1,000,000 lb. per month.

Santa Cruz County

R. R. R. (Patagonia)—A. E. Crepin has sold interest in this producer to Colonel Richardson, of Patagonia, and has moved to Tucson.

CONGRESSIONAL (Alto)—Josiah Bond, owner, has completed wagon road to mine, and machinery to sink main shaft deeper will be installed.

RIQUEZA (Alto)—This mine, belonging to Josiah Bond, under lease to Figueroa Bros., who are mining high-grade silver ore. Shipment will go forward this month.

DUQUESNE (Duquesne)—Mine has large amount of fair shipping ore in sight, which will be sent to smelter as fast as conditions of road will allow. Rains of January have been unusual, with considerable damage to every road in county.

CALIFORNIA

Calaveras County

FORD (San Andreas)—Option taken some time ago by John S. Benson. Mine will be unwatered and retimbered. Situated on Mother Lode and has well known characteristics of belt. Sixty acres of Ford south extension bonded to Eastern men.

ORO WATER, LIGHT & POWER CO. (Oroville)—Company contemplates extending dredging operations in this county. Arrangements reported for additional mining rights on ranch owned by Irving Hill, situated on Mokelumne River near Comanche.

SMITH RANCH (Campo Seco)—Mining rights bonded to W. E. Booker and others, and subleases let; the 45-ft. shaft being deepened to tap Fleming dike. Incline tunnel on another lease about 30 ft. in being advanced in good ground. Good ore being extracted from 30-ft. shaft on King lease.

Mariposa County

MARIPOSA COMMERCIAL & MINING CO. (San Francisco)—Suit for $1,142,301 damages filed at Oakland by George W. Lanyan, assignee of claims, for alleged breach of contract in refusing to sell Fremont Grant for $400,000. Claimants were S. Webber Parker and William H. Cook. Fremont Grant has been for sale for some time and number of different promoters or agents have undertaken to handle it. Grant contains mines as well as agricultural and grazing lands.

Placer County

ORO FINA MINING CO. (Auburn)—Capital stock of $100,000 to be increased to $200,000. Resolution to this effect was adopted in October.

WHISKY DIGGINGS (Lincoln)—Old mine being reopened by tunnel. Shaft will not be repaired at present. Ore carries lead, zinc, gold and some copper. Ores will be shipped to Selby. Operators San Francisco men.

San Benito County

NEW IDRIA (Idria)—Large shipment of quicksilver shipped to New York last week of January. First shipment direct to New York market in several months. To be sold at whatever New York price may be, as price is better there than in San Francisco.

San Bernardino County

BAGDAD MINING & MILLING CO. (Bagdad)—Company dissolved on account of nonpayment of taxes. New company reported to be contemplated by some of former owners.

COLORADO

Boulder County

COPPER GLANCE (Sunset)—W. J. Barrett has sold this group to newly incorporated Sunrise M. & M. Co., W. J. Hegel, president, and W. A. Notie, secretary-treasurer, Denver. Small mill to be erected.

U. S. GOLD CORPORATION (Boulder)—Mill nearing completion. Herreshoff roaster under construction and will be ready for operation in near future. No. 2 shaft unwatered to bottom and electric pump installed; 170-ft. and 400-ft. levels being opened and development will be resumed.

CARIMAN MINING & MILLING CO. (Boulder)—Company formed to develop and operate Caribou-Poorman group of properties controlling important system of veins for distance of about two miles. H. P. Low and C. B. Manville chief owners and N. H. Brown general superintendent. Company plans to develop mines at greater depth through Boulder County tunnel now 4600 ft. long. Tunnel will be advanced 7000 ft. to develop Caribou vein at depth of 1680 ft. below surface. Present surface equipment includes mining plant and mill at Caribou, mining plant at Boulder County tunnel and concentrating mill at Cardinal. Last named plant has been in satisfactory operation since last July and has capacity of about 100 tons a day. On account of unfavorable condition of old Caribou shaft company plans to make No Name its principal working shaft. Extensive improvements will be made in surface equipment at No Name. Underground workings being cleared and repaired preparatory to resumption of active mining operations. In meantime company's milling plants kept busy treating ore sorted from extensive dumps of Caribou, Poorman, and No Name mines. Estimated these dumps contain 250,000 tons of material that can be milled at a small profit. Extensive tests made and considerable dump material found to average about $6. New mill for treatment of dump material has capacity of 150 tons a day. Dump material scooped up by specially designed scraper and delivered to mill storage bins; crushed in Blake crusher and reduced by 6-ft. Hardinge ball mill to 30 mesh. Oversize delivered to 4½-ft. ball mill. Cyanide solution introduced at ball mill and treatment thereafter in solution. Pulp from crushing department passed to Flood classifiers and thence to battery of Wilfley and Card tables where heavy sulphide minerals are recovered. Middlings reground and returned to tables. Tailings passed to Dorr classifier. Sand delivered to three large leaching tanks. Slime goes to three Dorr agitators and two Dorr thickeners, thence to Portland filter. Precipitation accomplished on zinc shavings. Mill arranged on gravity system and only elevator and pump used are to return middlings and handle solutions. Claimed mill makes saving of 90% of metal in ore at cost of $2.83 a ton. Claimed that orebodies now being opened underground are from 10 to 15 ft. wide with substantial quantities of $16 ore being developed. Company plans extensive campaign of vigorous underground development.

Clear Creek County

PHOENIX (Idaho Springs)—Property leased to Ed Mosher who will operate mine through Newhouse tunnel. Lessee plans to begin unwatering operations in near future.

LAKE (Idaho Springs)—Surface workings leased to E. D. Quigley. Lessee clearing out Lake tunnel No. 2 which will be advanced 150 ft. Sinking on vein to depth of 600 ft. below this tunnel under consideration

Gilpin County

PRIZE MINING CO. (Nevadaville)—Company has commenced work on Prize, Prize Extension, Suderberg and Ashtabula properties, all of which will be worked through Newhouse tunnel. Drifts east and west from tunnel have been started and 400-ft. raise will be made to connect with old workings from surface. Company will repair equipment in Nevadaville and arrange to work over old dumps which contain considerable milling ore. Ore now produced from development is sent to Argo mill for treatment.

Lake County

BIG FOUR (Leadville)—This property, leased to Big Five Operating Co., will probably hereafter be worked through Yak Tunnel. After recent fire that destroyed surface plant and permitted workings to flood, negotiations were made with owners of Ibex property whereby Big Four acquires lease to considerable area of contiguous Ibex ground and will develop it by lateral from Little Jonny workings toward Big Four shaft. There will be about 749 ft of drifting and 202 ft. of raising to effect connection.

Teller County.

GRANITE CONSOLIDATED (Victor)—This company owned chiefly by McNeil and Penrose interests has purchased holdings of Ophir Gold Mining & Milling Co. comprising about 18 acres of choice land practically contiguous to Granite territory on Battle Mountain in Cripple Creek district. Ophir company has been controlled by Dennis Sullivan of Denver and Grant B. Schley of New York.

IDAHO

CROWN POINT (Silver King)—Leasers have made arrangements with Federal Mining & Smelting Co. to treat ore from Crown Point in Sweeny mill. Mining will be resumed at once.

INTERSTATE (Sunset)—Plans to enlarge present concentrating plant to handle 400 tons per day. Capacity now 300 tons. Pumps will supply additional water if necessary. C. M. Loeb and Otto Sussman, of New York, have been at mine on business this week. High price of spelter stimulated activity at mine. Mill now producing 150 tons of concentrates daily.

MICHIGAN

Copper

MASS CONSOLIDATED (Mass)—Most satisfactory physical conditions exist in development and operation of Evergreen lode. Never before possible to maintain operations here during such a period of depression. Usually necessary to suspend work when copper touched 12c. or even before on declining market. While there was no profit in operations with copper at 11c., it was advantageous for corporation to keep mine in operation and doubly advantageous for men employed. Rights for extensive operation of Evergreen lode obtained three years ago, bulk of last assessment being used for that purpose. Lode, operated from B shaft, has shown more extensive mass and barrel work than ever before, wider and richer than ordinarily opened. On 6th and 8th levels showing has been good, permitting judicious selection of rock and furnishing large amount of mass and barrel work. Opening from 11th has likewise proved remunerative. On this lode, as on Butler lode, where most of mining continues to be done, careful selection of rock can run milling returns up to 25 lb. if desirable, but at higher milling cost, higher mining cost and smaller rock tonnage. On the other hand, rock can be sent to mill in such enormous quantities that it will average 10 lb. return. Question of selection is one which depends entirely on commercial possibilities as figured on possible selling price of output, proper regard for the eventual working out of mine and basis for advanced openings. No mine in Lake Superior district, regardless of size or development, turns out same total of mass and barrel work that Mass shows. Two shafts in operations, B and C. First down to 18th level. At this depth attack on Butler lode commercially successful. Considerable tonnage now secured from raise on lode from 17th level. Butler lode steeper than shaft and crosscut from 18th level or from next horizontal point of attack below 17th will be comparatively short. In fact lode undoubtedly crosses line of shaft at about the point where 19th level will be. At crosscut from 17th, raise in lode now within 40 ft. of crosscut from 15th and this will be holed through within a few months. Lode at this point showing average productivity. Other shaft, C, now has attained depth of 250 ft. below 9th. It is substantial producer of average-grade milling rock and some mass material.

Iron

INDIANA (Iron Mountain)—Operations to be resumed at early date.

TULLY (Iron River)—Seventy miners given places during past week. Mine operated by Corrigan-McKinney.

BRISTOL (Crystal Falls)—Mine resumed operations Feb. 1, with 250 hands. Property closed last summer, when slump came. Now few idle men in city.

DUNN (Crystal Falls)—Corrigan, McKinney & Co. added 100 men to working force Feb. 1. Crew now up to normal. Territory adjacent to old property, secured short time ago, known to contain considerable ore and management has already started after it.

AMERICAN (Diorite)—Attempt made on Sunday morning, Jan. 31, to dynamite home of Capt S. J. Perkins. Two sticks of dynamite set off on front porch, blowing off porch and small part of house. None of occupants injured. Person responsible not known. Mine recently resumed after being closed since Aug. 1, 1914. Many men applied for work during January but there were places for only about 100, in addition to 150 employed in development and repair work while shaft was being fixed. Believed some one sought revenge for not being given place. One day last month 264 men journeyed to Diorite from Ishpeming, 10 miles, seeking work. Captain Perkins went to Diorite last fall from Gwinn, where he was employed as mining captain by Cleveland-Cliffs; was for number of years in charge of Ashland mine on Gogebic range.

MINNESOTA

Cuyuna Range

E. J. LONGYEAR CO. (Brainerd)—After drilling nine holes on Crow Wing County poor farm, company has surrendered option of lease. Excessive depth of surface, 200 to 250 ft., overlying iron formation, is cause of move.

CUYUNA-SULTANA (Ironton)—Bids being received for removal of 1,000,000 yards of overburden, which will uncover about eight acres, surface averaging about 60 ft. Drag-line method of stripping decided upon as most economical.

Mesabi Range

LA RUE (Nashwauk)—Excavation for washing plant now completed. Much repair work being done in anticipation of busy season.

IROQUOIS (Mountain Iron)—This mine, last operated by Rogers-Brown Ore Co., now being dismantled of machinery for shipment to Grand River, Mich. Stated orebody is not entirely exhausted.

HAWKINS (Nashwauk)—Company has completed erection of $3000 clubhouse for employees, with all modern conveniences. Machinery now being installed in recently constructed steel and concrete machine shops.

SCARCITY of underground miners reported in Virginia district; probably will increase as season opens. At Alpena mine 700 men employed underground at present, while Lincoln has 200 and Minorca works three full shifts. Common labor still remains plentiful.

QUINN-HARRISON (Nashwauk)—Location consisting of 30 residences will be built on company's property as soon as weather permits. Butler Bros. will begin construction of shops at early date. Work on superstructure of washing plant will begin within a few days.

MISSOURI-KANSAS-OKLAHOMA

CHILDRESS & CO. (Galena, Kan.)—Now cribbing shaft lost when mines caved a few weeks ago, carrying down hoist and other machinery; expected to get shaft cleaned out, as it was damaged but little by cave; machinery is lost, being completely buried several feet under waste rock and débris. Company expects to go under caved ground and timber it up, working lower level at 125 ft. where good run of zinc ore is known to exist.

BATTLEFIELD MINING CO. (Galena, Kan.)—New shaft started on north side of forty-acre tract south of Galena to catch ore run that Diplomat Mining Co. mined up to Battlefield north line. Diplomat working at 100-ft. level has been making good turn-ins for some time. Mr. Sapp, owner of Battlefield, expects to strike same run at 100-ft. level and says he will be hoisting pay dirt within 60 days. Battlefield shut down mill and other mines on land on account of low price of spelter, but will now unwater ground and start mill shaft in a short time, or as soon as the water is out of ground and needed repairs made on mill. Battlefield has been great producer in past and with new development in new shaft and water out of the old workings, tract will soon be paying good dividends again.

MONTANA

Fergus County

BARNES KING (Kendall)—December report brings to close unusually prosperous year. Amount realized from North Moccasin in gold bullion was $424,411; tons mined and milled 51,471, making average return nearly $8.25. Average cost of mining and milling will probably run between $4.25 and $4.75 leaving net profit of between $3.50 and $4.00, about $200,000 for 1914. During year final payment made for North Moccasin mine, and Piegan Gloster mill at Marysville rebuilt, all out of earnings of North Moccasin.

Silver Bow County

ANACONDA (Butte)—Production apparently back to 60% or 65% of normal, as against 50%, in last part of 1914. January yield, 13,700,000 lb., largest since August.

EAST BUTTE (Butte)—Rumors of resumption denied by management. Mine closed since Aug. 5, engaged in repair and development work and in making changes in smelting plant. Plant will have larger capacity and be more economical.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Estimates for January: Tonnage, 30,563; gross extraction, $414,000; net realization, $232,000.

GOLDFIELD MERGER (Goldfield)—This company, together with Deep Mines Co. reported as thrown into receiver's hands on application of Lucy Ames, shareholder.

GOLDFIELD EMPIRE MINING CO. (Goldfield)—Property of four claims sold to Reno men. First payment made, machinery ordered and work to start soon on 150-ft level of shaft.

JUMBO EXTENSION (Goldfield)—East and west drifts being driven from top of raise 503-D on 1017-ft. level; faces in ore assaying $25 and $17 respectively. West drift from raise 503-C opened 6-ft. oreshoot assaying $28 per ton. Oreshoot 4 ft. wide assaying $69 per ton being stoped in east drift on 921-ft. level. East drift on 865-ft. intermediate level in $9 ore. Exploratory work under way on intermediate, A, level below 921-ft level. Main shaft being repaired between 800- and 1000-ft. points. Original Velvet shaft, 400 ft. deep, will be enlarged from two compartments to three and sunk to 1017-ft. level to facilitate development work in northeast portion of Velvet claim. Eight-drill air compressor and 75-hp. electric hoist will be installed.

Humboldt County

AT ROCHESTER recent development work on Red Top lease, Rochester Snowstorm, Paymaster and Octopus progressing with satisfactory results. Sixty-room hotel in Lower Rochester being built by F. W. Kittle.

ROCHESTER MINES CO. (Rochester)—Power line from Lahontan to new mill finished, but due to delay of manufacture of transformers, power cannot be supplied before middle of February.

STOWELL MINING & LEASING CO. (Rochester)—A 400-ft. crosscut tunnel being driven to cut at depth oreshoot opened at surface. Some ore showing free gold opened and large tonnage milling-grade ore developed.

Lander County

GOLD-COPPER STRIKE AT HILLTOP made recently. Shoot opened on surface, stated to be 6 ft. wide, assaying well in both gold and copper.

Lincoln County

DAY-BRISTOL (Pioche)—Property sold by receiver on Jan. 19 for $99,200 to representative of A. W. Middleton, of New York. If property is worked, which will result in operation of Pioche-Pacific R.R., many properties in Jack Rabbit district will be worked.

Lyon County

SMITH VALLEY MINES CO. (Yerington)—Suit against receiver of this company instituted by Reading Mercantile & Transportation Co.

NEVADA DOUGLAS (Ludwig)—Reported reorganization in prospect. Special stockholders' meeting called for Mar. 4 in Salt Lake City to vote on consolidation with Moore Mining Co. New company to be called Nevada-Douglas Consolidated Copper Co., capitalized for 1,000,000 shares, par value $5 per share, will assume liabilities of present companies, $525,000 of Nevada-Douglas and $57,000 of Moore, and take over all assets of both; Nevada-Douglas stockholders will receive share for share in new stock for present holdings and 10,000 shares will be issued to Moore company for property. New stock will be assessable and assessment of 10c. per share evidently contemplated.

Mineral County

PITTSBURG-NEVADA (Rockland)—Severe weather has interfered with mill construction.

Nye County

TONOPAH EXTENSION (Tonopah)—New fire protection system being installed.

JIM BUTLER (Tonopah)—Improvements at Wandering Boy shaft completed and mining to begin at once.

TONOPAH VICTOR (Tonopah)—Water lowered to 1335-ft. level. New pumps will be put in operation at once.

DEXTER-WHITE CAPS (Manhattan)—Preliminary negotiations with Tonopah Mining Co. to take 60% interest concluded. Mine will be examined and ore tested; if results satisfactory, Tonopah Mining Co. will take short-time option for exploratory work.

BULL HEAD (Manhattan)—This property until recently known as Gold Crater, owned by Mushett and Wittenberg, has started operations and in drift north from working shaft on 150-ft. level cut zone of enriched schist, supposedly continuation of belt found in Big Pine and Reilly Fraction properties.

BIG PINE (Manhattan)—Gloryhole operations keep new mill grinding on from 100 to 125 tons of fines, which represents total of about 400 tons of rock broken and hoisted each day. Large proportion of oversize is due to fact that crusher is too small to crush enough tonnage to keep tube mill employed steadily. Grade of ore to mill steadily improving with depth gained in gloryhole work. Waste stacker and classifier in mill are latest improvements in equipment.

Storey County

C. & C. SHAFT (Virginia City)—Electric cable being installed to conduct power to pumps to be placed on 2700-ft level.

NEW YORK-NEVADA MINING CO. (Virginia City)—Twelve-months lease granted Virginia City men by referee in bankruptcy.

White Pine County

NEVADA CONSOLIDATED (McGill)—Stated recovery of entire plant, with oil-flotation process installed in one unit, increased from 68% to 71%. Copper content of tailings from this unit exceedingly low, gold recovery greatly increased.

NEVADA STAR MINING CO., Ltd. (Cherry Creek)—Liquidation and reorganization to take place at once. Assets to be disposed of to new corporation. Liquidator, Alfred Cornelius Stonehouse, 25 Bond St., Leeds, England.

NEW MEXICO

Dona Ana County

ORGAN MINES LEASING CO. (Organ)—Company has filed articles of incorporation. Norval J. Welsh named as agent. Mines situated at Organ.

Grant County

CHINO COPPER CO. (Hurley)—Excessive burden of icicles on one of main flumes caused capsize. Large quantity of stored water lost before it could be turned off.

BURRO MOUNTAIN COPPER CO. (Tyrone)—Experimental [illegible] operation ceased. Work being pushed on 1000-ton concentrator. Drilling for water throughout Phelps-Dodge ground continues.

Otero County

LA LUZ COPPER CO. (La Luz)—Articles of incorporation filed. Capitalization $250,000; $197,000 paid in. J. G. Barrett statutory agent.

Socorro County

TREASURER MINING CO. (Mogollon)—Order of foreclosure in case of Waters vs. company set aside by Judge Mechem at Santa Fe.

UTAH

Juab County

GRAND CENTRAL (Eureka)—New orebody opened on 900.

DRAGON (Silver City)—Recent gold strike on 600 has opened up to 12 ft. in width. Ore being shipped with copper ore from same part of property.

MAMMOTH (Mammoth)—Work on 600 level will be resumed as soon as company's water line from Cherry Creek is repaired. Good body of ore running well in copper and silver opened on this level.

IRON BLOSSOM (Silver City)—Work during past year increased available ore supply. Ore, some of which carries native silver, being mined from Van stope, on 500 level of No. 3 workings.

EAGLE & BLUE BELL (Eureka)—Orebody recently opened on 1700 developed for 270 ft. vertically, up to 26 ft. across, and 50 ft. on strike. Ore extends below 1700. Two raises being driven on ore, 50 ft. apart. Chief value in silver and lead.

Salt Lake

MONTANA-BINGHAM (Bingham)—Company's tunnel now in nearly 3500 ft., and good progress being made.

UTAH COPPER (Bingham)—During December ore mined averaged 1.6% copper, highest tenor in recent months; compares with 1.45% and 1.43% in second and third quarters respectively of 1914; 6,795,567 lb. copper produced. Starting of Arthur mill due in part to difficulty of handling frozen material in bins; also reported some changes and possible additions will be made to flotation plant at Magna mill.

OHIO COPPER (Bingham) — Reported attempts will be made to reorganize, but whether through foreclosure of mortgage not determined. Committee formed to try and put property upon its feet, Junius Beebe, of Boston, represents Boston interests on committee; chairman, G. M. P. Murphy, of New York; N. J. Catrow, of Salt Lake, third member. Several months ago bondholders' committee formed, which included W. O. Allison, president. This committee not active of late. New committee already represents $200,000 bonds but does not propose to antagonize original committee. With flotation process for treatment of Ohio ores, possible property may be made to operate at profit. In event of reorganization merger of Ohio and Bingham Central Ry. may be made.

Summit County

SILVER KING COALITION (Park City)—New strike made on 1450 thought to be continuation of Silver King Consolidated orebody. On 1300 drift is within 100 ft. of the 1700 level of Consolidated. Connections to be made here to provide better ventilation for both properties, and to add to safety.

SILVER KING CONSOLIDATED (Park City)—Development work on 1800 level being done on fissure responsible for large orebody between 1550- and 1700-ft. levels. Several stringers of ore cut. Forty-five tons daily being shipped from development.

Tooele County

GALENA KING (Stockton)—New lessees at this property have opened ore on main level, and resumed shipments. Ore runs well in galena, with fair amount of silver.

CANADA

Alberta

PLACER MINING certificates allowing holders to mine for gold by hand methods on North Saskatchewan River about Edmonton to be granted according to word received in Edmonton from department of mines at Ottawa. Rocker and grizzly methods to be allowed on strips of land 100 ft. wide over which the water extends at high water, but which are not covered at low water. Operations will be under direct supervision of mining recorder of district. As about 200 claims were worked until freezeup, it is likely mining will be active along river with going out of ice in spring.

Ontario

RIGHT OF WAY (Cobalt)—Owners considering reopening of property and prosecution of further development work.

DOME LAKE (South Porcupine)—Directors considering proposal to double capacity of mill.

SCHUMACHER (Schumacher)—Company buying machinery for mill. Dorr continuous decantation cyanide plant will be installed.

DOME (South Porcupine)—Mill tonnage for January expected to be 25,000 with gross value in excess of December production.

HOLLINGER (Timmins)—Four-weekly report for period ended Dec. 31 showed gross earnings of $156,059. Mill treated 20,775 tons averaging $12.28; total working costs $4.37 a ton.

MEXICO

Hidalgo

REAL DEL MONTE—Improvement in operations reported; production back to 60%, from 35%, in last part of 1914. Cyanide fairly plentiful. Further increase in operations expected.

The Market Report

Metal Markets

NEW YORK—Feb. 10

Copper has been very dull and lower. Tin has been lower on small business. Spelter has been higher, although there has been less excitement, the facts of the peculiar situation having become well recognized. Lead has been dull, but a little firmer in tone.

Copper, Tin, Lead and Zinc

Copper—The lull in buying which was in evidence toward the close of our last report became pronounced. The large producers quietly maintained their previous asking price, or rather made no effort to solicit additional business, being well satisfied with the large sales effected during the previous three months. Dealers, however, who are anxious to do business all the time immediately began to quote the market down, hoping to find a level at which copper could be turned over. Raw material from foreign sources was available on the basis of 14c., New York, for electrolytic. The buyers were quite willing to turn over their purchases at ⅛c. profit. Toward the close electrolytic copper was offered at 14¼@14½c., regular terms, with intimations that prices might be shaded and suspicions that some producers were offering sub rosa on that basis. However, the business transacted during the last week was inconsequential in volume, and in the absence of important transactions, quotations are but nominal.

Copper sheets base price is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15@15¼c., carload lots at mill.

Copper exports from Atlantic ports for the week ended Jan. 30 are reported by the Bureau of Commerce at 15,389,322 lb. The larger shipments were 6,289,648 lb. to France, 4,832,978 lb. to Great Britain, 1,717,428 lb. to Italy and 1,456,536 lb. to Sweden. Imports reported are: Metal, 1,792,629 lb.; in ore and matte, 884,726 lb.; total, 2,677,355 lb. Imports were from Canada, Peru and Japan.

Visible stocks of copper in Europe Feb. 1 are reported as follows: Great Britain, 17,090; Rotterdam, 1150; afloat from Australia, 4400; afloat from Chile, 2975; total, 25,615 long tons, a decrease of 310 tons during January.

Tin—But very little business was done. The price was a little easier. Conditions generally remain about as reported last week.

Visible stocks of tin on Feb. 1 are reported as follows: London, 6970; United States, excluding Pacific ports, 6931; total, 13,901 long tons, an increase of 505 tons during January.

Shipments of tin from the Straits in January were 5105 long tons, a decrease of 185 tons from last year.

Lead—Business in this metal was light in volume. A little carload business was reported at about 3.85c., New York, but the A. S. & R. Co., and other large producers continued to be sellers at 3.80c. In the St. Louis market the tone was a little firmer. Certain producers were asking 3.70c., but this was not reported as realized.

According to the chairman of the Broken Hill Block 10 Co., about 40% of the lead concentrates of Broken Hill are now being treated by Australian smelters.

Spelter—A considerable business was done, producers having found it easier to place April and later deliveries, sales of which aggregated some thousands of tons. A less volume of business for March delivery was done, and there was a little carload business for spot and prompt deliveries. The total volume of the last is insignificant and necessarily so, the supply having been practically exhausted. Here and there 100 tons or so are available, and when a consumer must have some he is obliged to pay high for it. Thus, 8[illegible]c., St. Louis, was realized last week on such business. April-May business was done in large tonnages at about 7⅝@7¾c. On some contracts running forward to July, considerably lower prices were accepted.

In general the smelters are not very well sold beyond March, although the position of the several concerns differs in that respect. On the other hand, some of the large consumers are supposed to have failed as yet to cover all of their March requirements. As to whether the rise in spelter has culminated or not much difference of opinion is expressed. The determinative conditions are greatly confused.

The prices realized for brass special ranged from 9½@11c., with evidences of recession in the latter part of the week when there appeared to be more sellers of this kind of metal than buyers. If the demand for brass special should exhibit a material relaxation, the tension in the market for Prime Western would naturally be eased also.

Zinc sheets were advanced during the week to 11c., then to 12c. per lb., and were quoted today at $12 per 100 lb., f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Difficulties having arisen in the Zinkhüttenverband owing to the closure of some of the Belgian works and the general derangement of conditions, the union was dissolved at a meeting at Berlin, Jan. 7, 1915, and an incorporation known as the Zinkhüttenvereinigung, m. b. H. was substituted.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Feb.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
4	4.8363	48¼	*14.40 @14.50	37	3.80	3.65 @3.70	7.67½ @8.17½	7.50 @8.00
5	4.8363	48¼	*14.35 @14.45	37	3.80	3.65 @3.70	7.80 @8.30	7.62½ @8.12½
6	4.8350	48¼	*14.30 @14.40	37	3.80	3.65 @3.70	7.80 @8.30	7.22½ @8.12½
8	4.8350	48⅛	*14.20 @14.30	37	3.80	3.65 @3.70	7.80 @8.30	7.22½ @8.12½
9	4.8300	48⅜	*14.10 @14.20	36	3.80	3.65 @3.70	7.80 @8.30	7.22½ @8.12½
10	4.8313	48¼	*14.10 @14.20	36	3.80	3.65 @3.70	7.80 @8.30	7.22½ @8.12½

*Nominal

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.	Silver	£ per Ton	Cts. per Lb.	3 Mos.	Best Selected	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
4	22[illegible]	62[illegible]	13.50	62[illegible]		171	152	18[illegible]	4.06	38	8.26
5	22⅝	62[illegible]	13.5[illegible]	62[illegible]	68[illegible]	176	152[illegible]	18[illegible]	4.06	38[illegible]	8.36
6	22⅝										
8	22 9/16	62[illegible]	13.63	63		176	155	18[illegible]	4.06	38[illegible]	8.[illegible]
9	22 9/16	62[illegible]	13.58	63	69[illegible]	173	153	18[illegible]	4.05	39[illegible]	8.[illegible]
10	22[illegible]	6[illegible]	13.[illegible]	63[illegible]		174	154	18[illegible]	4.06	[illegible]	8.[illegible]

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17¾c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52½c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum has been in rather better demand, with increased inquiry and some sales. Quotations are a shade firmer, at 19@19½c. per lb. for No. 1 ingots, New York—**Antimony** has been strong and active, with large sales, both domestic and for export. The close is rather excited, with prices uncertain. Ordinary brands are quoted at 17@18c. per lb., while 20@21c. is asked for Cookson's—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** has been strong with a decided upward tendency. In New York sales were made at $53, but at the close the leading interests quoted $54@57. San Francisco, $55 per flask for domestic orders. London price is £11 2s. 6d. per flask.

Gold, Silver and Platinum

Gold in the United States Feb. 1, as estimated by the Treasury Department: Held in Treasury against gold certificates outstanding, $988,590,269; in Treasury current balances, $212,106,479; in banks and circulation, $623,050,364; total, $1,823,747,112, an increase of $7,740,793 during January.

Sales of gold bars at the Assay Office in New York in January amounted to $3,795,795, an increase of $2,039,937 over December, 1914, but a decrease of $161,768 from January, 1914.

At New York, Feb. 8, a consignment of $1,000,000 in gold arrived from South America. It is understood that this was largely new gold from mines.

Platinum—The market continues quiet, with only moderate sales. Prices are still rather irregular, $38@42 per oz. being named for refined platinum; while $45@49 per oz. is quoted for hard metal, according to quality.

Silver—Latest advices indicate large shipments to India. This situation gives steadiness to the market; otherwise it is probable the price would have declined. Considerable silver has recently been shipped to France. Beyond this information there do not seem to be any new features.

Coined silver in the United States Feb. 1, as estimated by the Treasury Department: Standard dollars, $565,941,478, of which $476,018,000 are held in Treasury against silver certificates outstanding; subsidiary coins, $184,797,402; total, $750,738,880, an increase of $253,775 during January.

Exports of Metals and Minerals from Spain, 10 months ended Oct. 31, as reported by "Revista Minera," in metric tons:

	——Metals——		——Ores, etc.——	
	1913	1914	1913	1914
Iron	8,301	20,375	7,575,786	5,584,125
Copper	21,411	16,098	134,458	82,187
Copper precipitate	4,227	8,552	....	....
Lead	175,648	127,263	1,808	1,580
Zinc......	1,025	2,791	94,598	65,468
Manganese	.....	....	22,353	8,308
Quicksilver..	1,477	1,273	....	....
Pyrites................	....	....	2,468,511	2,452,064

Exports of salt for the 10 months were 471,870 tons in 1913, and 467,183 tons in 1914. Imports of coal in 1914 were 2,198,254 metric tons; of coke, 308,020 tons.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Feb. 6

The base price paid this week for 60% zinc ore was $65@66 per ton. No sales of lead ore were reported. Shipments were curtailed due to the heavy snow blockade.

SHIPMENTS, WEEK ENDED FEB. 6

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	1,698,210	......	166,000
Year	19,381,020	226,000	1,870,700

Shipments this week to separating plants, 2,084,700 lb. zinc ore.

The report for Jan. 30, receipt delayed by storm, shows sales of zinc ore at $60@63 per ton of 60% zinc; no sales of lead ore. Shipments for the week 5,006,460 lb. zinc ore and 335,500 lb. sulphur ore. Shipped to separating plants, 3,428,050 lb. zinc ore.

JOPLIN, MO.—Feb. 6

Blende, high price, $71; assay base, 60% zinc, $62@69; metal base, 60% zinc, $65@66; calamine base, 40% zinc, $43@46; average, all grades of zinc, $61.75 per ton. Lead, high price, $49; base price, $47 per ton of 80% metal contents; average, all grades of lead, $48.08.

Fully one-fourth the shipment again this week is from reserve stocks, but the unusually large shipment indicates some improvement in the production. The base price of the week for best grades of zinc ore was fixed yesterday, but bidding on metal base continued until late tonight.

SHIPMENTS, WEEK ENDED FEB. 6

	Blende	Calamine	Lead	Values
Total this week....	12,253,580	1,134,580	1,744,900	$454,810
Total this year.....	61,345,590	4,969,740	8,831,640	1,924,670

Blende value, the week, $39 ,170; six weeks, $1,645,410.
Calamine value, the week, $19,1[illegible]0, six weeks, $72,830.
Lead value, the week, $41,460; six weeks, $206,430.

Iron Trade Review

NEW YORK—Feb. 10

The month of January showed an increase of 5 7% over December in the make of pig iron, while the capacity of the furnaces in blast, Feb. 1, was greater by 15.2% than on Jan. 1. The increase came more largely from the steel works stacks than from the merchant furnaces, indicating an increase in the demand for finished steel; and this is confirmed by reports from the mills.

New business in pig iron is rather slow, especially in basic iron; on the other hand, buyers are reported to be taking iron more freely on contracts.

Increasing business is fairly well distributed, the most backward department being in structural steel. Railroad buying is improving and orders for rails are more frequent, though inclined to be small.

Some good foreign orders for wire and for shrapnel steel are reported from abroad. High ocean freights are interfering to some extent with this foreign trade.

In addition to the billet order noted last week, the Tennessee Coal, Iron & R.R. Co. has orders to roll 10,000 tons of rails to go to Chile and 7500 tons to Russia. These will be rolled at Ensley.

Pig Iron Production in January showed an increase over December. The reports of the blast furnaces, as collected and published by the "Iron Age," show a total of 160 coke and anthracite stacks in blast on Feb. 1, having a total daily capacity of 56,300 tons; an increase of 7500 tons over Jan. 1. Allowing for the charcoal furnaces, the estimated make of pig iron in the United States in January was 1,629,400 long tons. Of this total 1,115,900 tons, or 68.5%, were made by the furnaces owned or operated by steel works.

PITTSBURGH—Feb. 9

Steel orders are increasing slowly in most lines, though plates and shapes are rather backward. Tubular goods and wire products are gaining steadily. Bookings as a whole are of considerably larger volume thus far this month than in the corresponding period of any previous month since the war began.

The steel industry of the country is now operating at more than 50% of capacity and production continues to increase. Indications are now distinct that the improvement is to continue steadily, even though gradually. There are no signs of a backset such as occurred a year ago at this time after a somewhat similar improving movement.

The steel trade in Pittsburgh has been decidedly encouraged by the address at the Engineers' Society banquet last night by President James A. Farrell of the Steel Corporation. Mr. Farrell predicted a continued improvement in the steel trade, based upon his own minute and accurate observation of the flow of business, and formally announced the management was arranging for a resumption of the new construction work which was suspended last year on account of hard times.

The Steel Corporation's export branch last week booked 56,000 tons of export iron and steel, representing more than double the average rate of booking in 1914, and predictions are made that there will be further increases.

The Amalgamated Association has accepted a reduction of 11.2% in the sheet scale and a reduction of 6% in the tinplate scale, on account of reductions made by various nonunion mills. The union controls about 22% of all the sheet mills and about 11% of the tin-plate mills, and includes tonnage labor only.

Pig Iron—On a single carload inquiry yesterday a prominent producer quoted $13.60, Valley, on bessemer iron, or 15c. below the market quoted for some time past, but it is claimed that on a large inquiry $13.60 would not be shaded. Basic is largely nominal at $12.50, the old quotation, but seems firm at that figure. Demand for foundry iron is rather light but it is between buying movements, consumers being fairly well covered for the quarter. The pig-iron market is very steady even though quiet and elements of strength are that little if any iron is accumulating while hardly any of the idle furnaces would blow in unless offered advances of say $1 a ton over present quotations. The market stands as follows: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25;

forge, $12.50@12.75; malleable, $12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Apprehensions as to the future supply of ferromanganese are approaching an acute stage. There have been no imports for some time, and while a number of consumers have signed the agreement prohibiting export of steel to certain countries they still do not receive shipments on their old contracts. An eastern steel interest has been trying to buy from Carneegie and Jones & Laughlin the past week without success, and is said to have a supply for only another fortnight. On an average the steel mills have alloy enough for about three months of operation at the present rate . While Carnegie and Jones & Laughlin are making ferromanganese they do not know whether they can secure much more manganese ore. The contract market remains $68, Baltimore, subject to the embargo. Small lots of spot can sometimes be picked up at $85 or thereabouts, and there is more offered at $100, though no important tonnage at any figure.

Steel—The widely reported withdrawal of the Carnegie Steel Co. from the billet and sheet-bar market is of no particular consequence, seeing that it had already covered its regular customers at attractive prices, and as noted last week its advanced asking prices were higher than delivered prices, Pittsburgh, based on quotations freely made by Youngstown mills, at $18.25 for billets and $18.50 for sheet bars. Rods are quite firm at $25, Pittsburgh.

Foreign Iron and Steel Trade of the United States, 11 months ended Nov. 30, is valued as below, by the Department of Commerce:

	1912	1913	1914
Exports	$265,377,556	$271,818,459	$184,922,071
Imports	26,679,274	30,787,211	27,104,665
Excess, exports	$238,698,282	$241,031,248	$157,817,406

In 1914, as compared with 1913, there was a decrease of $86,896,388, or 31.9%, in exports; and a decrease of $3,682,546, or 12%, in imports.

IRON ORE

A few cargoes of Swedish ore have arrived at Philadelphia, the ore being on old contracts. The vessels have loaded with coal for the return trip.

Several cargoes of Indian manganese ore have arrived at Philadelphia, consigned to the Carnegie Steel Co. This ore was shipped from India before the embargo was put on.

The division by ranges of water shipments of Lake iron ore for the year is given by the "Iron Trade Review" as follows, in long tons:

	1913	1914	Changes
Marquette	3,966,680	1,363,419	D. 2,603,261
Menominee	4,965,604	3,755,726	D. 1,209,878
Gogebic	4,531,558	3,664,451	D. 867,107
Baraboo	145,010	100,000	D. 45,010
Vermillion	1,566,600	931,077	D. 635,523
Mesabi	34,038,643	21,447,998	D. 12,590,645
Cuyuna	733,021	859,226	I. 126,205
Total	49,947,116	32,121,897	D. 17,825,192

The Cuyuna range alone showed an increase in 1914. In that year 72.3% of the total came from the Minnesota ranges and 27.7% from Michigan and Wisconsin.

Imports and Exports of Iron Ore in the United States, 11 months ended Nov. 30 were, in long tons:

	1913	1914	Changes
Imports	2,370,878	1,300,315	D. 1,070,563
Exports	1,027,572	549,392	D. 478,180

The larger imports in 1914 were 763,964 tons from Cuba; 280,887 tons from Sweden; 66,982 tons from Spain; 52,514 tons from Canada; 38,575 tons from Newfoundland and Labrador. Exports were chiefly to Canada.

COKE

Connellsville—The coke market continues stagnant. The steel interests have blown in quite a number of blast furnaces, and have increased their coke production accordingly, shipments in the week ended Jan. 30 being 28,000 tons in excess of those the previous week, but there are no merchant furnaces blowing in such as would throw additional business to the merchant coke operators. There has been scarcely any demand for prompt furnace coke and with continued offerings the market has sagged another 5c. to $1.50. There are no negotiations to give a line on contract prices. Foundry coke is $2@2.35 for prompt, while contracts for good brands could be made at $2.15@2.35 at ovens.

Anthracite Shipments in January were 4,831,329 long tons, a decrease of 449,315 tons as compared with January, 1914. These shipments this year were the lightest reported since 1905, in January.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie year ended Dec. 31, in short tons:

	1913	1914	Changes
Anthracite	10,711,335	11.201,150	I. 489,815
Bituminous	51,526,267	47,769,227	D. 3,757,040
Coke	13,892,825	9,548,354	D. 4,344,471
Total	76,130,427	68,518,731	D. 7,611,696

The total decrease in 1914 was 10%. The largest proportional loss was in coke.

Fuel Exports and Imports in the United States, 11 months ended Nov. 30, in long tons:

	Exports		Imports	
	1913	1914	1913	1914
Anthracite	3,927,995	3,645,777	913	19,335
Bituminous	16,856,781	13,105,304	1,248,796	1,207,281
Coke	805,320	544,098	78,913	114,862
Bunker coal	7,093,271	6,775,071	.....	.....
Total	28,683,367	24,070,250	1,328,622	1,341,478

The bunker coal, or coal furnished to steamers in foreign trade is practically all bituminous. The greater part of the trade, both imports and exports, is with Canada. There was a loss of 4,613,117 tons, or 16.1%, in exports; and a gain of 12,856 tons, or 0.9%, in imports.

SAULT CANAL TRAFFIC

The total movement of freight through the Sault Ste. Marie canals in 1914 is reported officially at 55,369,934 short tons, a decrease of 24,348,410 tons, or 30.5%, from 1913. The number of vessel passages in 1914 was 18,717, showing an average cargo of 2243 tons. The mineral freights included in these totals were, in short tons, except salt, which is in barrels:

	1913	1914	Changes
Coal	18,622,938	14,487,221	D. 4,135,717
Iron ore	48,109,353	31,413,765	D. 16,695,588
Pig and m'f'd iron	402,912	239,683	D. 163,229
Copper	85,378	91,764	I. 6,386
Building stone	6,181	....	D. 6,181
Salt, bbl	730,431	777,208	I. 46,777

The United States canal was open from April 20 to Dec. 17, or 242 days; the Canadian canal from April 20 to Dec. 14, or 239 days. In 1914 iron ore was 56.7%, and coal 26% of the total freight.

Chemicals

NEW YORK—Feb. 10

The general market is not especially active and is in rather an unsettled condition still.

Arsenic—The market is quiet, with supplies equal to the demand. Prices are steady at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and fairly good. Prices are again firmer, the current quotations being $4.75 per 100 lb. for carload lots and $5 per 100 lb. for smaller orders.

Nitrate of Soda—The market is active with much inquiry and fair sales. Prices have advanced rather sharply and the present quotations are 2.12½c. per lb. for spot and all deliveries up to July; while 2.10c. per lb. is named for later positions.

Pyrites—Arrivals at Baltimore for the past week included two cargoes, 10,411 tons, of pyrites from Huelva, Spain.

Potash Salts—A despatch from the U. S. Consul-General at Berlin says: "The Potash Syndicate, Berlin, on Feb. 1, decided to form a commission to consider means for denaturizing potash salts so as to preclude the possibility of using them for ammunition and military purposes and making them valuable only as fertilizers. Upon receipt of the report of the commission the syndicate will confer with the Government relative to moderating the embargo on potash. The syndicate would be seriously embarrassed by the continued absolute embargo—from Jan. 29, 1915—and large quantities of salts now under way would be detained."

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new wells completed in January as follows: Pennsylvania grade, 291; Lima-Indiana, 24; Central Ohio, 114; Kentucky, 4; Illinois, 47; Kansas-Oklahoma, 379; Texas-Louisiana, 72. A total of 931 completed wells in the oil fields of the Mid-Continent and those east of the Mississippi in January gives a decrease of 121 from the December figures. New production of the same divisions amounted to 148,535 bbl., a decrease of 5773 bbl. There were 195 dry holes and 193 gas wells. At the close of January there were 221 rigs up and 1453 wells drilling.

Assessments

Company	Delinq.	Sale	Amt
Belcher Silver, Nev.	Feb 8	Mar. 1	$0.10
Blue Bull, Nev.	Jan. 4	Feb. 8	0.01
Booth, Nev.	Jan. 25	Mar 1	0.02
Brunswick Con., Nev.	Feb 16	Mar. 9	0.01
Caledonia, Nev	Mar. 8	Mar. 31	0.05
Carbonate, Ida.	Jan 28	Feb. 28	0.001
Cash Boy, Nev	Jan. 15	Feb. 15	0.005
Cedar-Talisman, Utah	Feb 8	Mar. 1	0.005
Clear Grit, Ida (post)	Feb. 9	Mar. 3	0.0015
Clearwater Con., Ida		Feb. 15	0.001
Darby, Ida (post)	Dec 14	Feb. 15	0 001
Emerald, Utah (three instal)		June 9	0 01
Gethin Le Roy, Utah (post.)	Feb 16	Mar. 7	0 02
Gypsy Qn., Nev	Jan 12	Feb. 16	0.01
Idaho-Nev., Ida	Jan 7	Feb. 1	0.001
Indiana, Mich	Feb. 4		1.00
Iron King, Ida	Feb 18	Mar. 19	0 001
Keystone, Utah (post)	Feb. 23	Mar. 23	0.02
King Pine Crk., Ida	Feb. 12	Mar. 13	0 002
Lucky Friday, Ida	Dec 14	Feb. 11	0 003
Majestic-Idol, Nev.	Dec. 15	Jul. 20	0.005
Manhattan Con., Nev.	Feb 30	Mar. 1	0.01
Nor. Bnkr Hill, Ida	Jan 30	Mar 6	0.002
Ophir, Nev	Feb. 11	Mar. 5	0 10
Overman, Nev	Mar. 8	Mar. 26	0 05
Pioche Coalition, Nev.	Feb. 10	Mar. 1	0 025
Reindeer-Queen, Ida	Feb. 15	Mar. 8	0.003
Rescue-Eula, Nev	Feb. 11	Mar. 22	0 01
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev.	Feb. 8	Mar. 2	0 05
Sunset Dev., Ida	Jan. 18	Feb. 18	0.0025
Tarbox, Ida	Jan. 28	Feb. 28	0 0025
Tar Baby, Utah	Mar. 5	Apr. 5	0 005
Ton Gip Qn., Nev	Jan 12	Feb 16	0 01
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Umatilla, Nev.	Jan. 4	Feb. 8	0.01
Utah-United, Utah	Feb. 20	Mar. 15	0 01
Verde May, Ida	Feb 1	Mar 1	0 001
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

In general the steel stocks have been strong, accompanying renewed activity in the steel market. Bethlehem Steel common was very active, closing the week at 56¼, on renewed dividend rumors. This is despite the interview given out by Schwab that dividends were still some time off.

COLO. SPRINGS Feb 8

Name of Comp.	Bid.
Acacia	05
Cripple Cr'k Con.	01
C. K. & N.	.06¾
Doctor Jack Pot.	10
Elkton Con.	49
El Paso	1 65
Findlay	02⅞
Gold Dollar	04½
Gold Sovereign	03½
Isabella	17
Jack Pot	07¾
Jennie Sample	03
Jerry Johnson	03
Lexington	‡ 009
Old Gold.	‡ 01
Mary McKinney	30
Pharmacist.	01¼
Portland	1 17
Raven B. H	03½
Vindicator	1 28

SALT LAKE Feb. 8

Name of Comp.	Bid.
Beck Tunnel	07
Black Jack	08
Colorado Mining	11
Crown Point	.01½
Daly-Judge	5 25
Gold Chain	10
Grand Central	64
Iron Blossom	96
Little Bell	10
Lower Mammoth	06½
Mason Valley.	1 00
May Day.	15
Opohongo	01½
Prince Con	27½
Seven Troughs	03
Silver King Coal'n	2 85
Silver King Con	1 75
Sioux Con	02¾
Uncle Sam	06
Yankee	05½

TORONTO Feb 8

Bailey	01	Dome Exten	07
Coniagas.	4 75	Foley O'Brien	15
Peterson Lake	24	Hollinger	22 25
Right of Way.	01	Imperial	01½
Seneca Superior	1 00	Jupiter	10
Silver Queen	02	McIntyre	24
T. & Hudson Bay	30 00	Pearl Lake	02
Timiskaming	17	Porcu. Gold	‡ 25
Wettlaufer-Lor.	04	Preston E. D.	01
Big Dome	[illegible] 75	Rea	15

SAN FRANCISCO Feb 8

Comstock Stocks		Misc. Nev. & Cal.	
Alta	[illegible]	Belmont	[illegible] 50
Belcher	30	Jim Butler	66
Best & Belcher	06	Lone Star	08
Caledonia	21	MacNamara	03
Challenge Con.	05	Midway	07
Confidence	10	Mont.-Tonopah	[illegible]
Con. Virginia	05	North Star	13
Crown Point (Nev.)	‡ 01	Rescue Eula	06
Gould & Curry.	03	West End Con.	[illegible]
Hale & Norcross	04	Atlanta	[illegible]
Julia	02	Booth	[illegible]
Mexican	10	C. O. D. Con.	[illegible]
Occidental	84	Comb. Frac.	07
Ophir	13	Jumbo Extension	[illegible]
Overman	07	Pitts.-Silver Peak	11
Potosi	02	Round Mountain	[illegible]
Savage	03	Sandstorm Kendall.	08
Sierra Nevada	11	Silver Pick	06
Union Con.	20	Central Eureka	25
Yellow Jacket	21	So. Eureka	2 25

N. Y. EXCH. Feb 8

Name of Comp.	Clg.
Amalgamated	53⅝
Am.Sm.&Ref.,com.	64⅝
Am. Sm. & Ref., pf.	103
Am. Sm. Sec., pf. B	‡80
Anaconda	26⅜
Batopilas Min	.75
Bethlehem Steel, pf.	104
Chino.	36
Colo. Fuel & Iron.	24
Federal M. & S., pf.	28
Great Nor., ore., ctf.	31¼
Guggen. Exp.	51½
Homestake.	113
Inspiration Con.	18⅝
Mex. Petroleum	76½
Miami Copper.	18⅝
Nat'l Lead, com.	49
National Lead, pf.	108
Nev. Consol.	11⅞
Ontario Min.	2
Phelps Dodge	‡175
Quicksilver, pf.	1¼
Ray Con.	17⅝
Republic I&S, com.	20¼
Republic I&S, pf.	74½
SlossSheffi'd, com.	25
Sloss Sheffield, pf.	‡82
Tennessee Copper.	29¾
Utah Copper	52⅝
U. S. Steel, com.	40⅜
U. S. Steel, pf.	104

N. Y. CURB Feb 8

Name of Comp.	Clg
Beaver Con.	26
Big Four.	07
Blue Bell	03½
Braden Copper	7⅛
B. C. Copper	‡ 50
Buffalo Mines	13/16
Can. Cop. Corpn.	1⅜
Can. G. & S.	03
Caribou	50
Chambers Ferland.	12
Con. Ariz. Sm.	25
Coppermines Cons	1¼
Davis-Daly	1 3/16
Diam'field-Daisy.	07
Dia. Black B	03
Ely Con	‡ 01
Florence	62
Goldfield Con	1½
Goldfield Merger.	21
Greene Cananea.	23½
Kerr Lake	4¼
La Rose	⅝
McKinley-Dar-Sa	42
Mines of Am	2⅛
Mutual Min., pf	‡2½
Nevada Hills	30
New Utah Bingham	‡7/16
Nipissing Mines	5½
Ohio Copper	01½
Oro	.10
Pacific Smelt	1/32
Stand'd Oil of N.J.	400
Standard S. L.	1⅜
Stewart	1 11/16
Tonopah	6⅝
Tonopah Ex.	2 7/16
Tonopah Merger	36½
Tularosa	5/16
West End Ex	03½
Yukon Gold	3⅜

LONDON Jan 27

Alaska Tre'dwell	£7 12s 6d
Camp Bird	0 8 0
El Oro.	0 9 6
Esperanza	0 8 9
Mexico Mines	4 2 6
Oroville	0 12 9
Philippine Dr	1 0 0
Santa Gert'dis	0 11 3
Tomboy	1 3 9
Tough Oakes.	0 13 9

BOSTON EXCH Feb. 8

Name of Comp.	Clg.
Adventure	1
Ahmeek	245
Alaska Gold M.	30
Algomah	.50
Allouez	42
Am. Zinc	20⅝
Ariz. Com., ctfs.	4½
Bonanza	32
Butte-Ballaklava	2⅛
Butte & Superior	47
Calumet & Ariz.	53½
Calumet & Hecla	393
Centennial	17
Cliff	‡1
Copper Range	33½
Daly West	1¾
East Butte	8⅝
Franklin.	4¼
Granby	66½
Hancock	11¾
Helvetia	30
Indiana.	4
Island Cr'k, com.	45
Island Cr'k, pfd.	86
Isle Royale	21¼
Keweenaw	2¼
Lake	6½
La Salle.	4
Mass.	3½
Mayflower	5
Michigan	50
Mohawk	59½
New Arcadian	5¼
New Idria Quick.	‡3½
North Butte	23
North Lake	1
Ojibway	.70
Old Colony	4
Old Dominion	43½
Osceola	69
Quincy	56¾
Santa Fe	1
Shannon	5½
Shattuck-Ariz.	23⅛
Superior	27⅞
Superior & Bost.	1⅜
Tamarack	32
Trinity.	2½
Tuolumne.	.26
U. S. Smelting	20⅝
U. S. Smelt'g, pf.	40
Utah Apex	2
Utah Con	9½
Victoria.	1⅛
Winona	1¾
Wolverine	43
Wyandot.	50

BOSTON CURB Feb. 8

Name of Comp	Bid
Alvarado	60
Bingham Mines.	‡3¾
Boston Ely.	13
Butte & Lon'n Dev.	23
Calaveras	98
Calumet-Corbin.	14
Chief Con	65
Corbin	‡1
Cortez	.15
Crown Reserve	.73
Eagle & Blue Bell.	85
First Nat. Cop	1 1/16
Houghton Copper.	1¼
Iron Cap Cop., pf.	‡5
Majestic	14
Mexican Metals	15
Nevada-Douglas	37
New Baltic	1⅜
Oneco	‡ 60
Raven Copper	07
Smokey Dev.	.10
So. Lake	4¼
Tonopah Victor	‡ 17
Trethewey	12
United Verde Ext	1 15/16

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506		28.357	26.573	
March	57.870	58.067		26.669	26.788	
April	59.490	58.519	......	27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	......	65.259	....	70.188	
March	14.131	......	64.765	.....	69.170	
April	14.211	......	64.747	....	69.313	
May	13.996	......	63.182	.....	67.786	
June	13.603	......	61.336	...	66.274	
July	13.223	......	60.540	..	64.955	
August	*	.....	‡	.....	‡	.
September	*	....	‡	.....	‡	.
October	*	.....	‡	...	‡	
November	11.739	.....	53.227	..	*	
December	12.801	.	56.841	...	*	..
Year	13.602		61.524		68.168	.

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830		181.556	
March	38.038	.....	173.619	
April	36.154	....	163.963	..
May	33.360	...	150.702	...
June	30.577	....	138.321	.....
July	31.707	.....	142.517	.....
August	*	.....	‡	....
September	32.675	....	‡	...
October	30.284	....	‡	.....
November	33.304	....	139.391	.
December	33.601		147.102	.
Av. year	34.301	.	156.564	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048		3.937	.	19.606	
March	3.970	.	3.850	.	19.651	.
April	3.810	...	3.688	.	18.225	.
May	3.900	..	3.808	..	18.503	
June	3.900	....	3.810	...	19.411	.
July	3.891	...	3.738	...	19.051	
August	3.875	....	3.715	...	‡	
September	3.828	...	3.658	...	‡	
October	3.528	..	3.384	..	‡	
November	3.683	.	3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862	.	3.737	..	19.079	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377		5.228		21.413	
March	5.250		5.100		21.460	
April	5.113		4.963		21.569	
May	5.071	..	4.924	.	21.393	
June	5.000		4.850	.	21.345	
July	4.920		4.770	..	21.568	
August	5.568		5.418	..	‡	
September	5.380		5.230	..	‡	...
October	4.909		4.750		‡	..
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06		14.12		14.08	
March	15.07		13.94	..	14.10	
April	14.90		13.90	.	14.13	..
May	14.90		13.90		14.27	....
June	14.90		13.90		13.96	...
July	14.90		13.90		13.90	...
August	14.90		13.90		14.08	..
September	14.90	.	13.90	.	14.03	....
October	14.84	.	13.75		13.97	..
November	14.59	....	13.43	...	13.83	...
December	14.70	....	13.45	.	13.83	
Year	$14.88		$13.78		$14.01	...

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Gold Mining in Bolivia

By Francis Church Lincoln*

SYNOPSIS—Bolivia, once a source of much of the Inca gold, has today but two active gold mines, the Olla de Oro and the Incaoro. Four other lode mines were recently explored; most of the gold lodes of Bolivia have been worked either by Spaniards or Indians. No placers are regularly operated, though recently several have been under investigation.

The ancient golden wealth of Bolivia came mainly from its placers, but attempts to work the famous old placers by modern methods have so far met with the most disheartening failure. The Chuquiaguillo placer near La Paz was worked successfully for a time by a German company under the management of J. A. Sedlmayr, but when it was taken over by an American company it failed and was sold at public auction. An English company known as the Incahuara Gold Dredging Co. put in a dredge on the Kaka river at enormous expense only to find that the ground would not pay. An Englishman named Biber erected an extensive hydraulic plant near the town of Yani, but met with an unfortunate end just as he was beginning to operate it. Officially he committed suicide because of the disappointing result of his first cleanup, but rumor says he was murdered. A letter published in an American mining journal in 1912 caused a rush of several hundred American prospectors to Bolivia to seek gold on the Tipuani river where the Spaniards and the Portuguese had met with much success. They found gold, but in deposits of such a character that they were unable to work them at a profit. These failures by no means prove that there are no good placer gold mines in Bolivia, but rather that great care and good judgment should be exercised in the selection and operation of properties. No gold placers of importance are in regular oper-

The Incaoro Camp on the Eastern Slope of Bolivia

The Incaoro mine is at an elevation of 13,650 ft., and is about 117 miles northeasterly from La Paz. The trail crosses four passes at an altitude of over 15,000 ft.

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ation in Bolivia. A few Indians are working irregularly upon the Chuquiaguillo and other famous old placers, the Amy placer of the Incaoro Mines Co. is being prospected, and a drainage tunnel is being run on the Chungamayo (Ten Rivers) property to the south of La Paz. With these exceptions, the gold-placer industry of Bolivia is at a standstill, having never regained its former importance. Bolivia will yet produce considerable placer gold, but it is to her lodes that she must look mainly for the gold supply of the future.

Two Active Lode Mines

There are at present two producing gold mines in Bolivia, the Olla de Oro (Pot of Gold) and the Incaoro (Inca Gold). Both were worked by the ancient Spaniards and both were relocated in recent years by David G. Bricker, formerly of Butte, Mont. The Olla de Oro mine was found first and sold to an English company, Mr. Bricker remaining at the mine as manager. Disagreements between the directors and Mr. Bricker finally resulted in his leaving the Olla de Oro and seeking another mine. He then found the Incaoro mine which he sold to the Incaoro Mines Co. of Delaware, of which he is vice-president and general manager.

The Old Olla de Oro Camp, near Umabamba, Bolivia, 43 Miles East of La Paz

The old mill has been twice wrecked by flood, though ancient landmarks indicated that nothing of this kind had occurred since early Spanish times. A new mill was erected last June about two miles from the old site; new Hardinge mills have been added to bring the capacity up to 80 tons per day.

While there are no other gold mines in operation in Bolivia at present, prospecting is fairly active and development work was recently in progress on four properties; the Kakabarranca; the Suri; the Huancapampa; and the Caracote. There are also repeated rumors of the reorganization of the Amaya Pampa mine which is now shut down. The Rosario mine at Araca has a large low-grade vein which was recently worked on a small scale for a number of years. The Amaya Pampa (Death Meadow) mine in the province of Chayanta, department of Potosí, was in operation from 1893 till December, 1911. Its mill consisted of six small stamps with a capacity of eight tons per day and a cyanide plant with a capacity of 20 tons per day. It is altogether possible that the Rosario and Amaya Pampa operations failed because of the small scale upon which they were conducted. It seems probable that many good gold lodes will be discovered, and that most of these will be found to have been worked by the ancient Spaniards.

Distribution of Gold Deposits

The principal gold belt of Bolivia extends from Suchez on the Peruvian border southward through the center of the department of La Paz and then swings eastward through northern Cochabamba into the department of Santa Cruz ending at Concepción near the Brazilian boundary. The two producing gold mines, the first three of the four lode properties mentioned above as being under development, and all three of the placer properties similarly noted, are situated in this belt.

South of this, in the department of Oruro and in the southern part of Cochabamba and northern part of Chuquisaca, silver is found but there is practically no gold. Further south, a second and more irregular gold belt begins at Amaya Pampa in northern Potosí and extends southward throughout the department with an easterly extension on the Camblaya river which forms the boundary between the departments of Chuquisaca and Tarija. In this belt are situated the Amaya Pampa mine and the Caracote prospect.

All of the gold lodes mentioned occur in a black slate containing occasional interbedded strata of quartzite. This was classified by d'Orbigny as of Silurian age, but so far as I am aware no fossils have been found in this slate at any of the mines or prospects. While the structure of the various deposits differs greatly, the contents are on the whole similar. In all the veins, free gold occurs in quartz and is frequently visible to the naked eye. Base gold is also present in pyrite, arsenopyrite, stibnite and pyrrhotite, but except in the case of the Caracote prospect the sulphides are small in quantity and their gold content while high is economically of minor importance.

The Olla de Oro Mine

The Olla de Oro (Bolivia) Mine, Ltd., has its home office at 33 St. Swithin's Lane, London, E. C., and its local office in La Paz. George Easley, an American mining engineer, is Bolivian manager. The mine is situated on the Umabamba river, 43 miles by fair mule trail easterly from La Paz. The trail crosses a divide 13,000 ft. in height and then descends into Palca cañon to the town of Palca, 18 miles from La Paz. A second divide, 14,150 ft. in altitude, must then be crossed to the Umabamba river; the new Olla de Oro camp is at an elevation of 9000 ft.; the old camp is on the mountainside a mile further and 1200 ft. higher.

The country rock is the Silurian of d'Orbigny, a nonfossiliferous black slate with a few interstratified beds of quartzite. The ore deposits are of the saddle-reef type, resembling those of Nova Scotia and of Bendigo, Australia, save that at the Olla de Oro the saddles have been faulted near their crests leaving little more than half of them available for exploitation. The reefs are composed mainly of quartz in which free gold occurs, frequently in pieces visible to the naked eye. Gold-bearing pyrite, pyrrhotite and arsenopyrite also occur in the reefs.

Mining is done largely by contract. Holes are paid for at the rate of $0.016 (4 centavos) per inch when in slate, and $0.032 per in. when in quartz. Drifting and raising cost $16 (40 bolivianos) per linear meter, everything but the steel being furnished by the contractor. Miners who are not working on contract receive from $0.80 to $1.20 per day; helpers $0.60 to $0.80; and outside men $0.60 and under.

There is a 50-ton amalgamating mill at the old camp, shown in the illustration. This mill has twice been wrecked by a flood, although ancient landmarks indicated that nothing of the kind had occurred since early Spanish times. The mill machinery consists of an 8x15-in. Blake crusher, a 4½-ft. Hardinge conical ball mill, a 6-ft. Hardinge conical pebble mill and a revolving screen, all operated by a 3-ft. Pelton waterwheel. Amalgamation is carried on inside the pebble mill as well as upon amalgamating plates outside. The ore plates about $5 per ton, and the tails run about $2.50, mostly in the sulphides. In the mill now under construction at the new camp, provision is being made to save the gold in the tails in the form of concentrates. The new mill is also to be of the Hardinge type but is to have double the capacity of the old one. It will be equipped with two ball mills, two pebble mills, four revolving screens, one Wilfley table and one Deister slime table, all operated by a water turbine.

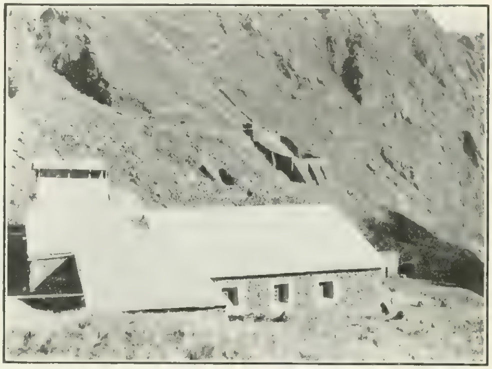
THE INCAORO MINE

The Incaoro Mines Co. is an American concern incorporated in the state of Delaware with a capital of $1,000,000. Horace G. Knowles, formerly U. S. Minister to Bolivia, is president of the company and David G. Bricker is general manager.

The mine is located at Pallaya, near the town of Yani, and is 117 miles by wagon road and mule trail northeasterly from La Paz. The wagon road goes as far as the town of Achacachi on the shore of Lake Titicaca, 12,500 ft. above the level of the sea. Thence the trail goes to the town of Sorata on the Atlantic drainage slope at an elevation of 8500 ft., and then crosses four passes all over 15,000 ft. in height, to the mine at 13,650 ft. The camp is situated in a little glacial valley shown in the engraving on the first page.

The country rock is a nonfossiliferous black slate containing occasional strata of fine-grained gray quartzite and is in every respect similar to that at the Olla de Oro mine. This rock has been folded and highly contorted, and the ore deposits, which are bedded veins, have been bent and twisted with it. The surface has since been subjected to intense glacial action. As a result of these two factors, some ore deposits of extremely peculiar shapes have been developed. In some instances the bedded veins are evidently nothing more than quartzite strata which have in part been replaced by vein matter, and it is possible that all the veins are of this type although no quartzite has as yet been found in the principal vein. The chief vein mineral is quartz, with which occur a little white mica and less native gold, while more rarely gold-bearing arsenopyrite, pyrrhotite and pyrite make their appearance in the veins. The gold is frequently visible to the naked eye, both in the quartz and in the slate adjacent to the veins.

About 100 Aymará Indians are employed in the mine at prices ranging from $0.16 (40 centavos) for the smallest boys to $1.60 (4 bolivianos) for mine captains. A small amount of work is done by contract. Holes in quartz are then paid for at the rate of $0.02 per in. in slate and $0.04 per in. in quartz; while drifting and crosscutting are paid for at the rate of $12 per linear meter.



THE NEW INCAORO MILL

The Incaoro mill is shown in one of the accompanying engravings. It is a 50-ton amalgamating mill of the Hardinge type run by a Pelton waterwheel. The installation consists of a bar screen, jaw crusher, 4½-ft. conical ball mill, 6-ft. conical pebble mill and six amalgamating plates. The mill is at present running on ancient Spanish fillings and pillars which plate about $5 per ton, the tailings containing little gold. However, as a concentrate running from $16 to $1500 per ton can be made at slight extra cost, concentrating tables are soon to be installed. The capacity of the mill is also about to be doubled by the addition of another unit.

FIVE LODE PROSPECTS

The Bolivian Development & Exploitation Co. is a Delaware corporation capitalized at $1,000,000. Horace G. Knowles is president and Luis Zalles of La Paz is vice president. This company, for which I was formerly resident engineer, is interested in the development of the Kakabarranca, Suri, and Caracote gold prospects.

The Kakabarranca prospect is an ancient Spanish mine, recently relocated by Dr. L. E. Benson of Los Angeles.

It is situated 111 miles by good trail easterly from La Paz, near the town of Coropata. The trail to the mine crosses a pass over 15,000 ft. in height and a river at 1000 ft., the prospect itself being at an elevation of 7900 ft. above sea level. The country rock is the same black nonfossiliferous slate noted at the two producing mines but at Kakabarranca the quartzite strata are missing. The ore deposits are parallel fissure veins with steep dips. The slaty cleavage also dips steeply but the veins cut it cleanly, though at small angles. The vein filling is quartz in which native gold, at times visible to the naked eye, is found. Rarely, a little pyrite and arsenopyrite are encountered. The property is being developed by means of a tunnel on the vein which will probably strike the main ore shoot below the ancient Spanish workings.

One of the few new gold prospects opened in Bolivia is that near the town of Suri. This town is 90 miles by wagon road and good trail from Eucaliptus station on the Antofagasta & Bolivia Ry. The wagon road extends for 52 miles from the railroad to Caluyo stage station where the trail begins. This crosses Quimsa Cruz pass at an altitude of over 15,000 ft. to the town of Quime and follows down the Quime river till opposite the town of Inquisivi, where it crosses the foothills of the main range of the Andes to Suri. The geology is similar to that at the Kakabarranca prospect, save that the principal vein instead of being nearly perpendicular lies nearly flat. The chief vein filling is white to glassy quartz containing native gold. At the surface a rich shoot containing pyrite, chalcopyrite and galena occurred, and native gold was found intergrown with the galena.

The Huancapampa prospect is situated on the steep slopes of Mount Chilcoya. It is three miles in a northerly direction from the town of Palca which is on the trail to the Olla de Oro mine. The mine is an ancient one, at present owned by Francisco Valentie of La Paz. The country rock ranges from black slate to mica schist. The ore deposits are quartz veins parallel to the slaty cleavage. These veins are narrow and have no great extent, either laterally or in depth, but they are numerous and frequently rich, free gold being often visible to the naked eye. Señor Valentie recently put half a dozen Indians to work cleaning up the mine preparatory to commencing development work.

Juan M. Saracho, vice president of Bolivia, owns some interesting gold-bearing antimony veins at Caracote, 35 miles by fair trail from Agua Castillo station on the Potosí branch of the Antofagasta & Bolivia Ry. The trail to this prospect passes through the town of Porco, two miles from the railroad, on past the historic Porco mines to the village of Quimsapalca, 15 miles beyond Porco, and thence to Caracote camp at an elevation of 11,950 ft. This camp is in the southern gold belt of Bolivia. The country rock consists of slates and quartzites similar to those at the mines and prospects in the northern belt. The veins follow roughly the stratification of the slate, but at times cut across it and are evidently associated with fissures. The vein filling consists of quartz, stibnite and gold. The fillings vary from nearly pure quartz to nearly pure stibnite, changing from one to the other within short distances or being composed partly of one and partly of the other lying side by side. The gold is free and frequently visible to the naked eye in the quartz, but base and invisible in the stibnite. The prospect was worked to a slight extent by the Spaniards, and recently a little development work has been carried out and trial shipments of a ton of the quartzose ore and a ton of the antimonial ore were sent to New York. The ores contained 0.72 oz. and 1.15 oz. of gold and 6% and 56% of antimony, respectively.

The Amaya Pampa mine in the southern belt has been shut down for the last two years, but the workings are so numerous that it is impossible to exclude the Indians and a number of them are "high-grading" in the mine at present. The ore deposits are gold quartz veins in black slate.

THREE BOLIVIAN GOLD PROSPECTS NOW UNDER DEVELOPMENT

(1) Near the town of Suri, a "new" gold prospect is being opened (2) Huancapampa on the steep slopes of Mt. Chilcoya (3) Caracote, a gold-antimony prospect

PLACERS UNDER DEVELOPMENT

The Amy placer of the Incaoro Mines Co. is situated a short distance from the Incaoro mine between the mine and the town of Yani. It was worked by the Spaniards but still contains considerable areas of good unworked ground. The placer lies in a glacial valley. The ground is at present being prospected.

The Cía. Minera Chungamayo was organized in Hamburg in 1911 to work an ancient placer located by Max Angermann in 1910. The Chungamayo placer is situated on the eastern slope of the main range of the Andes, six miles up stream from the town of Lambate, province of Sur Yungas, department of La Paz.

The famous Chuquiaguillo placer near La Paz, which was recently purchased at public auction by Benedicto Goytia, president of the Bolivian Senate, is being worked on a small scale by Indians.

The Casapalca District, Peru

Casapalca Correspondence

Although much work in the Casapalca district, Peru, was suspended at the outbreak of the European war, all the operating companies made substantial progress in the first half of 1914. The San Antonio mine, owned by the Sociedad Minera de Huarochiri, was equipped with a small air compressor and drills, development work having shown the orebodies to persist; the mine has yielded a large tonnage of high-grade silver ore in the past and now ships considerable rich ore besides the low-grade ore sent to the Casapalca smelting works; the mine has been connected with Elias Mujica's Americana concentrator in which some of the low-grade ore will be treated in the future. The Cia. de Minas del Carmen is driving a long adit to cut the Carlos Francisco vein 400 ft. below any existing workings; power is now obtained from the Backus & Johnston Co. The Aguas Calientes group of mines, owned by Ricardo Bentin, has been working steadily. The company now has ample power, its 500-hp. hydro-electric plant on the Rio Rimac having been completed late in 1914. The company recently enlarged its mill and is also driving a long adit to develop its orebodies at depth.

The principal mine in the Casapalca district is the Carlos Francisco, operated by the Backus & Johnston Co., which also owns the Casapalca smelting works where most of the ore of this district is smelted. Preparations are now under way to install electric haulage in the Carlos Francisco, as well as electric hoists for the upper levels of the mine. A motor-driven compressor of 1955-ft. capacity, installed late in 1914, furnishes the mine ample compressed air, besides a supply for the smelting works. An aërial tramway was constructed last year for bringing down to the mill a large tonnage of low-grade ore left on the dumps of the upper workings of the mine. This tramway, which is about 6000 ft. long, reaches an altitude of 16,000 ft., being perhaps, the highest tramway in existence. The capacity of the tramway is 15 tons per hour; it is self operating, in fact, enough power is developed by it to run a crusher and an elevator at its upper terminal.

The Casapalca smelting works has been practically doubled in capacity. The second blast furnace, 52x160 in. at the tuyeres, and the two new stands of 96x150-in. converters have been operating successfully; the 42x264-in. Dwight-Lloyd sintering machine was completed late in 1914. The smelting plant is now practically finished, so far as present conditions require, thus bringing to a close the construction work initiated by the late J. Howard Johnston. The 2000-hp. hydro-electric plant, installed on the Rio Rimac has run successfully and lightning troubles, so severe in the high altitude of Casapalca, proved to be much less formidable than had been anticipated; in 1914, the transmission line was continued to Morococha to furnish power for the extensive interests of the company in that district.

In Morococha, the advent of power from Casapalca, as well as from the Cerro de Pasco company's plant at Oroya, has made it possible to operate the mines in the Morococha district on a much larger scale, as well as at greatly decreased costs. Electric pumps have been installed in the Natividad, Pachacata and Alapampa mines and electric hoists in the Victoria and Alapampa. A 2500-cu.ft. air compressor has been installed for the Natividad, and one of 1955-cu.ft. capacity for the mines on the Santa Clara hill, where extensive development work is in contemplation. When conditions return to normal, the output of the Casapalca and Morococha districts will exceed anything recorded of them in the past.

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The Assay of Precious Metal Bullion*

The foundation of this paper lies in a comparison of silver determinations in 579 redeposits in the U. S. mint service by cupellation methods, showing such wide differences as to require an extensive examination into the conditions of the determination and the possibility of developing a better method. The silver fineness is obtained by a difference determination, being the difference between 1000 and the gold and base metal present which are obtained by direct determination. Its accuracy is, therefore, dependent upon the accuracy of the two determinations which are actually made. When the net errors of the two actual determinations are opposite, it may happen that the silver figure will be close to the truth, but when they are both on the same side, the error in the silver determination may be large.

Two papers by the author have shown that the inaccuracy of the gold cupellation is often much greater than is generally supposed. In some ordinary bullions it may be one fine or more, while in some cyanide bullions it may rise to three to five fine.

The cupellation for base metal in gold bullion is a ridiculously simple operation and may be described in a few words. The assay sample of the bullion is weighed wrapped in the proper amount of sheet lead and cupeled, accompanied by the proper proofs, to a button of gold and silver, which is cleaned and weighed. The difference between the weight and the sample taken and the button of gold and silver, when corrected by the proof, is called base metal that has been driven off or absorbed by the cupel. Aside from carelessness, there appears to be but few chances for variation in the operation, but the paper shows that some of these are exceedingly potent.

Tests upon the volatilization of precious metals during actual cupellation are described, which lead to the conclusion that in the vast majority of cases and with the exception of bullion high in copper and certain exceptional classes of bullion, such as those containing arsenic and antimony, the volatilization of precious metals in properly conducted base-metal assays is insignificant.

Many determinations of lead and copper retained by gold and silver assay buttons are given and lead to the conclusion that this is a most important factor in the accuracy of the results. From 0.5 mg. up to 3 mg. of lead per gram of button may be retained by the gold and silver button. The copper was seldom less than 1 mg., and in one instance rose to 20.84 mg. We have no means of controlling the amount of residual lead and copper. It rests entirely in the judgment of the cupeler. When he thinks the lead and copper have been driven off, he removes his assays from the furnace. The figures given

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Note.—This is the author's abstract of his original paper.

*Published by permission of the Director of the Mint, by [illegible] P. Dewey, in the August and September numbers of the Journ. of Industrial and Engineering Chemistry, pp. [illegible] and [illegible].

show that the lead and copper remaining in apparently finished beads cupeled under similar conditions may vary greatly.

The question of the absorption of precious metals by the cupel is thoroughly discussed and the distinction between true absorption and the separation of beads emphasized. Many assays of used cupels are given, often with the screen analysis of the bone-ash from which the cupels were made.

A most excellent illustration of everyday work is supplied by the cupels from three bullions assayed in one of the smaller offices on a day when the writer happened to be examining the institution. The cupel absorptions of gold and silver, in milligrams, were as follows:

	No 1	No 2	No. 3
A sample	2 62 2 68	3 75	4 81
B sample	1 63 1 87	3 95	6 03

A bullion 757 fine in gold, 196 fine in silver, and 17 fine in base metal was assayed 8 times in duplicate with a proof between each pair of duplicates and again 8 times in a different cupel and a slightly hotter part of the furnace with the following results:

RESULT OF VARYING TEMPERATURE

Gold and Silver Absorbed, mg.

	1st Run			2nd Run (warmer)	
1st Assay	Proof	2nd Assay	1st Assay	Proot	2nd Assay
1 55	1 71	1 75	2 18	2 26	2 00
1 73	1 88	1 76	2 23	2 36	2 46
1 81	1 82	1.75	2.19	2 41	2 35
1 80	1.88	1.76	2 32	2 44	2 28
2 43	2 47	2 42	2 96	3.11	3 10
2 37	2 66	2 44	3 22	3 26	3 00
2 67	2.66	2 61	3.34	3 28	3 16
2 67	2 62	2 60	3 41	3 60	3 14

The general conditions in one of the largest laboratories in the service are illustrated in the following table, which gives the cupel absorptions in base metal assays on a wide range of bullions:

CUPEL ABSORPTIONS, BASE METAL ASSAYS

Gold Absorbed mg	Silver Absorbed mg	Total Absorption mg.
0 97	0 78	1 75
0 75	1.07	1 82
1 13	0 85	1 98
1 58	0 58	2 16
1 17	1 04	2 21
1 06	1 25	2 31
1 34	0 97	2 31
0 91	1 43	2 34
1 01	1 38	2 39
1 09	1 36	2 45
0 28	2 25	2 53
1 03	1 51	2 54
1 23	1 36	2 59
0 90	1 72	2 62
1 08	1.73	2 81
1 12	1.78	2 90
0 81	2 24	3 05
1 02	2 13	3.15
1 65	1 57	3 22
1 75	1 76	3 51
1 64	1 91	3 55
1 70	1 94	3 64
1 51	2 15	3 66
1 05	2 62	3 67
1 81	1.97	3 78
1.58	2 24	3 82
1 95	1 88	3 83
1 63	2 36	3 99
0 42	3 59	4 01
1 93	2 10	4 02
2 10	2 15	4 25
2 24	2 27	4 51
2 49	4 32	6 81

As a general illustration of what may occur with a rain of microscopic beads, accompanied in some cases by separate beads, six such cupels showed the following results:

METAL RECOVERED FROM BEADED CUPELS

Gold mg	Silver mg	Total mg
3 55	2 46	6 01
2 98	3 13	6 11
3 15	2 98	6 13
3 28	2 34	5 62
2 81	4 87	7 68
2 16	4 56	6 72

Five base-metal assays each were made on two high-grade bullions, accompanied by two proofs. The cupels were arranged in the muffle in three rows of four with the proofs in Nos. 2 and 3 of the middle row. The cupels showed the following absorptions:

ABSORPTION WITH HIGH-GRADE BULLION

Composition	Cupel Absorptions Gold mg	Silver mg	Total mg
	No 1 Bullion		
Gold 898.5 fine	1 86	1 08	2.94
Silver 89. fine.	1 97	1 02	2 99
Base 12.5 fine	2 21	1 10	3.31
	2 54	1 19	3.73
	2.48	1 19	3.67
	No. 2 Bullion		
Gold 895.5 fine	2 02	1.03	3 05
Silver 98.5 fine	1 74	1.09	2.83
Base 6 fine. . .	2 12	1.24	3.36
	2 42	1 30	3.72
	2.60	1.29	3.89
	Proofs		
Gold 450 mg	2 22	1 06	3 28
Silver 45 mg	2 36	1 18	3 54

Many more sets of cupel assays are given and they lead to the inevitable conclusion that variations in the cupel absorptions even under substantially identical conditions open the way for large variations in the results. It is generally assumed that the proof assays will correct this and other variations, at least approximately, but if the conditions of the work lead to variations in the assay itself, they must do the same for the proofs, and it is quite possible for the proofs to be very misleading. As a matter of fact, the base-metal proof question is an exceedingly troublesome one to deal with and requires the exercise of much thought and caution. Substantially the same proof may lead to widely differing corrections when the work is performed under supposedly similar conditions in the same laboratory. Under differing conditions in the same laboratory, and still more so under differing conditions of different laboratories, the proofs may give corrections differing astonishingly.

Quadruple base-metal assays were made with two sets of samples from two high-grade bullions. Eact set of four assays was run by itself with a proof between each pair of assays. The arrangement of figures in the table represents the arrangement of the cupels in the furnace, the top row representing the front row of cupels in each set. The fineness figures represent the combined gold and silver fineness shown after correcting the button weights by the proof figures in the middle.

ASSAYS WITH MIDDLE PROOFS, IN DOUBLE ROWS

1st samples Gold and Silver Fineness	Proof	Gold and Silver Fineness	2nd samples Gold and Silver Fineness	Proof	Gold and Silver Fineness
		1st Bullion			
912 3	2 5	912 8	910 4	0 2+	909 3
909 7	1 9	911 3	910 2	0 4—	910.3
909 1	2 3	908 3	907 5	0 4+	907 1
909 7	2.8—	909 8	908 6	0 0	908.3
909 9	2.6—	911.1	911 8	0 9+	911 5
910 5	3 3—	912.3	911 5	0 4+	911.5
907 6	2 4—	913 5	907.7	0 9+	909 0
909 3	2 5—	909 8	905 9	1 3+	905.4
		2nd Bullion			
953 3	1 69	957 5	961 0	0 5+	952 2
953 2	2 30	953 0	952 6	0 2	952 9
951 0	1.37—	953 9	960 8	0 1+	952.6
954 2	2 25—	954.2	958 8	0 4	959.2
957 7	1 04—	952 2	947 2	3 9+	953.6
955 3	1 75	953 6	958.0	0 1	952.2
958 2	1 19	957 6	957.7	1 8	957 2
956 6	2 15	956 3	947.8	2 1+	953.0

COMPOSITION OF BULLIONS AND PROOFS

	Bullions No 1	No 2	Proofs No. 1	No. 2
Gold	713 75	758	711	760
Silver	198	196	200	200
Base	88 25	16	Copper	30

These assays were all made in one laboratory by one assayer. The first samples were run at one time and the second at another. A part of the differences shown are undoubtedly due to differences in samples.

This table is worthy of most careful study. It discloses both the remarkable agreement and the utter unreliability of results at times yielded by this method of assay.

The mass of data presented in this paper warrants the following conclusions regarding the cupellation for base metal: There are two chief sources of operative error in this determination, the absorption of gold and silver by the cupel and the retention of base metal by the precious-metal button. At present we do not have the means of controlling either of these with any certainty, or of readily ascertaining their extent in commercial work. These errors may balance each other, but they often fail to do so. A low cupel absorption may be accompanied by either a high- or a low-button retention, or a high cupel absorption by either kind of button retention, and the relations may be reversed in the duplicates. A third defect arises from the fact that the proofs are subject to the same uncontrollable errors as the assays and the proof corrections may be fallacious.

Notwithstanding these defects, which render the method unsatisfactory, the simplicity and ease of execution of the cupellation method commend its use and undoubtedly it will be extensively employed for many years to come. It is also evident that the defects are inherent and that there is no apparent way of overcoming them in the present state of our knowledge. It therefore becomes necessary to seek for a better method, and preferably a direct determination of the silver.

The need for a better method leads to an extensive investigation of titrating with sulphocyanate. In a vast majority of cases the assay sample was alloyed with cadmium, in order to get the silver into solution in nitric acid, but in a few cases, sufficiently low in gold, the silver was dissolved directly. Duplicate samples of 12 bullions were prepared and 10 determinations were made, in four laboratories, by both cupellation and titration, making 40 determinations of silver on each bullion. All the results reported are tabulated in the paper. With each method certain results are evidently vitiated by accidents. Rejecting these we have the following differences between the highest and lowest finenesses, or ranges in the determinations:

DETERMINATIONS BY SULPHOCYANATE METHOD

No.	Cupel	S C	No.	Cupel	S C
1	8.25	24.00	7	5.50	8.75
2	7.50	7.50	8	14.50	9.00
3	6.75	16.00	9	3.00	12.00
4	4.25	6.75	10	10.00	10.00
5	7.00	10.00	11	9.00	8.00
6	4.00	10.00	12	10.75	9.50

The determination of silver in solution by titration with a solution of sulphocyanate was described by Volhard, in *Journ. für prakt. Chem.*, in 1874, and is generally spoken of as the "Volhard method," but priority has been claimed for Charpentier, based upon publications in *Compt. rend.*, in 1871, and *Bull. Soc. Ing. Civ. de France*, in 1870.

In general, the method consists in adding a liberal amount of a ferric salt to the silver solution and then adding from a burette a solution of a sulphocyanate of a convenient strength, finishing drop by drop, until the characteristic red color of the ferric salt with sulphocyanate appears. More or less elaborate descriptions of it will be found in various textbooks.

When working upon high-grade silver, 992 fine or over, this method probably yields fully as accurate results as the Gay-Lussac method, titration with salt solution. No special apparatus is necessary and when only a few determinations are required, it is more rapid than the Gay-Lussac method. The chief advantages of the Gay-Lussac method is its ability to turn out, with proper equipment, a larger volume of work in a day's time.

When, however, the method is applied to miscellaneous materials, some objections appear. Mercury and palladium interfere. Moderate amounts of copper and platinum are not objected to. It is often said that 70% of copper may be present, but this is certainly a mistake. Nickel and cobalt obscure the end color. It has been suggested when Ni and Co are present to add excess of sulphocyanate and titrate back with silver. Chloride of silver must be absent, since it gradually reacts with sulphocyanate in solution. Lower oxides of nitrogen must be absent. Ferrous iron in presence of nitric acid must not be used as the indicator, since this would mean lower oxides of nitrogen. It should be noted that ferric sulphate as indicator may cause precipitation of lead sulphate when the bullion contains lead. It has been recommended to use two solutions, a standard and tenth standard.

In dissolving bullion carrying tin in nitric acid, purple of Cassius is almost always formed and this interferes most seriously in determining the sulphocyanate end point.

When the investigation was inaugurated, it developed that one of the small offices was already in the habit of using sulphocyanate titration on some deposits, and the following table shows their results on 15 bullions of widely varying composition arranged by progressively increasing silver fineness:

SULPHOCYANATE ON DIFFERENT BULLIONS

	Silver		Gold		Silver		Gold
	Cupel	Sulphocyanate			Cupel	Sulphocyanate	
No. 1	15 13.5	14.2 15.2	897.5	No. 9	275.0 276.5	276.8 275.8	652.75
No. 2	91 91	91.2 91.2	897.25	No. 10	319.25 319.25	314.3 315.3	608
No. 3	120.5 119.25	112.5 113.5	194	No. 11	338.0 338.5	338.6 337.7	436.75
No. 4	116.75 117.25	118.6 117.6	691.5	No. 12	402.75 402.75	401.5 400.5	594.5
No. 5	161.5 161.5	148 147	559.5	No. 13	434.0 434.25	438 436	548.75
No. 6	190.5 193.0	189.6 189.6	719	No. 14	440.25 440.75	434 436	537.75
No. 7	246 245	241.3 242.3	626.75	No. 15	440.5 440.5	446.1 445.1	549.5
No. 8	261.25 261.25	260.5 261.6	720.5				

Nos. 1 and 4 were cyanide bars, No. 5 was a jewelry scrap bar and No. 3 carried lead as the main base metal. The original office numbers on these bars were between 85 and 115, mass-melts 3, 4, 5 and 6, and chips bar No. 4.

At the redeposit office, five of these bars were also examined by the sulphocyanate method, being original bar No. 95 and mass melts 3, 4, 5 and 6.

RE-EXAMINATION BY SULPHOCYANATE METHOD

	1st test	2nd test	3rd test	4th test
No. 95	12.1 10.1	13.2	12.2 13.2	12.2 13.2
Mass 3	271.9 271.9	270.2 269.2	272.8	270.8 271.8
Mass 4	235.5	232.6 234.7	231.0	[illegible] [illegible]
Mass 5	186.5 186.0	181.8 187.0	187.3 186.3	186.3 184.2
Mass 6	[illegible]	[illegible] [illegible]	[illegible] 258.5	[illegible] [illegible]

Different samples of a bullion were submitted to three laboratories and assayed in duplicate by both methods. Ten of the 12 results fell between 441 and 444 fine in silver, showing a most remarkable agreement. Unfortunately, however, the other two results were much lower, as follows:

	Cupel	Sulphocyanate
First laboratory.	443 0	434 0
	444 0	435 0
Second laboratory	444 6	441 9
	441 0	441 9
Third laboratory	441 0	444 0
	442 0	443 0

Gold..263 25

Many more comparisons between the two methods and also with salt titration are given.

Careful consideration of these comparisons shows that the sulphocyanate method is capable of yielding satisfactory results in many instances, but the widely varying results often shown suggest the desirability of explicit instructions for carrying on the method and especially of pointing out probable and possible sources of error in the manipulations. Therefore, each assayer, whose work was used in this paper, was asked to write a history of his experience with the method. Also during the course of the tests various observations have been reported from time to time regarding the operation of the method. A study of this data has brought out the following points now discussed.

Various assayers prefer to make the cadmium alloy in a small porcelain crucible or annealing cup over a Bunsen burner or small blast lamp. This allows the direct transfer of the weighed sample to the crucible or cup before heating and the omission of the lead-foil container for the sample if desired. Dusty samples, however, should be inclosed in lead foil. The alloying operation is then easily observed and is under better control. Where much work is to be done, a copper stand to hold several assays may be made and this may be warmed up on the lip of the muffle or even inside the muffle after it has cooled down from other work, before heating over the lamp. Much less cyanide is required than in alloying in a scorifier. One assayer uses only three grams of cadmium. This, however, raises the question of the amount of silver retained by the residual gold. This point calls for further investigation. Personally I am also convinced that the very foundation of the work, the question of the formation of a proper alloy with the cadmium, requires investigation.

Much serious objection has been raised against alloying the samples with cadmium in a scorifier in the muffle, liability to crack after short use, liability of particles of sample to escape alloying with the cadmium, difficulty of observing the process, liability of overheating with sudden evolution of gas, particularly in adding Cd, which may project small particles of the sample out of the fusion, especially in the early stages of the operation, liability of small beads becoming entangled in the cyanide, particularly on pouring, are urged against this operation. Its chief advantage, in allowing the re-use of the cyanide, is greatly reduced by the fact that a much smaller amount of cyanide will answer in other containers.

There is very general objection to pouring the fusion, and it is preferred to cool the fusion in the crucible or cup, and to run water, warm if possible, directly into the cool crucible or cup to dissolve the cyanide. Where much work is done, an arrangement of small faucets allows the solution of the cyanide from several fusions at one time. A wire-gauze frame, with gauze cover, to hold several crucibles and a suitable rope sprinkler, make a very convenient dissolving arrangement.

Two assayers assert postively that the disappearance of fumes does not give sufficient heating of the solution, but that the solution must be vigorously boiled after that. Care must, however, be exercised to avoid mechanical loss of solution in this boiling. It is, therefore, better to dissolve the alloy in a conical flask rather than in a regular silver bottle. The titrating must be done absolutely cold, and all the conditions as to titrating must be kept as uniform as possible. When the bullion contains only a little silver, some operators prefer to add a known amount of silver to the solution before titrating.

When titrating a solution of pure silver, as in standardizing the solution, the end point may be sufficiently sharp, but, as it so often happens with volumetric methods in general when applied to miscellaneous materials, so this method presents its most serious difficulty in determining the end point in practical work. Also, as usual, the personal equation of the operator exerts its greatest influence at this point in the method. While it helps the work along to know approximately the amount of silver present, the careful operator is not obliged to make a preliminary assay for this purpose.

One bullion, No. 1 in the first comparison, yielded two groups of closely agreeing results and was exhaustively investigated with the result of showing that this bullion is quite unsuited to either volumetric method.

An extensive investigation on synthetic bullions and mixtures showed that if accurate results are desired, proofs must be run with the assays. Proofs will not only correct for the composition of the metal, but also for the visual variation of the operator. Of course, in miscellaneous work, bullions may be grouped and a generalized proof used for several titrations, just the same as such a general proof is often used in cupellation work.

While in the vast majority of cases, cupellation yields fairly concordant results, yet the determination of silver by this method in different laboratories often shows a difference of five in the fineness reported. Occasionally much larger differences are shown. In the comparisons, differences of five fine between individual determinations in the group are common. Even duplicate assays often show a difference of five fine.

While in the cadmium-sulphocyanate determinations wide differences often appear, yet in many cases the results agree among themselves and are often fully as concordant as the corresponding cupel results. Many of the differences are undoubtedly due to lack of familiarity by the operators with the method. The method has not been extensively employed and is comparatively new, when considered in connection with the many years of wide application of the cupellation method. With more extended and extensive use, much better agreement in the results could be expected. On the whole, therefore, this paper shows that the sulphocyanate method compares favorably with cupellation and stands a good chance of supplanting it where accuracy is desired.

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Crude Oil Fuel The Black Mountain Mining Co. with a power house on the railroad at Magdalena, Sonora, substituted Texas crude oil for coal with the following results, according to Percy E Barbour: Oil cost 75c. plus $1.50 freight, making a total of $2 25 at the plant. Three barrels were used in place of one ton of coal which cost $7.15 laid down. Thus a saving of 10c. per ton of coal was made on the face and a further saving of waste and labor brought the total saving as figured by the management up to $1.50 per ton of coal in favor of oil fuel

Design of Angle-Sheave Frames--I

By Floyd L. Burr*

SYNOPSIS—Treatise covering the entire subject of angle-sheave frame design. Nature of problem; unknown quantities which must be determined in designing; formulas derived by spherical and plane trigonometry; form sheet for computations. Graphical method for solving problem illustrated by examples. Four types of structure recognizable. Methods of erection of the several types.

The angle-sheave frame, according to my conception, is a structure designed to support a sheave wheel whose function is to turn a hoisting rope through an angle, thus changing its direction. Two portions of the rope will be considered, the entering portion and the emerging portion; and these portions may be considered and spoken of as two ropes. The plane of the two ropes may be a vertical plane, and thus all headframes would strictly be classed as angle-sheave frames.

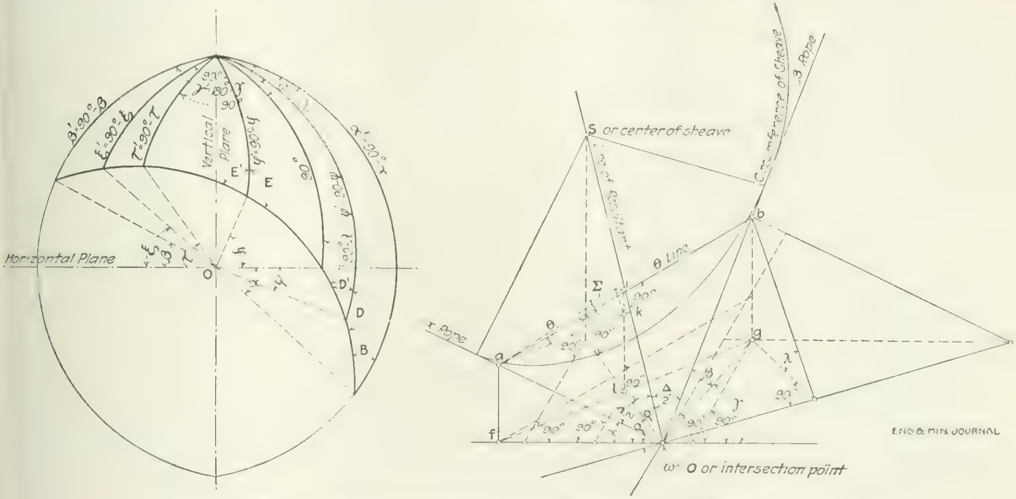

Fig. 1. Mathematical Relations Involved in Problem

Exhibited by plane trigonometry

Exhibited by spherical trigonometry.

These cases where both ropes are in the same vertical plane do not involve any difficulty mathematically, but the general case in which the rope changes direction both vertically and horizontally may be somewhat perplexing.

General Consideration of the Problem and Calculations

Of course, the general problem is to establish a sheave wheel of the desired size in such a position and at such inclination as to contain in its center plane the two ropes in their desired position and to allow the ropes to lie in the grooved rim of the wheel during their change in direction.

Generally the fixed conditions will involve a distant point from which the rope emerges, such as the center of the face of the hoisting drum or the rim of some other angle sheave, and a second distant point to which the rope is to travel, such as a head sheave or another angle sheave. Often there is also fixed the point in space at which the rope is to be changed in direction; if conditions do not rigidly fix this point, we must fix it arbitrarily. This last mentioned point will be called the "intersection point"; it is the point at which the ropes would intersect if they changed direction at the vertex of an angle instead of by following the groove of the wheel.

Knowing the relative positions of these three points in space or of their visibly marked positions on the ground, we may determine by any convenient form of survey or computation the horizontal angle between the ropes and the vertical angle of each rope.

Designations Used

We will designate one of these vertical angles α and the other β, and we will speak of the corresponding ropes as the "alpha-rope" and "beta-rope" and of vertical planes containing them as the "alpha-plane" and "beta-plane." Angles below the horizontal will be indicated as negative, the vertex of the angle being taken at the intersection point. The rope to be designated as the alpha-rope shall be so chosen that the horizontal angle of the beta-rope, measured from it in clockwise direction, shall be less than 180°. The supplement of this horizontal angle shall be designated γ. Thus we will have given the known angular quantities α, β and γ. Besides these angles the radius of the sheave, known as R, will be fixed or chosen. It should be noted that we may have both ropes below horizontal, or both above, or either one above while the other is below.

The unknown angle in space between the ropes, in the plane of the ropes—that is, the alpha-beta plane—shall be designated Δ. Neglecting the effect of friction, the line of resultant stress produced by the tension in the ropes will be the line which bisects Δ, or, in other words, the line joining the intersection point and the center of the sheave. We will call this "the line of the resultant." Its vertical angle we will designate as ϕ and its horizontal angle from the alpha-rope as ρ. We will designate as the "theta-line" a line in the alpha-beta plane normal to the line of the resultant. Its vertical angle shall be called θ and the vertical plane containing it the "theta-plane." In an inclined plane containing the theta-line and normal to the line of the resultant, the angle between the theta-line and the line along which this plane intersects a horizontal plane shall be designated Σ. The vertical angle of the line of intersection of the rope plane and a vertical plane normal to the vertical plane of the line of the resultant is ξ. The designation of the horizontal angle between the alpha-rope and the line of intersection of the plane of the ropes with the horizontal plane through the intersection point shall be ω. The angle of inclination of the alpha-beta plane shall be called λ. The vertical angle of the line of intersection of any vertical plane at any horizontal angle ε from the vertical plane of the alpha-rope is ψ. The vertical angle of the line of intersection with the alpha-beta plane of a vertical plane at right angles to the psi-plane is τ.

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The inclined distance from the intersection point to the center of the sheave shall be called V, the horizontal projection of it W; the horizontal distance of the sheave center from the intersection point measured normal to the alpha-plane shall be called Z; the height of the center of the sheave above or below the intersection point shall be Y; the distance of the center of the sheave from the intersection point measured parallel to the alpha-plane shall be X.

To summarize, then, the known quantities are α, β, γ, and R, while the unknown ones are Δ, ϕ, λ, θ, Σ, ξ, ω, ρ, φ, τ, V, W, X, Y and Z. The relations are exhibited in Fig. 1.

Depending upon the type of structure to be built and the method of laying out the construction, various groups of these angles will be used: ϕ-ρ-θ, ϕ-ρ-ξ, ϕ-ρ-Σ, and ψ-ε-τ are combinations most generally needed. The quantities, V, W, X, Y and Z are often useful and occasionally λ and ω may come into use. In many cases it would be wise to compute all the quantities in order to check as much as possible the correctness and accuracy of the work of computation and of laying out in the structure.

FORMULAS

In Table I are given formulas for the determination of all the unknown quantities. Two independent formulas are given for the determination of each of the quantities Δ, ϕ, ρ, θ, λ and ω, to enable one to check the determination of these fundamental values. Some of the formulas are based upon plane trigonometry and others on spherical trigonometry.

In the general use of these formulas, account must be taken of the algebraic signs of the functions of the angles and constant vigilance is needed in the lookout for negative signs. As an aid toward avoidance of error, and to facilitate computation and make it less fatiguing, it is found desirable before starting to use the formulas to fill out a list of all natural functions and logarithmic functions and simple combinations which will be required, and to include in this the algebraic signs of the quantities. With this preliminary work done, the remaining combinations are not at all tedious. The "form sheet" shown filled in in Tables II and III has been found to be most convenient. It gives the known quantities, the algebraic signs, the natural and logarithmic functions of known quantities together with simple combinations, the logarithmic functions of unknown quantities to be gradually derived and filled in, and a list of results.

TABLE I. FORMULAS FOR VARIOUS UNKNOWN QUANTITIES USED IN ANGLE-SHEAVE CALCULATIONS

Given quantities α, β, γ, and R and sometimes ϵ. To find the values of the useful quantities φ, ρ, θ, Σ, ξ, ω, λ, V, W, X, Y, Z, and sometimes ψ and τ and also of the incidental quantities α', β', γ', Δ, $\frac{\Delta}{2}$, B, φ', D, D′, E, E′, ξ, and ψ'.

Definition Formulas

$\alpha' = 90° - \alpha$ $\qquad \varphi' = 90° - \varphi$

$\beta' = 90° - \beta$ $\qquad \psi' = 90° - \psi$

$\gamma' = 180° - \gamma$ $\qquad \xi' = 90° - \xi$

$D' = 180° - D$

$E' = 180° - E$

$\tau' = 90° - \tau$

Principal Formulas

$$\cos \Delta = \cos \beta' \,.\, \cos \alpha' + \sin \beta' \,.\, \sin \alpha' \times \cos \gamma'$$

$$\sin \frac{\Delta}{2} = \frac{\sqrt{2}}{2} \times \sqrt{1 - \sin \alpha \,.\, \sin \beta + \cos \alpha \,.\, \cos \beta \,.\, \cos \gamma}$$

$$\sin B = \frac{\sin \beta' \,.\, \sin \gamma'}{\sin \Delta}$$

$$\cos \varphi' = \cos \alpha' \,.\, \cos \frac{\Delta}{2} + \sin \alpha' \,.\, \sin \frac{\Delta}{2} \,.\, \cos B$$

$$\sin \varphi = \frac{\sin \beta + \sin \alpha}{2 \cos \frac{\Delta}{2}}$$

$$\sin \rho = \frac{\sin \frac{\Delta}{2} \,.\, \sin B}{\sin \varphi'}$$

$$\tan \rho = \frac{\cos \beta \,.\, \sin \gamma}{\cos \alpha - \cos \beta \,.\, \cos \gamma}$$

$$\sin \rho = \frac{\sin \gamma \,.\, \cos \beta \,.\, \tan \varphi}{\sin \beta + \sin \alpha}$$

$$\sin \theta = \frac{\sin \beta - \sin \alpha}{2 \sin \frac{\Delta}{2}}$$

$$\cos \theta = \frac{\sqrt{\cos^2 \alpha + \cos^2 \beta + 2 \cos \alpha \,.\, \cos \beta \,.\, \cos \gamma}}{2 \sin \frac{\Delta}{2}}$$

$$\sin \Sigma = \frac{\sin \theta}{\cos \varphi}$$

$$\sin E = \frac{\sin \alpha' \,.\, \sin B}{\sin \varphi'}$$

$$\tan \xi' = \sin \varphi' \,.\, \tan E'$$

$$\tan \lambda = \frac{\sqrt{\tan^2 \alpha + \tan^2 \beta + 2 \cos \gamma \,.\, \tan \alpha \,.\, \tan \beta}}{\sin \gamma}$$

$$\sin \lambda' = \sin B \,.\, \sin \alpha'$$

$$\sin \omega = \frac{-\tan \alpha}{\tan \lambda}$$

$$\tan \omega = -(\cos \alpha' \tan B)$$

$$\cos D = -\cos B \,.\, \cos \epsilon + \sin B \,.\, \sin \epsilon \,.\, \cos \alpha'$$

$$\sin \psi' = \frac{\sin B \,.\, \sin \alpha'}{\sin D}$$

$$\tan \tau' = \sin \psi' \,.\, \tan D'$$

$$V = \frac{R}{\sin \frac{\Delta}{2}}$$

$$W = V \,.\, \cos \varphi$$

$$X = \frac{R}{\sin \Delta} (\cos \alpha - \cos \beta \,.\, \cos \gamma)$$

$$X = W \,.\, \cos \rho$$

$$Y = \frac{R}{\sin \Delta} (\sin \beta + \sin \alpha)$$

$$Y = V \,.\, \sin \varphi$$

$$Z = \frac{R}{\sin \Delta} (\cos \beta \,.\, \sin \gamma)$$

$$Z = W \,.\, \sin \rho$$

Table of Algebraic Signs

		Sine	Cosine	Tangent
1st quadrant	0° to 90°	+	+	+
2nd quadrant	90° 180°	+	—	—
3rd quadrant	180° 270°	—	—	+
4th quadrant	270° 360° or 0° −90°	—	+	-

SOLUTION BY GRAPHICAL METHOD

Another method for determining the needed elements of the angle-sheave problem is the graphical. This method may be a little faster than the analytical and does away with the necessity for alertness in looking for negative signs, but it has its own disadvantages. It may be used as the principal method or as a check method. Two drawings for the problems are reproduced herewith, Figs 2 and 3, to illustrate the method.

In diagram No. 1, Fig. 2, we have both ropes above the horizontal plane; let α be 25° and β 40°. Let γ equal 70° and let the sheave wheel be 10 ft. in diameter It is required to find the values of the unknown quantities.

In the first diagram, draw a horizontal line, and from a point o draw lines representing the alpha-rope and the beta-rope at angles of 25° and 40° above the horizontal. On these lines lay off a convenient unit distance *oa* equals *ob*, say 10 in., and from the points *a* and *b* draw perpendiculars to the horizontal line intersecting it at *c* and *d*. The lines *oc* and *od* are then the horizontal projections of the unit distances.

Now in the second diagram, draw lines *o'f* and *o'g* equal to *od* and *oc* at angle γ, and complete the triangle by drawing the third side *fg*. This then is a diagram of horizontal projections.

TABLE II. FORM SHEET FILLED OUT IN COMPUTATIONS OF ILLUSTRATIVE PROBLEM NO. 1

$\alpha = +25°$ $\alpha' = 65°$
$\beta = +40°$ $\beta' = 50°$
$\gamma = 70°$ $\gamma' = 110°$
$R = 5$ ft
$\epsilon = 35°$

Logarithms

$\sin\alpha = 9.625\ 9483+$
$\cos\alpha = 9.957\ 2757+$
$\tan\alpha = 9.668\ 6725+$
$\sin\beta = 9.808\ 0675+$
$\cos\beta = 9.884\ 2540+$
$\tan\beta = 9.923\ 8135+$
$\sin\gamma = 9.972\ 9858+$
$\cos\gamma = 9.534\ 0517+$
$\sin\epsilon = 9.758\ 5913+$
$\cos\epsilon = 9.913\ 3645+$
$\sin\alpha' = 9.957\ 2757+$
$\cos\alpha' = 9.625\ 9483+$
$\sin\beta' = 9.884\ 2540+$
$\cos\beta' = 9.808\ 0675+$
$\sin\gamma' = 9.972\ 9858+$
$\cos\gamma' = 9.534\ 0517$
$\sin\beta + \sin\alpha = 0.027\ 5152+$
$\sin\beta - \sin\alpha = 9.342\ 7581+$
$\cos\beta\ \cos\gamma = 9.418\ 3057+$
$\cos\beta\ \sin\gamma = 9.857\ 2398+$
$\cos\alpha - \cos\beta\ \cos\gamma = 9.809\ 0914+$
$R = 0.698\ 9700+$
$\frac{\sqrt{2}}{2} = 9.849\ 4850+$
$\sin\Delta = 9.999\ 7459+$
$\frac{R}{\sin\Delta} = 0.699\ 2241+$
$\sin\frac{\Delta}{2} = 9.841\ 9289+$
$\cos\frac{\Delta}{2} = 9.856\ 7876+$
$2\sin\frac{\Delta}{2} = 0.142\ 9589+$
$2\cos\frac{\Delta}{2} = 0.157\ 8176+$
$\frac{R}{\sin\frac{\Delta}{2}} = 0.857\ 0411+$
$\sin B = 9.857\ 4989+$
$\cos B = 9.841\ 1688+$
$\tan B = 0.016\ 3258+$
$\sin\varphi' = 9.827\ 1957+$
$\cos\varphi' = 9.869\ 6981+$
$\sin\varphi = 9.869\ 6976+$
$\cos\varphi = 9.827\ 1957+$
$\tan\varphi = 0.042\ 5022+$
$\sin\rho = 9.872\ 2271+$
$\cos\rho = 9.824\ 0802+$

$\tan E' = 0.614\ 9109-$
$\tan\lambda = 0.064\ 6382+$
$\sin D = 9.963\ 4390+$
$\tan D' = 0.368\ 3312+$
$\sin\psi' = 9.851\ 3306+$
$V = 0.857\ 0411+$
$W = 0.684\ 2368+$

Natural Functions

$\sin\alpha = 0.422618+$
$\cos\alpha = 0.906308+$
$\cos^2\alpha = 0.821394+$
$\tan^2\alpha = 0.217443+$
$\sin\beta = 0.642788+$
$\cos^2\beta = 0.586824+$
$\tan^2\beta = 0.704088+$
$\sin\alpha\ .\ \sin\beta = 0.271654+$
$\cos\alpha\ \cos\beta\ \cos\gamma = 0.237455+$
$2\cos\alpha\ \cos\beta\ \cos\gamma = 0.474910+$
$2\cos\gamma\ \tan\alpha\ \tan\beta = 0.267650+$
$\cos\beta'\ \cos\alpha' = 0.271654+$
$\sin\beta'\ \sin\alpha'\ \cos\gamma' = 0.237455-$
$\cos\alpha'\ \cos\frac{\Delta}{2} = 0.303904+$
$\sin\alpha'\ \sin\frac{\Delta}{2}\ .\ \cos B = 0.436891+$
$\cos B\ \cos\epsilon = 0.568242-$
$\sin B\ \sin\epsilon\ \cos\alpha' = 0.174596+$

Results

$\Delta = 88°\ 02'\ 24''$
$\frac{\Delta}{2} = 44°\ 01'\ 12''$
$B = 46°\ 04'\ 36''$
$\varphi' = 42°\ 12'\ 03''$
$D = 113°\ 10'\ 54''$
$D' = 66°\ 49'\ 06''$
$E = 103°\ 38'\ 27''$
$E' = 76°\ 21'\ 33''$
$\xi' = 70°\ 08'\ 03''$
$\psi' = 45°\ 14'\ 40''$
$\tau' = 58°\ 54'\ 32''$
$\phi = 47°\ 47'\ 57''$
$\rho = 48°\ 10'\ 10''$
$\theta = 9°\ 06'\ 54''$
$\Sigma = 13°\ 38'\ 26''$
$\xi = 19°\ 51'\ 57''$
$\omega = 336°\ 18'\ 28''$
$\lambda = 49°\ 15'$
$\psi = 44°\ 45'\ 20''$
$\tau = 31°\ 05'\ 28''$
$V = 7.195$
$W = 4.833$
$X = 3.223$
$Y = 5.330$
$Z = 3.601$

In the first diagram, draw a horizontal line through *ı*. From the intersection *e* lay off to the left the distance *h* equal to *fg*. Draw a straight line through *h* and *b* nd we have the theta-line and the angle θ.

From *h* and *b* draw arcs with unit distance as radii nd establish point *o''* at the intersection. This deternines Δ and the line of resultant may be drawn in, biecting it. This last portion of the first diagram, of ourse, represents the alpha-beta plane.

From the center point *i* of the theta-line, draw a line *j* perpendicular to the horizontal line *cd*; *ij* is the elevaion of the point *i* of the line of resultant above the inersection point of the ropes *o*. Now on the second diaram lay off from *f* the distance *fl* equal to *hk* and draw n the horizontal projection of the line of resultant, deternining ρ. Lay off from *j* in either direction *jm* equal to *'l* and complete the triangle of reference, determining ϕ.

In the second diagram draw from the point *l* a line erpendicular to *o'l*, intersecting *o'f* at *n*. Then in the first iagram lay off to the left from *o* on *oc* a distance *ox* qual to *o'n*, and erect a perpendicular at *x*, intersecting *oa* at *y*. Draw a horizontal line through *y*, intersecting *ji* at *z*. Then lay off *zp* equal to *ln* and draw *pi*, completing the triangle of reference for ξ.

In that portion of the first diagram which represents the alpha beta plane draw in a circle tangent to the two rope lines from center *s* to represent the sheave wheel. It may be drawn at any convenient scale, say ½ in. to the foot. *o''s* will then be the distance *V*. Lay off *mt* equal to *V* on the line *mi* and let fall a perpendicular line *tu* to the horizontal line. Then *tu* equals *Y* and *um* equals *W*. In the second diagram, lay off *o'v* equal to *um* on line *o'l* and draw a perpendicular *vw*, which equals *Z*, while *o'w* equals *X*.

TABLE III. FORM SHEET FILLED OUT FOR ILLUSTRATIVE PROBLEM NO. 2

$\alpha = -25°$ $\alpha' = 115°$
$\beta = +40°$ $\beta' = 50°$
$\gamma = 70°$ $\gamma' = 110°$
$R = 5$ ft
$\epsilon = 35°$

Logarithms

$\sin\alpha = 9.625\ 9483-$
$\cos\alpha = 9.957\ 2757+$
$\tan\alpha = 9.668\ 6725-$
$\sin\beta = 9.808\ 0675+$
$\cos\beta = 9.884\ 2540+$
$\tan\beta = 9.923\ 8135+$
$\sin\gamma = 9.972\ 9858+$
$\cos\gamma = 9.534\ 0517+$
$\sin\epsilon = 9.758\ 5913+$
$\cos\epsilon = 9.913\ 3645+$
$\sin\alpha' = 9.957\ 2757+$
$\cos\alpha' = 9.625\ 9483-$
$\sin\beta' = 9.884\ 2540+$
$\cos\beta' = 9.808\ 0675+$
$\sin\gamma' = 9.972\ 9858+$
$\cos\gamma' = 9.534\ 0517-$
$\sin\beta + \sin\alpha = 9.342\ 7581+$
$\sin\beta - \sin\alpha = 0.027\ 5152+$
$\cos\beta\ .\ \cos\gamma = 9.418\ 3057+$
$\cos\beta\ \sin\gamma = 9.857\ 2398+$
$\cos\alpha - \cos\beta\ \cos\gamma = 9.809\ 0914+$
$R = 0.698\ 9700+$
$\frac{\sqrt{2}}{2} = 9.849\ 4850+$
$\sin\Delta = 9.934\ 8531+$
$\frac{R}{\sin\Delta} = 0.764\ 1169+$
$\sin\frac{\Delta}{2} = 9.938\ 8453+$
$\cos\frac{\Delta}{2} = 9.694\ 9779+$
$2\sin\frac{\Delta}{2} = 0.239\ 8753+$
$2\cos\frac{\Delta}{2} = 9.996\ 0079+$
$\frac{R}{\sin\frac{\Delta}{2}} = 0.760\ 1247+$
$\sin B = 9.922\ 3867+$
$\cos B = 9.738\ 9390+$
$\tan B = 0.183\ 4477+$
$\sin\varphi' = 9.989\ 0051+$
$\cos\varphi' = 9.346\ 7500+$
$\sin\varphi = 9.346\ 7502+$
$\cos\varphi = 9.989\ 0051+$
$\tan\varphi = 9.357\ 7450+$
$\sin\rho = 9.872\ 2269+$

$\cos\rho = 9.824\ 0802+$
$\tan E' = 0.092\ 0225-$
$\tan\lambda = 9.934\ 7636+$
$\sin D = 9.879\ 8964+$
$\tan D' = 0.065\ 7866+$
$\sin\psi' = 9.999\ 7660+$
$V = 0.760\ 1247+$
$W = 0.749\ 1298+$

Natural Functions

$\sin\alpha = 0.422618-$
$\cos\alpha = 0.906308+$
$\cos^2\alpha = 0.821394+$
$\tan^2\alpha = 0.217443+$
$\sin\beta = 0.642788+$
$\cos^2\beta = 0.586824+$
$\tan^2\beta = 0.704088+$
$\sin\alpha\ \sin\beta = 0.271654-$
$\cos\alpha\ \cos\beta\ \cos\gamma = 0.237455+$
$2\cos\alpha\ \cos\beta\ \cos\gamma = 0.474910+$
$2\cos\gamma\ \tan\alpha\ .\ \tan\beta = 0.267650-$
$\cos\beta'\ .\ \cos\alpha' = 0.271654$
$\sin\beta'\ \sin\alpha'\ \cos\gamma' = 0.237455$
$\cos\alpha'\ \cos\frac{\Delta}{2} = 0.209376-$
$\sin\alpha'\ \sin\frac{\Delta}{2}\ \cos B = 0.431579+$
$\cos B\ \cos\epsilon = 0.449059-$
$\sin B\ \sin\epsilon\ \cos\alpha' = 0.202734$

Results

$\Delta = 120°\ 36'\ 16''$
$\frac{\Delta}{2} = 60°\ 18'\ 08''$
$B = 56°\ 45'\ 23''$
$\varphi' = 77°\ 00'\ 42''$
$D = 130°\ 40'\ 37''$
$D' = 49°\ 19'\ 23''$
$E = 128°\ 58'\ 29''$
$E' = 51°\ 01'\ 31''$
$\xi' = 50°\ 18'\ 51''$
$\psi' = 88°\ 07'\ 10''$
$\tau' = 49°\ 18'\ 28''$
$\varphi = 12°\ 50'\ 18''$
$\rho = 48°\ 10'\ 10''$
$\theta = 37°\ 49'\ 30''$
$\Sigma = 38°\ 58'\ 29''$
$\xi = 33°\ 11'\ 09''$
$\omega = 32°\ 48'\ 44''$
$\lambda = 40°\ 42'\ 46''$
$\psi = 1°\ 52'\ 50''$
$\tau = 40°\ 11'\ 32''$
$V = 5.756$
$W = 5.612$
$X = 3.743$
$Y = 1.279$
$Z = 4.182$

Following out a similar manner of reasoning and graphical representation, the other unknown quantities are readily determined.

When α and β are both negative—that is, when both ropes are below the horizontal—the graphical solution will be identical with the one described. When α is negative and β positive, the principle will be the same with a slight difference in arrangement of the lines. Diagrams 3, 4 and 5 of Fig. 3 work out the problem under these conditions. No further explanation will be required.

Tables II and III give the calculations necessary in solving these two problems by the analytical method.

These angle-sheave problems do not in most engineers' experience come frequently and hence do not become routine work. Consequently I do not consider great speed in solving to be essential, but it is obvious that the results must be correct and generally need at least a fair degree of accuracy.

The Types of Structure

In any angle-sheave frame whatever, the sheave wheel will be supported by a pair of members whose axes lie in planes parallel to the plane of the sheave, or, in other words, the alpha-beta plane. Generally also the plane containing these two axes will be at right angles to the plane of the sheave. These members will usually at their ends frame into main supports which are vertical, horizontal or at right angles to the sheave supports.

For the purpose of placing these members either in the drawings or, in some forms of construction, in the structure itself, it will be necessary to know the longitudinal and transverse inclinations of the members. This is the same as saying that we need the inclinations or vertical angles of two intersecting lines of the alpha-beta plane.

In the design of those types of structures where it is feasible, it will be found desirable to place these members approximately parallel or normal to the line of the resultant. For these cases the angles ϕ and θ, or ϕ and ξ, will give the inclinations required. Sometimes the angle Σ will be useful.

When the supporting members cannot be placed parallel or normal to the line of the resultant, it will be necessary to fix their horizontal direction expressed as angle ω and to compute or to determine graphically the longitudinal and transverse inclinations ψ and τ of the members for their specified directions. Their axes are, of course, also in planes parallel to the alpha-beta plane. Then in the design or erection of the structure, these angles ω, ψ and τ are used in the same way as θ, ϕ and ξ.

I recognize four principal types of framework, briefly described as follows:

Type No. 1—When the line of the resultant is steep and either upward or downward, the principal part of the frame may take the form of a pair of members parallel to the resultant reaching upward into the air from a concrete or other base. The sheave is attached to these members and the stress, tension or compression depending upon the direction of the resultant is transmitted to the concrete base, which by virtue of its weight resists the lifting tendency or by its stiffness spreads the compression over a sufficient area of the soil beneath, while by end bearing and skin friction it resists the tendency to slide horizontally. The tension or compression members may be of steel or wood. A variation of this type would be a case in which these main members are attached to some other extensive structural frame beneath, through the medium of which the stress is transmitted to the earth.

Type No. 2—When the line of the resultant is comparatively flat, the frame may consist essentially of a pair of strut-beam members parallel to the resultant, framed between two piers or towers, one or both of which will tend to overturn in a longitudinal direction when the rope is stressed. The piers or towers may be of steel or wood or concrete or reinforced concrete, while the strut-beam may be of wood, steel or reinforced concrete. The towers or piers may, as a variation in design, get some of their stability from diagonal tension or compression braces reaching to the ground or to auxiliary piers or natural anchorages.

Type No. 3—The same sort of a structure as that mentioned for type 2 may be set with the supporting-beam members normal to the resultant. In this case the resultant load subjects the members to the bending stress only, and tends to overturn the towers in a transverse direction.

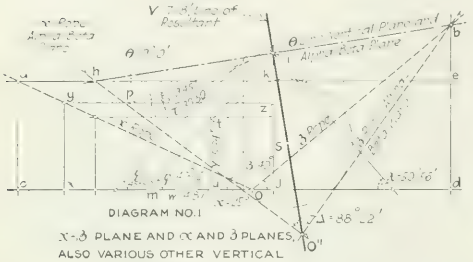
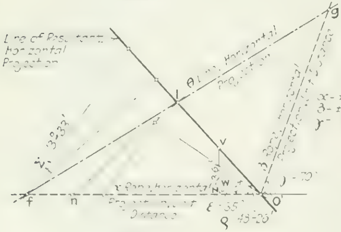


DIAGRAM NO.1

x-β PLANE AND α AND β PLANES, ALSO VARIOUS OTHER VERTICAL PLANES



Line of Resultant Horizontal Projection
θ Line Horizontal Projection
α-25°
β-40°
γ-70°
γ-70°
g
f
n
v
w
O'
ξ-35°
Q 43°20'

DIAGRAM NO.2

HORIZONTAL PLANE THROUGH INTERSECTION POINT

Fig. 2. Diagrams for Solving Problem 1

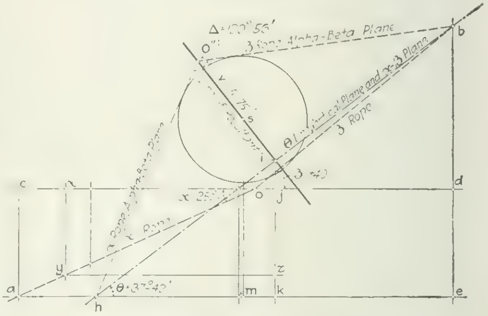
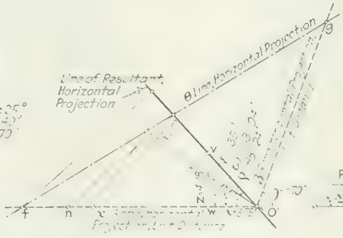


DIAGRAM NO.3

α-β PLANE & α & β PLANES



Line of Resultant Horizontal Projection
θ Line Horizontal Projection
g
f
n
v
N
w
O'
γ-70°

DIAGRAM NO 4

HORIZONTAL PLANE THROUGH INTERSECTION POINT

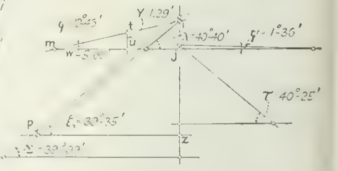


DIAGRAM NO.5

VARIOUS VERTICAL PLANES

ENG & MIN JOURNAL

Fig. 3. Diagrams for Solving Problem 2

Type No. 4—When it is not convenient to set the supporting members either parallel or normal to the line of the resultant, these members may be set in a convenient direction and supported by two towers or piers. The stress effects are of course a combination of those in the preceding two types.

It should also be mentioned that in the last three types there may be only one heavy pier or tower from which beams may extend as cantilevers to support the sheave wheel. Of course, many variations are possible.

Fig. 4 shows sketches of these various types.

We are now concerned with the method of laying out or putting into position the supporting beams. The method will be different for different types.

METHOD OF ERECTING TYPE 1

Taking up the first type, we must first of all establish on the ground a point such as a stake, nail or other mark, which is vertically under the intersection point and at a known difference of elevation. At a convenient short distance from it there must be set similarly another point in the vertical plane of the resultant. These points are readily established, as we have had the intersection point fixed from the beginning, and to get the vertical plane of the resultant we have merely to set up the transit at the intersection point and turn off the angle ρ as a horizontal angle. Of course, the angle may be turned off without a transit if necessary. Now the frame will consist of two members braced together, of required length, and provided with necessary foot plates or anchorage details, and with necessary detail for support of the sheave bearings. On this frame, as it lies on the ground, we will mark the intersection point and also a point farther along on the center line at such a location that when the frame is in position this point will be vertically over the second point on the ground. A plumb-bob is suspended from each of the two points on the frame and the frame is tilted up by tackle and shifted and rolled until the following conditions obtain: Each plumb-bob is over its corresponding point on the ground; the intersection point is at proper elevation; the members stand at the longitudinal inclination of the angle ϕ, as determined by a good contact clinometer or by tangent measurements; the members stand at a transverse inclination of the angle θ, as determined by the clinometer on a thin-edged straight-edge laid across the faces of both members at right angles to their axes at any convenient longitudinal point.

In case the intersection point on the frame is inaccessible, a point at a known distance from it on the center line may be used instead. In case the plumb lines would not hang free from the points mentioned on the center line, points on an offset line may be used; of course, making corresponding offset corrections or changes in points on the ground.

It can be understood readily that this method is somewhat tedious, as it is strictly a case of successive approximations. The adjustment for one angle throws out the adjustment for the other. In order to avoid most of the use of the clinometer, a slightly different method was used on the last structure of this type which has been built by the Penn company. By this method, a plumb-line was suspended from a convenient point of determined location on top of the frame and a fixed point established at the bottom of the frame, so located by computation as to be vertically under the point of suspension when the members stand at the inclination angles ϕ and θ. By watching the plumb-line and the lower point, the members could thus be brought to proper inclination. The angles ϕ and θ could then be checked by the use of the clinometer.

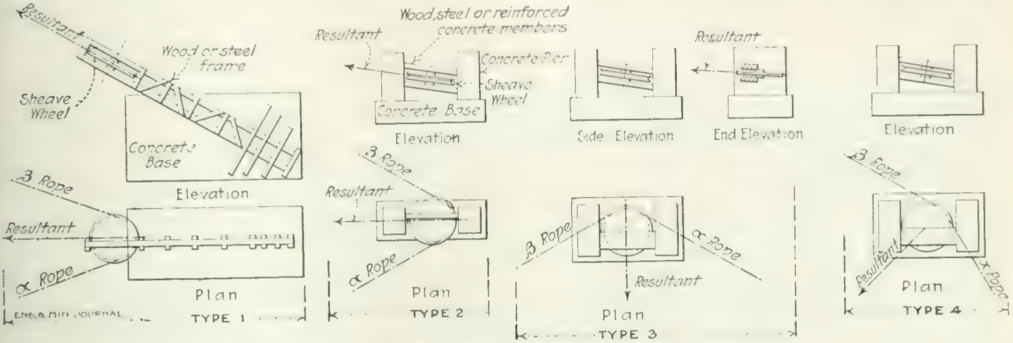


FIG. 4. THE FOUR TYPES OF ANGLE-SHEAVE FRAMES

ERECTING TYPES 2, 3 AND 4

In establishing the position of the members for the second type, if those members be of steel, wood or reinforced concrete, built into piers of concrete, the angles used will generally be ρ, ϕ and ξ. In all this work the linear quantities V, W and Y will generally be needed at some stage of the work.

The pier forms should first be erected, leaving the inside faces open. The steel or wood strut-beams should then be put in and tilted, rolled and lifted until they are at proper longitudinal and transverse inclinations as per ϕ and ξ or ϕ and θ. If these members are rather heavy it will be best to lay out supports for them beforehand by spiking across the open sides of the pier forms wooden pieces for them to rest upon. These pieces are to be placed at the inclination ξ. They must be set at proper elevation and a line connecting their centers must be inclined at the angle ϕ. Wooden straight-edges and a good contact clinometer will be useful in this work.

In case the strut-beams are to be of reinforced concrete their forms are to be treated precisely as if they were the members themselves.

If the strut-beam members are of steel, framed into steel towers or girders, the angles ρ, ϕ and θ or Σ or ξ will be used in making up the detail drawings for the structural connections. The correct fabrication of the parts will leave nothing to lay out in the field except the center lines of the structure.

What has been said about type 2 will apply equally well to types 3 and 4, except that the angles will not be the same. In type 3, ϕ will be transverse inclination and ε will be longitudinal. In type 4, ε will fix the center line, ϕ will be longitudinal inclination and τ transverse inclination.

(To be continued)

Guggenheim Exploration Co.

The report of the Guggenheim Exploration Co. for the year ended Dec. 31, 1914, shows net income of $3,383,622, equal to 16.27% on the outstanding capital stock. The surplus on the above date amounted to $24,972,000, an increase of $160,660, as compared with the previous year.

At the end of the first quarter the dividend was increased from 12% to 14% per annum, which is the present rate. The statement of assets and liabilities as of Dec. 31 last shows:

Assets—	1914
Am. Smelters' Sec. Co. "A" (33,656 shares)	$3,029,040
*Utah Copper Co. (404,504 shares)	9,161,767
*Yukon Gold Co. (2,842,625 shares)	10,114,564
*Chino Copper Co. (97,750 shares)	2,534,803
*Am. Smelt. & Ref. Co. com. (69,500 shares)	4,767,265
*Ray Cons. Copper Co. (154,300 shares)	3,245,851
*Miscellaneous investments	56,439
*Alaska Yukon properties	1,047,262
Furniture, fixtures, etc.	1,630
Accounts collectible	1,406
Cash and demand loans	11,837,273
Total	$45,797,300
Liabilities—	
Capital stock outstanding	$20,793,300
Unpaid taxes (estimated)	32,000
Surplus	24,972,000
Total	$45,797,300

*Carried at cost.

The statement of assets shows that the company's stock holdings underwent no change during the year except in American Smelters' Securities Co. "A" stock, which was decreased by 344 shares. It has also disposed of a book value of $72,181 of its Alaska Yukon assets.

Taking Feb. 1 quotations of 90 for Smelters' preferred A; 53⅞ for Utah Copper, Yukon Gold at 2¾, Chino at 36, A. S. & R. common at 62⅜, Ray Con. at 17⅞ and the rest of the investments at book value, Guggenheim Exploration has a present value of $67.57 per share.

Sweden's Iron and Steel Trade and the War

SPECIAL CORRESPONDENCE

The war has had a paralyzing effect on Sweden's industry generally. Her stone export has practically ceased, and the recent German embargo on her timber export will seriously affect this important Baltic trade. In iron and steel the exports fell, in August, 1914, to 13,600 tons, as against 17,800 tons in the same month of 1913. With better shipping service during September and October there was some improvement, and the total export went up respectively to 32,100 and 33,200 tons, though during the corresponding months in 1913 the figures were 15,100 and 55,500 tons. The iron ore export to the end of October was 1,172,000 tons less this year than for the same period of last year. There were 125 Lancashire furnaces operating during August and September, but at the end of October, there were only 110 working. Of the total of 24 bessemer converters, only 9 were in operation at the end of October, and of the 75 Martin furnaces only 49. The pig-iron output had, during the first 10 months of the year, been less by 56,000 tons as compared with the same period in 1913. The outlook as regards water-power supply, in connection with the iron works, during the winter, is particularly dark, and it is complained that decision on debatable questions of water rights has been hung up too long.

The iron mines in Kiruna are working five days in the week, and at Malmberget four days. The transport of ore to the Norwegian shipping port of Narvik has fallen since the war to about 50,000 tons monthly, as against a normal 200,000 tons.

The Grängesberg Bolaget has notified the Swedish State that it purposes shipping to the Rigsgraendsen Station from Kiruna, 3,950,000 tons of iron ore during 1916. The amount for 1915 will be 3,738,000 tons, and the total for 1914 was 3,700,000 tons. This will mean that practically the whole of the output will be shipped from Narvik.

Last November a giant blast was put in at the Sydvaranger iron mines, North Norway. The charge was 6000 kg. of dynamite. The shock for miles around is described as similar to that of a strong earthquake.

Articles Contraband of War

A proclamation revising the list of articles to be treated as contraband of war has been issued recently by the British government, all previous ones on the same subject having been withdrawn. The articles enumerated in Schedule I will in future be treated as absolute contraband, and the articles mentioned under Schedule II will be considered as conditional contraband, says the *Iron Trade Review*.

We give only those articles of interest to the mining industry.

SCHEDULE I

Powder and explosives specially prepared for use in war. Ingredients of explosives, viz., nitric acid, sulphuric acid, glycerine, acetone, calcium acetate and all other metallic acetates, sulphur, potassium nitrate, the fractions of the distillation products of coal tar between benzol and cresol inclusive, aniline, methylaniline, dimethylaniline, ammonium perchlorate, sodium perchlorate, sodium chlorate, barium chlorate, ammonium nitrate, cyanamide, potassium chlorate, calcium nitrate, mercury.

Ferroalloys, including ferrotungsten, ferromolybdenum, ferromanganese, ferrovanadium, ferrochrome.

The following metals: Tungsten, molybdenum, vanadium, nickel, selenium, cobalt, pig iron, manganese.

The following ores: Wolframite, scheelite, molybdenite, manganese ore, nickel ore, chrome ore, hematite, zinc ore, lead ore, bauxite.

Aluminum, alumina and salts of aluminum. Antimony, together with the sulphides and oxides of antimony. Copper, unwrought and part wrought, and copper wire. Lead, pig, sheet or pipe. Iron pyrites. Mineral oils and motor spirit, except lubricating oils.

SCHEDULE II

Fuel, other than mineral oils. Lubricants.

Powder and explosives not specially prepared for use in war.

Details of Practical Mining

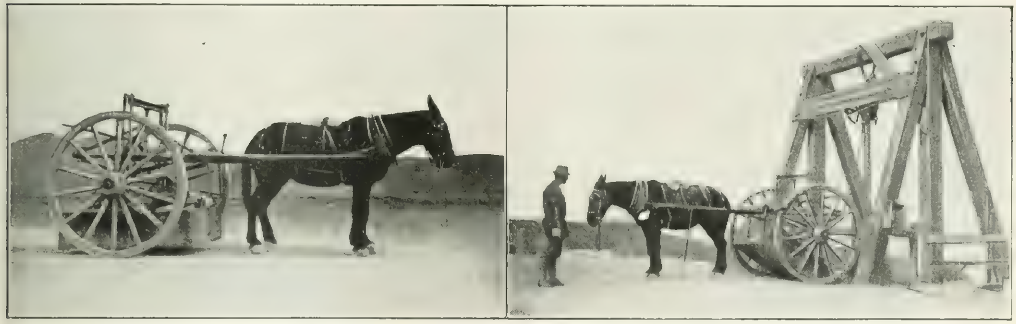
Cart for Rock Quarries

By George Benton Wilson*

In quarries, broken rock is usually transported by cars running on tracks and drawn by locomotives or mules. This method is not without its disadvantages, among which may be mentioned the following: The cars frequently become derailed, and time is consumed in taking up and relaying the tracks. Even in quarries where the tracks are carefully removed before blasting, much broken rail is to be seen on the dump. Shoveling into high cars is slow and inefficient, and it is difficult to devise trackage that will always distribute the cars close to the face. The shovelers are often idle while the trammers are replacing loaded cars with empty ones.

All of these objections have been overcome or minimized by the American Smelting & Refining Co. in its limestone quarries at Topliff, Utah, by using the mule carts shown in the illustrations. It will be seen that they are little more than a pair of broad-tread wheels, 6 ft. in diameter, which can be backed over a steel pan. The pan is picked up by means of a jack of the lever-and-rack type which stands on the cart axle. The pans are open at the rear end and, in loading, are walled with coarse pieces of rock. The sides of the pans have heavy hooks by means of which they are lifted. The front ends have a smaller hook, which engages the chain from the crank barrel on the shafts, by means of which the pans are dumped, as shown in the illustration. In order to relieve the mule of the load during dumping, an iron strut is placed under one of the shafts. This strut is hinged to the shaft and when not in use lies under the shaft and is held in place by a ring around both shaft and strut. To dump the cart, it is backed against a beam placed in such a position that the pan dumps directly into the crusher. A gallows-frame and chain-block, shown in the illustration are used to handle the heavy parts of the rock crusher, and are not essential parts of the dump.

The shafts are made of 3-in. pipe and are given a good clearance over the pan by the drop axle. The jack is held in position on the axle by means of angle-iron braces, as shown in the illustrations. The upper end of the jack bears against a piece of railroad iron carrying yokes at each end which pass around the axles and terminate in links on their lower ends. These links engage the hooks on the sides of the pans. A quarryman assists the driver to lift the pan with the jack. Many extra pans are distributed along the quarry face, which enables the quarrymen to shovel continuously. The use of these carts makes it necessary to keep the quarry floor level, but this is easily accomplished by spreading some of the fines, which would otherwise be thrown over the dump. It is much cheaper than the upkeep of car tracks. The system is more economical than cars and trackage.



A Convenient Cart for Handling Rock

The cart illustrated is not patented and was designed by the American Smelting & Refining Co.'s engineers. I am unable to give credit for the origin of the idea, as somewhat similar carts are said to have been used elsewhere prior to their installation in the Topliff quarry in 1907.

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Mountain Road Construction

Writing in *Engineering News*, F. W. Harris, recently locating engineer for the Washington state highway commission, gives some pertinent hints as follows:

Dry-laid slope walls are a great aid in maintaining alignment on heavy rock work, as it is not necessary to make the rock cuts so heavy, owing to the saving on embankment quantities by the use of walls. The thickness of a slope wall at the bottom should be 0.6 of the height; the batter, 0.3 ft. to 1 ft.; the thickness at the top, 1½ to 2 ft., and large stones should be set on top of the wall to serve as a guard-rail. The cost is from 70c. to $1.50 per cu.yd. Italians make good wall builders.

It is always a hard matter to get supplies into a mountain country, so that equipment has to be of light weight.

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*Consulting mining engineer, A. S. & R. Co., Salt Lake City, Utah such as picks, shovels, mattocks and wooden wheelbarrows, drill steel and dynamite. This becomes more important where pack-horse trails lead to the work, for then there is no opportunity for hauling material at reasonable cost.

In heavily timbered country, where consistent with drainage, the grade should be laid with an average of 2 ft. in cut. This will place the road on as good a foundation as the country affords. Shallow fills of 1 and 2 ft. should be avoided, as any number of inspectors could not watch station men close enough to keep them from making a shoddy fill. For drainage, 0.5% should be considered a minimum grade.

On heavy grades exceeding 3% in sand, clay and earth cuts, the side ditches should be filled with 1 to 2 ft. of gravel or small rocks to prevent scouring and undermining the slope. This protection should be applied when the finishing stakes are set, as it only requires about one day's heavy rain to ruin the toe of the slope in the ditch.

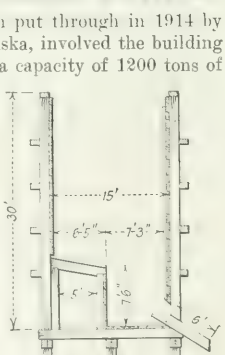
Timber culverts should be used on new work, since waiting for concrete pipes delays the work. All ordinary timber culverts last 10 years and cedar culverts from 20 to 50 years. By the time the culverts are ready for renewal, a better idea of the drainage of the country is obtainable and facilities for hauling cement are better.

It is not advisable to attempt too much refinement in balancing quantities. Excavation should run about 1½ cu.yd. to 1 cu.yd of embankment. In timbered country 10% of the total excavation can be considered as worthless, since it consists of humus, rotten logs, roots, etc. Another 10% should be deducted for quantities lost in blasting stumps. These percentages should each be increased to 15% where excavation averages less than a 3-ft. cut. These percentages also vary with the region. In the Bitter Root Mountains in Idaho they would be about 5% in each case. On the western slopes of the Cascades on the Washington and British Columbia coast, 15% would not be too high.

* * *

Bin with Compromise Bottom

A campaign of reconstruction put through in 1914 by the Ellamar Mining Co., of Alaska, involved the building of a new bin at the mine, with a capacity of 1200 tons of copper ore. Among the main features of this bin are its division into three compartments each holding 400 tons, the placing of all tie rods in the partitions so as to protect them from falling ore and particularly the means adopted to overcome the disadvantages of both the inclined and the flat bottom. For this last purpose a housing was built in the lower rear corner of the structure, as shown in the cross-section. The space filled by this reduces by so much the quantity of ore tied up and unavailable, a point of importance when the ore is of high grade, while it provides space for storage when desired; at the same time the difficult and expensive construction of the sloping bottom bin is avoided.



Cross Section of Bin with New Type of Bottom

Instructions for First-Aid Treatment*

Wounds That Bleed—Abrasions, Cuts, Punctures

Drop 3% alcoholic iodine into wound freely; then apply dry sterile gauze to wound and bandage it. Do not otherwise cleanse wound.

Severe Bleeding

Place patient at rest and elevate injured part. Apply sterile gauze pad large enough to allow pressure upon above and below wound. Bandage tightly.

If severe bleeding continues apply tourniquet between wound and heart and secure doctor's services at once. Use tourniquet with caution and only after other means have failed to stop bleeding.

Nose Bleeding

Maintain patient in upright position with arms elevated. Have him breathe gently through mouth and not blow nose. If bleeding continues freely, press finger firmly on patient's upper lip close to nose or have him snuff diluted white wine vinegar into nose.

Injuries Which Do Not Bleed—Bruises and Sprains

Cover injury with several layers of sterile gauze or cotton, then bandage tightly. Application of heat or cold may help, other means are unnecessary. If injury is severe place patient at rest and elevate injured part until doctor's services are secured.

Eye Injuries—Except Eye Burns

For ordinary eye irritations flood eye with 4% boric acid solution. Remove only loose particles which can be brushed off gently with absorbent cotton wrapped around end of toothpick or match.

Do not remove foreign bodies stuck in the eye. In that case and for other eye injuries, drop castor oil freely into eye, apply sterile gauze, bandage loosely and go to doctor.

Fire, Electrical and Sun Burns

Do not open blisters. Use burn ointment (3% bicarbonate of soda in petrolatum) freely on sterile gauze applied directly to burn. Cover with several thicknesses of flannel or soft material, then bandage but not tightly.

Acid Burns

Thoroughly flush wound with water, then dry wound apply burn ointment and bandage as above.

Alkaline Burns

Thoroughly flush wound with water, then flood wit white wine vinegar to neutralize (dilute vinegar for alkaline eye burns), dry wound, apply burn ointment an bandage as above.

Dislocations

In case of dislocation of finger except second joint o thumb, grasp finger firmly and pull it gently to replac joint, then place finger in splint and bandage. In othe cases rest dislocated part and secure doctor.

Fractures

Make patient comfortable and secure doctor's service at once. Avoid unnecessary handling to prevent shar edges of broken bones tearing artery. If patient must b moved, place broken limb in as comfortable position a possible and secure it by splint.

Frost Bites

Rub with ice, snow or cold water; treat as "fire burns.

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*From a Bulletin of the Conference Board on Safety an Sanitation (National Affiliated Safety Organizations; M. W Alexander, Secretary, West Lynn, Mass.) Copyright, 191 Reprinted from "Engineering News."

Chills and Cramps

Give patient 20 to 30 drops of Jamaica ginger in hot or cold water. If no improvement, send for doctor.

Internal Poisoning

Immediately secure doctor's services. Make patient drink large quantities of water, preferably warm, and make him vomit by sticking one's finger down his throat or by other means.

Heat Prostration

Give patient teaspoonful of aromatic spirits of ammonia in hot or cold water. In case body feels warm apply cold to it; if necessary give cold bath. In case body feels cold and clammy, apply heat to it and send for doctor.

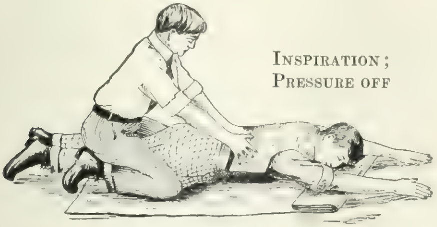
Shock, Following Injury

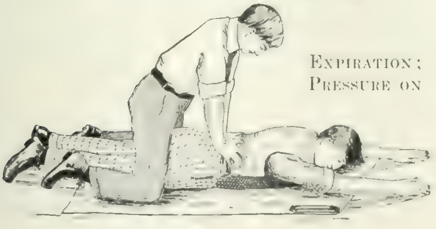
In case shock is due to severe bleeding, control it first as directed under "severe bleeding" and summon a doctor.

Lay patient flat on back and keep him warm with blankets, hot-water bottles, etc., and provide plenty of fresh air. Let patient inhale fumes of aromatic spirits of ammonia. If fully conscious give patient hot drink or teaspoonful of aromatic ammonia in hot or cold water.

Asphyxiation or Electric Shock

Immediately free patient from electrical circuit, using every care to protect one's self against electric shock. Then if patient is unconscious, even if he appears dead, lay him on his belly with arms extended forward, turn his face to one side, remove false teeth, tobacco, etc., from his mouth and draw his tongue forward.


INSPIRATION; PRESSURE OFF


EXPIRATION; PRESSURE ON

Kneel, straddling patient's thighs, facing his head, and resting your hands on his lowest ribs. Swing forward and *gradually* bring weight of your body upon your hands and thus upon patient's back, then immediately remove pressure by swinging backward. Repeat this movement about twelve times per minute without interruption for hours if necessary, until breathing has been started and maintained (see illustrations).

Meanwhile send for a doctor, have patient's tight clothing loosened, keep him warm and provide plenty of fresh air. Do not give patient liquids by mouth until he is fully conscious.

Protection of Pipe Lines Against Alkali*

The pipe lines serving the California oil fields have frequently to be carried through alkaline soil. The effect of this alkali is to corrode the pipe and in some cases render it useless in a few years. Various attempts have been made to cover the pipe and prolong its life. Asphaltum paint has not been successful. Crude oil runs away through the soil. Quick-setting bituminous enamels put on in a fairly thick layer have had some success, but cannot be applied to a cold pipe or a wet one. The most extensive and successful method devised employs specially prepared roofing paper. Such paper is applied to the pipe in either a spiral wrap or a longitudinal lap. In the spiral wrap the paper is cut at the mill into the desired width, 3 to 12 in., and furnished in lengths of from 50 to 100 ft. As soon as the pipe is screwed together, and before lowering into the ditch, it is coated with hot asphaltum and the wider strip is wound on spirally before the asphaltum sets. There is a crack left by this spiral and this is again coated with hot asphaltum and a 3-in. strip wound over it as a batten. The asphaltum is a thin grade of the ordinary refined product, applied at about 200° F., of such consistence that it will not set for about five minutes after application. At joints, 3-in. strips of paper stuck together with asphaltum are wound around the pipe on each side of the collar until a shoulder is built up flush with the outer circumference of the collar; the sleeve and shoulder are then coated with hot asphaltum and covered with a 12-in. strip of paper. This last strip is bound down with wire, as are also the ends of the spiral wrap.

The longitudinal lap system has been more extensively used. For this the paper is delivered in rolls about 6 in. wider than the pipe circumference and about 72 ft. long. The paper is applied by coating the pipe with hot asphaltum, wrapping the paper around it and sticking it down with the same material. When the oil is to be pumped hot the paper is not always stuck down, since it is calculated that the effect of the heat from the oil and the pressure of the earth will result in its sticking. It is a question, however, whether wrinkles and cracks will not develop in such cases. The lap should always be made on top of the pipe, with the outer portion looking down, and wires should be placed about every 16 in. in order that the weight of the paper itself will not pull it away from the pipe. The joints are protected by building up shoulders as with the spiral wrap.

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Bunker Hill & Sullivan Storage Battery Haulage

In a paper presented before the February meeting of the A. I. M. E., the following advantages of storage-battery locomotives were noted: (1) Elimination of the dangerous trolley wire; (2) easy access to the face; (3) elimination of the cost of installation and upkeep of trolley wires and track bonding; (4) elimination of the danger of electrolysis from stray trolley currents. These advantages, with other minor points, result in a high degree of safety, economy and efficiency; the storage-battery haulage system has given excellent satisfaction.

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*Abstract of an article by C. P. Bowie in "California Journal of Technology," November, 1914

Details of Milling and Smelting

Handfiring in Waste-Heat Boilers*

In view of the extensive use of waste-heat boilers in metallurgical operations, the following article from *Power,* Feb. 9, 1915, by Osborn Monnett, will be of interest. Mr. Monnett deals particularly with making waste-heat boiler installations capable of hand-firing.

A typical installation is shown in Fig. 1. This boiler receives the waste gases from a billet-heating furnace, the gases coming through the perforated side walls of the setting. When this furnace is not in use the boiler can be fired by hand in the usual manner. As shown, the setting consists of a standard tile-roof furnace, with deflection arch, siphon steam jets and panel doors. Many metallurgical furnaces have underground breechings and it is generally simple to lead the gases to the boiler.

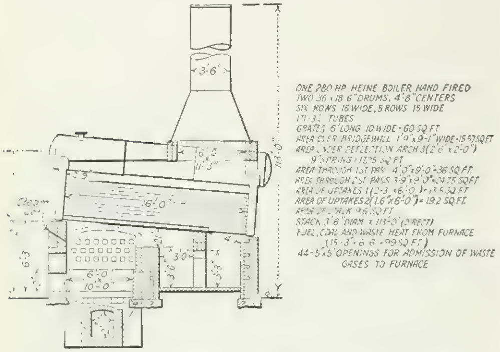
3'-6"
16'-0"
16'-0"x11'-3"
113'-0"
Steam
6'-3"
6'-0"
10'-0"
3'-0"
3'-6"
3'-3"
ONE 280 HP HEINE BOILER HAND FIRED
TWO 36 x 18 6" DRUMS, 4'-8" CENTERS
SIX ROWS 16 WIDE, 5 ROWS 15 WIDE
171-3½ TUBES
GRATES 6' LONG 10 WIDE = 60 SQ FT
AREA OVER BRIDGEWALL 1'9"x9'-1" WIDE = 15.57 SQ FT
AREA UNDER DEFLECTION ARCH 3(2'6"x2'-0")
9" SPRING = 17.25 SQ FT
AREA THROUGH 1ST PASS 4'0"x9'-0" = 36 SQ FT.
AREA THROUGH 2ST PASS 3'-9"x9'0" = 24.75 SQ FT
AREA OF UPTAKES 1(2'-3"x6'-0") = 13.5 SQ FT
AREA OF UPTAKES 2(1.6"x6'-0") = 19.2 SQ.FT.
AREA OF STACK 9.6 SQ FT
STACK 3'6" DIAM x 113'-0' (DIRECT)
FUEL, COAL AND WASTE HEAT FROM FURNACE
(15'-3"x6'6" = 99 SQ FT)
44-5"x5" OPENINGS FOR ADMISSION OF WASTE
GASES TO FURNACE

Fig. 1. Typical Waste-Heat Boiler Setting with Auxiliary Hand-Fired Furnace

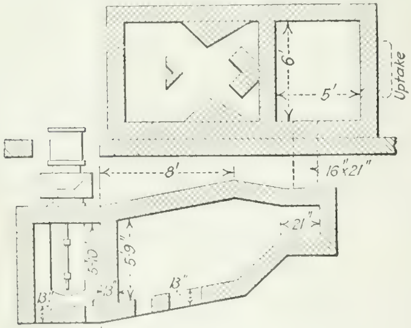

Fig. 2. Waste-Heat Return Tubular Boiler and Forging Furnace with Underfeed Stoker

The underfeed type of stoker is especially adapted for the smokeless operation of metallurgical furnaces because it does not depend on natural draft for its air supply. Owing to the length of the gas passes and number of turns, etc., there is generally but little suction over the fire from natural draft. Any stoker depending on natural draft and an ignition arch is at a big disadvantage from the standpoint of maintenance and capacity. An underfeed stoker will operate satisfactorily under conditions where a natural-draft stoker would burn up from the heat bottled in the furnace.

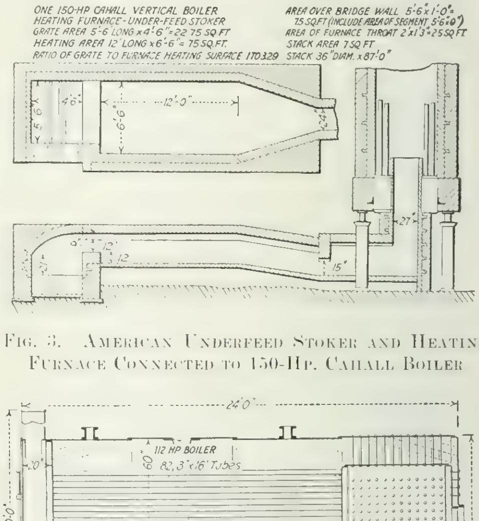
ONE 150-HP CAHALL VERTICAL BOILER
HEATING FURNACE - UNDER-FEED STOKER
GRATE AREA 5'-6 LONG x 4'-6" = 22.75 SQ FT
HEATING AREA 12' LONG x 6'-6" = 75 SQ.FT.
RATIO OF GRATE TO FURNACE HEATING SURFACE 1 TO 3.29
AREA OVER BRIDGE WALL 5'-6"x1'-0" =
7.5 SQ.FT (INCLUDE AREA OF SEGMENT 5'-6"x0")
AREA OF FURNACE THROAT 2'x1'3" = 2.5 SQ FT
STACK AREA 7 SQ FT
STACK 36" DIAM. x 87'-0"
4'6"
5'6"
12'-0"
6'-6"
24"
27"
12
12
15"

Fig. 3. American Underfeed Stoker and Heating Furnace Connected to 150-Hp. Cahall Boiler

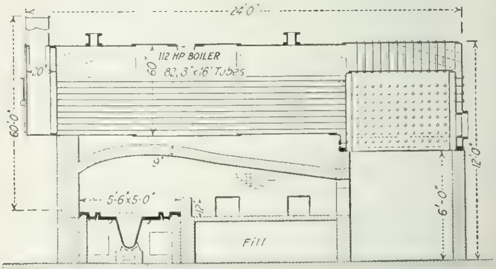

Fig. 4. American Underfeed Stoker and Forging Furnace with 112-Hp. Firebox Boiler

Fig. 2 shows a waste-heat boiler of the horizontal return-tubular type installed in connection with a reheating furnace having an underfeed stoker. The boiler itself is equipped for hand firing, an ordinary No. 8 furnace containing a pier and wing walls being installed behind the bridge-wall. The usual rules for furnace areas based on the grate surface are followed. If the boiler is to be used much, independently of the waste-heat furnace, the same stack height required by an independent boiler should be provided.

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*Copyright, 1915, by Osborn Monnett.

Another combination of metallurgical furnace and waste-heat boiler is shown in Fig. 3. In this case the ratio of grate to metallurgical heating surface is given as 1:3.29. The gases pass up through the lower drum of a specially constructed Cahall vertical boiler. Obviously, the proportions of the furnace depend on the product to be heated, so that the design must be varied to suit the conditions. The accompanying illustrations merely indicate how the different combinations can be operated without smoke.

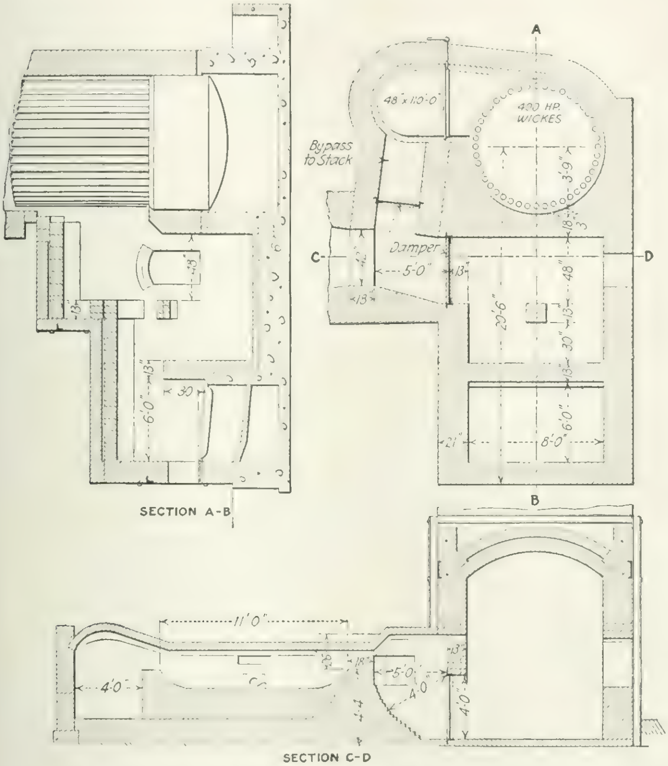

FIG. 5. JONES UNDERFEED STOKER AND MALLEABLE-IRON MELTING FURNACE WITH 400-HP. WICKES WASTE-HEAT BOILER

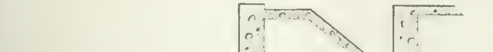

FIG. 6. JONES SELF-CLEANING UNDERFEED STOKER IN FORGING FURNACE AND WICKES WASTE-HEAT BOILER

Forging furnaces are often connected to waste-heat boilers, as the steam raised by the boilers can be used to advantage in the steam hammers, the same fuel sufficing for all operations in the shop. Fig. 4 shows an interesting and compact installation of this kind, consisting of a 112-hp. firebox boiler over a forging furnace fitted with an underfeed stoker.

When hand fired, the malleable-iron melting furnace produces a great deal of smoke. The underfeed stoker can be applied to this furnace with advantage and the waste heat used for steam making, as shown in Fig. 5. The latter consists of a 400-hp. Wickes waste-heat water-tube boiler attached to a melting furnace using an underfeed stoker and having an auxiliary hand-fired furnace for emergency purposes. With a bypass to the stack the melting furnace can be operated when the boiler is down for cleaning or repairs. Also, the furnace can be cut off from the boiler and the latter operated independently by closing the firebrick curtain-wall or damper, as indicated in the drawing. This makes a flexible combination. Another forging furnace with a Jones self-cleaning underfeed stoker is shown in Fig. 6, attached to a Wickes waste-heat boiler.

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Fettling Reverberatory Furnaces at Steptoe

In fettling the reverberatory furnaces at the Steptoe works at McGill, Nev., R. E. H. Pomeroy states[1] that it has been the practice for the last five years to make use of all converter secondaries, there being no blast furnace at this plant for disposing of this material. This byproduct is used more particularly along the firing wall or at some point where heavy material is required to sink into the bath and form a secure foundation at the furnace side for siliceous fettling above and on the slag line. The principal siliceous fettling used is mill slimes or siliceous concentrates. The furnaces are fettled daily by hand, using shovel and ladle, and about 30 tons of this material are used per furnace day. No brick side-door coverings are used as each door is provided with an outside sill or shelf and the openings are piled full of fettling material.

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Tin Deposition from Mineral-Acid Solutions was tried by Frank C. Mathers and Barrett W. Cockrum (American Electrochemical Society's October, 1914, meeting). Fluoride, chloride, perchlorate and fluoborate solutions were tried with clove oil, peptone, gelatin, glue, phloridzin, sandalwood oil, aloes, tannic acid, levulose, eucalyptus oil, catechu, benzoic acid, caffeine, pyrogallol formin, licorice, oxalic acid, salicin, saponin, podophyllin, jalapin, digitalin, morphine and gum arabic. None of the deposits was good, and the authors state any further work should be done with other addition agents.

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[1] "Bull. of A. I. M. E.," February, 1915.

Company Reports

Oroville Dredging

The following is an abstract of the Oroville Dredging Co., San Francisco, Calif., for the year ended July 31, 1914. A total of 2,897,557 cu.yd. of material was excavated. Total expenditures were $143,152 of which $117,246 were for operations. Net bullion returns were $251,599 and miscellaneous earnings, $8357; total receipts, $259,956, making a net profit of $116,804 before charging depreciation on capital accounts. Balance to surplus after all charges was $73,903. The accompanying table of costs, which covers only operating expenses, shows a cost of 4.04c. To this must be added 0.9c. for expenses not charged to operations and about 1.8c. for charges at San Francisco and depreciation charged for dismantlement of dredges. This makes a total of about 6.74c. per cu.yd.

OPERATING COSTS OF OROVILLE DREDGING, LTD., PER CUBIC YARD

Dredges	Boston 4	Exploration No. 2	Exploration No. 3	Total and Average
Total dredging time..	7,538 hr.	3,578 hr.	7,529 hr.	18,645 hr.
Cu.yd. excavated	1,217,957	340,387	1,339,213	2,897,557
Average depth, ft......	30.5	31.5	30.2	30.5
Labor and material....	1.31c.	1.6c.	1.07c.	1.25c.
Electric power	0.79c.	0.90c.	0.67c.	0.75c.
Water	0.07c.	0.11c.	0.07c.	0.08c.
Repairs	1.43c.	0.92c.	0.75c.	1.06c.
Smelting and express..	0.03c.	0.05c.	0.03c.	0.03c.
General expenses	0.62c.	1.17c.	0.56c.	0.66c.
Taxes and insurance..	0.30c.	0.24c.	0.19c.	0.21c.
Total operating	4.55c.	4.99c.	3.34c.	4.04c.
Average daily yardage	3,336	1,967	3,641	3,208
Actual dredging time, hr. and min. daily...	20 39	20 41	20 37	20 38
Acres dredged, year ..	24.70	6.70	27.40	58.80
Bullion returns	8.58c.	12.79c.	7.72c.	8.68c.
Net revenue, operating	4.03c.	7.80c.	4.38c.	4.64c.

Average cu.yd. per acre, 49,278.
Average yield per acre, $4278.
Average operating expenses per acre, $1994.

Nevada Wonder

The report of the Nevada Wonder Mining Co., Wonder, Nev., for the year ended Sept. 30, 1914, shows a total production of 48,570 tons of ore having an average value of $15.52 per ton of which 93.2% was recovered by the mill. A summary of cash statements shows that total receipts were $664,862 and operating expenditures, etc., $441,820, leaving a profit balance of $223,042. Dividend payments amounted to $281,636, making a decrease of $58,594 in cash on hand reported at Sept. 30, 1913. The operating statements of the mining and milling company give the following costs:

	1912-13	1913-14
Mining cost per ton of ore	$3.37	$4.70
Shaft sinking per ton of ore.................	0.31	0.55
Enlarging shaft per ton of ore...............	0.18	0.04
Milling per ton of ore.......................	3.25	3.37
Marketing products per ton of ore...........	0.24	0.28
Total cost per ton ore......................	$7.35	$8.94
Average value per ton of ore................	$14.63	$15.52
Loss in tailings per ton of ore..............	0.93	1.06
Recovery per ton of ore.....................	$13 70	$14.46
Less total cost per ton of ore..............	7 35	8.94
Profit per ton of ore mined and milled..	$6.35	$5.52

Development work amounted to 11,276 ft., making the total to date 29,916 ft. The cost of drifting, crosscutting and raising averaged $6.44 per ft. and shaft sinking $30.80 per ft. for the Hidden Treasure shaft to $38.53 per ft. for the Nevada Wonder shaft. The stamp duty was 13.31 tons per stamp per 24 hours.

Stratton's Independence

The report of the Stratton's Independence Mine, Victor, Colo., for the year ended June 30, 1914, shows a profit of $71,941 after deducting London-office expenses. Development work was chiefly confined to proving up the mill veins at greater depths and following them southward into the granite area. It is stated that the work in the productive area of the Independence did not disclose any new ore. The mill veins are today the sole source of shipping ore produced by the company. The lessees produced 18,736 tons which was sorted down to 7782 tons of ore having a gross value of $158,173 and a net value of $109,428 after payment of freight and treatment charges, of which the company got $34,991 for royalties and charge on profits. The company produced 19,785 tons of shipping ore which was sorted down to 3899 tons having a gross value of $68,740 and a net value of $46,806 after payment of freight and treatment charges. In addition to this ore the company treated for its own account 46,527 tons of ore in its mill, averaging $2.84 per ton. There were also 133,875 tons of dump ore treated. The average of all ore treated was 0.14396 oz. of gold per ton of which 80% was recovered. The cost of milling including moving dump ore was as follows: Coarse crushing and sorting, 15.63c. per ton; fine crushing, concentrating and treating concentrates, 50.40c.; cyaniding and special chemicals, 46.72c.; miscellaneous, 14.25c.; mining dump ore, 11.1c.; total, $1.3810 per ton milled. It is expected that the dump ore will be exhausted this year. In speaking of the future it is stated that the company expects to be able to mine a grade of mill ore from the Independence that will pay the expense of mining and milling and that some profit may come from occasional finds of shipping ore.

Temiscaming & Hudson Bay

The report of the Temiscaming & Hudson Bay Mining Co., New Liskeard, Ont., for the year ended Aug. 31, 1914, shows a dividend payment of $91,132 for the holding company, but it is stated that no dividends were received from the operating company because of the purchase by that company of the control of the Dome Lake Mine at Porcupine. The report of the operating company shows a total income of $198,082 and a total expenditure of $145,522 leaving a profit of $52,560. The end of the ore reserves of No. 1 mine was reached in June and the property was closed down in July. The production for the 10 months was 393,360 oz. of silver having a net value of $196,435. The total production from this property since the mine was opened in 1907 has been 5,601,-

168 oz. having a gross value of $3,120,514 and a net value of $2,825,561. No ore has been developed in No. 2 workings, but the prospects are considered favorable. The total cost of producing silver during the year was 25.2c. per oz., freight and smelter deductions alone amounting to 7.19c. The total cost of mining, including stoping, tramming, pumping, hoisting and depreciation, was $3.08 per ton. A record of the concentrating plant shows that 18,581 tons were treated averaging 19.5 oz. of silver, of which 86.3% was extracted. The ratio of concentration was 10:1 and the cost was $1.59 per ton for operating expenses only.

⁂

Utah-Apex

The report of the Utah-Apex Mining Co., Bingham, Utah, for year ended Aug. 31, 1914, shows a profit of $54,561 from the sale of 121,675 tons of ore. It is estimated that the net earnings would have been $122,159 greater had the company obtained the same price for lead as the previous year. Milling operations were suspended for two months on account of construction work in connection with increasing the capacity of the mill. The mine was also forced to close its entire plant for a time on the order of the local sheriff in an effort to secure the Mexican desperado Lopez, who was known to be hiding in the mine. Development work account standing on the books as an asset was charged off at the rate of 50c. per ton of ore mined so that this account now stands at $138,876 instead of $199,714 as reported last year. The outstanding bond indebtedness was reduced $68,000, face value, during the year, leaving a total of $105,000 now outstanding.

During the month of September the mill treated 8253 tons of ore yielding 2800 tons of concentrates. It is expected that the recent installations in the mill will bring the daily capacity of the mill to 100 tons of concentrates a day. A fire brigade has been organized among the employees and weekly drills are the rule. A 60,000-gal. water tank has been installed just above the mill and is to serve for fire purposes only. Mule haulage has been replaced on the 700 level by electric haulage.

⁂

Camp Bird

The report of the Camp Bird, Ouray, Colo., for year ended June 30, 1914, shows a profit on its Camp Bird property of $437,848. This amount is reduced to $322,468 by the London office after deducting directors' fees and other office charges and adding receipts from interest and miscellaneous income. To make a dividend payment of $221,130, provide for income tax, losses on loan accounts, payments on new property, depreciation on investment, etc., about $211,124 was apparently drawn from the reserve in addition to the net balance stated above.

A reorganization of the company's affairs has taken place owing to the failure of some English houses in which the former chairman was interested. H. C. Hoover is the new chairman. A technical committee has also been formed, of which R. J. Frecheville is chairman. In addition to the Camp Bird property the company is also interested in the Santa Gertrudis, the Messina (Transvaal) Development Co., the Central American Goldfields Syndicate, and other mining companies.

The ore reserves at the Camp Bird were estimated to contain 25,709 tons of ore that would yield a profit of $307,648. The mills treated 30,595 tons of ore yielding an average of $26.19 per ton; of this, 52.97% was recovered by amalgamation, 42.07% by concentration, and 4.96% by cyanidation. The contents recovered averaged 1.135 oz. gold, 4.27 oz. silver, 1.324% lead and 0.26% copper per ton of ore.

⁂

Consol. Mining & Smelting Co.

The report of the Consolidated Mining & Smelting Co. of Canada, Trail, B. C., for the year ended Sept. 30, 1914, shows a net profit of $174,012 after writing off $193,119 for depreciation. Out of this four dividends aggregating $464,376 were paid. In addition to these expenditures the plant account was increased $366,567 and property account $283,122. These expenses which were paid out of surplus or by borrowed money have placed the company's cash account in a bad position. Overdrafts and interest due banks now amount to $1,438,904, but the value of the metals shown in the statement of assets amounts to a little more than the amount due banks. Cash on hand totaled $2978. The total tonnage smelted at Trail was 374,771 tons having a gross value of $6,000,662. The metals produced from this ore were as follow: Gold, 129,083 oz.; silver, 2,568,301 oz.; lead, 34,617,318 lb.; copper, 3,645,997 lb. Development work totaled 33,146 ft. and diamond drilling 28,896 ft. It is stated that the development at the Rossland mines and also at the Sullivan group is encouraging.

⁂

Davis-Daly

The report of the Davis-Daly Copper Co., Butte, Mont., for the year ended June 30, 1914, shows that 52,198 dry tons of ore were shipped for which it received $268,178. Other receipts from rentals, royalties, etc., brought total receipts to $271,973. Expenditures totaled $379,993 which is $108,020 in excess of receipts. Since Apr. 1, 1914, operations have been confined wholly to development on the 1400 and 1700 levels and sinking the Colorado shaft which has been extended to a depth of 2346 ft. It is stated that a vein of commercial ore was encountered about 250 ft. below the 1900-ft. level. The report shows a balance of $258,850 in current assets of which $171,591 is in unpaid assessments.

⁂

South American Copper Syndicate

The report of the South American Copper Syndicate, an English corporation operating the Aroa or Quebrada mines, Aroa, Lora, Venezuela, for year ended June 30, 1914, shows a net profit of $52,210 and dividends paid aggregating $34,123. It is stated that the total cost of mining and transporting several thousand of tons of ore shipped to smelters has been charged as a part of the year's expense, but no credit for the value of this ore is taken in the accounts. A smelter for the treatment of low-grade ores is under construction, but owing to several mechanical breakdowns and other difficulties it has not yet been completed. Only ore averaging about 8% copper is sent to Europe for treatment.

Correspondence and Discussion

Capital and Labor

ARE LABOR ORGANIZATIONS AND SENTIMENTAL THEORISTS ALONE ENTITLED TO BE HEARD IN FRAMING LEGISLATION, OR SHOULD CAPITAL INSIST UPON THE RIGHT TO BE REPRESENTED?

The Congress and the legislatures of 48 states of the Union are daily engaged in the discussion and enactment of laws regulating industry and commerce. In the preparation and consideration of these laws Union Labor and every other factor except the main factor in production and distribution, as well as many sentimental societies which are not at all factors in either the production or distribution of wealth, are represented. They are not only present at the hearings before committees as accredited agents of organizations, but they exercise a subtle and powerful influence upon all legislators by the threat and the exercise of influences "at home" in the legislators' districts.

All interests except the most important are fully represented. While the present industrial system endures—and all history teaches that it will endure as long as civilization continues—the greatest of all factors in the production and distribution of wealth is the man of initiative, the man of organizing and administrative capacity, who can secure the necessary capital for the institution of industry and can conduct that industry so that labor and capital may both secure a fair return therefrom.

All know that Union Labor as now organized could not entirely manage any industry it today dominates and secure for the members of its organization the daily returns which they now enjoy, even if the labor organizations were presented with or should be permitted to confiscate the capital now used in that particular industry. The logical thinkers of the labor movement attempt to avoid the force of this fact by the advocacy of the confiscation of all capital, so that there would be no competition against a system where there would be no incentive to initiative, to industry, to improvement. The great majority of the people of the United States believe in the much denounced "Capitalistic System" of production. All rights to property in the United States rest upon the acquiescence of the majority in such rights and to the belief of the said majority that said "Capitalistic System" most conduces to the common good.

If this were not so, with the persistent activity of the insistent minority and the apathy of the majority which has continued for the past decade, all rights of property would long ago have been swept away and the Commune would, ere this, have been instituted in America.

To the work of calling the attention of the electorate to the subtle and insidious invasions by legislation of the rights in which they believe; to the illustration of the infraction of fundamental principles; in the fair and open presentation of the rights to property before legislators considering the regulation by law of industry and commerce, the employers have, thus far, done practically nothing in a proper and permanently effective manner. Generally, capital has too serenely relied upon the judiciary to protect constitutional rights, until now adverse legislation has gone so far and, by reason of the silence of those whose rights are invaded, is so vociferously supported by the minority that a general public sentiment appears to have been created (although in fact it has not) and the judiciary itself is under the influence of this sentiment and is ignoring or misconstruing constitutional provisions in obedience to this, seemingly, great popular demand.

Such resistance as has been made to these influences and activities of the minority has been made by organizations like the Citizens Industrial Association which pursued weak methods in an attempt to defend rights under the law. Whenever it shall become necessary to conspire to uphold the laws, then law is at an end.

Whenever it becomes necessary to bribe to secure the enforcement of law then the law had better remain unenforced. It is not necessary to employ agents secretly to uphold the rights to property. It is not wise timidly to beg from legislators to be accorded as privileges or immunities that which 90 per cent. of the community recognize to be rights under a constitutional government.

The time has come when the men whose brains, energies and money make the opportunities for industry and commerce must boldly and effectively assert themselves as factors to be considered in legislation in order to end this saturnalia of unequal, oppressive and unjust legislation. Labor associations have come to stay. No sane employer now denies the right of employees to collective bargaining and to coöperative action for their protection. These associations, however, must be compelled to incorporate under the law; they must be held to such responsibility as attends all others who enjoy rights under the laws.

How shall employers assert themselves? How shall those who advocate equal laws and the abolition of unnecessary and oppressive laws make their influence felt? In what manner should they coöperate? It is only by the maintenance of a permanent and vigilant organization that any effective coöperation may be secured. What shall be the scope and what the limitations of such an organization? How shall such an organization when formed be kept from abusing its powers, from employing illegal methods upon the false idea that the end may justify the means? How shall it be kept from becoming the agency of some particular interest; from advancing the personal ambitions of some individual; from being the annex to some political party?

Union Labor knows all political parties uses all of them —and ties itself to none.

Its membership almost to a man supports the political party which, at the moment, is by its candidates and propaganda particularly advancing the interests of Union Labor; but Union Labor, as an organization, does not commit itself to the support of any political party. An employers' organization, if advocating the enforcement of ordinary rights under the law, should compel the recognition of such rights by all parties and should not fear to condemn the platform or the candidate of any party which denies such rights. It should be equipped to present the employers' side of every controversy wherever legislation is pending. It should assist in the defense of its members whenever the general rights of property are denied and wherever and whenever such rights are collectively assaulted.

It should seek to enforce indemnity for every destruction of property by organizations of labor; it should assist in the preparation and dissemination of expressions calculated to increase the respect for and observance of just laws and should advocate the repeal of unjust laws; it should foster and encourage the development of this country's resources and further the extension of commerce abroad.

To these ends and for these purposes the American Society of Industry and Commerce should be organized with headquarters in Washington, D. C. The initiation fees and annual dues should be within the means of the small manufacturer and small business man. It should encourage and assist the organization of a mutual insurance fund for indemnity for losses by unprovoked strikes. It should issue a weekly or monthly bulletin at Washington similar to that issued by the American Federation of Labor. The operations at Washington and the control of the National organization should be in the hands of a board of one hundred governors to be selected, at least one, from each State. It should openly maintain a legislative bureau at Washington and one in each State for the purpose of properly presenting facts and arguments publicly. It should have an annual convention. Each State should comprise a district under the direct charge of a District Board. The district board should have a dinner or luncheon conference quarter-yearly, to be attended by the members of that district and the visiting members of other districts. Each district bureau should be encouraged and assisted in its work by the National organization.

As it is now, no legislator dares defend the rights of employers. To do so, marks him as the victim for an assault by Union Labor—with no organization to dispute Union Labor's impudent claim of right completely to control legislation.

This organization would, at least, crystallize existing sentiment in America so that legislators would learn that rights are not entirely confined to that class so vociferously represented by the walking delegate. The mining industry should be vitally interested in such an organization, but it should not be confined to any industry. It should represent those who believe that America is still a land of opportunities, that individuals are not securely chained to their environment and that the culture of the "class-conscious" microbe is not necessary to the preservation of society. It should embrace in its membership all who believe in a government of few, simple, sane, just laws; all who realize that the multiplication of unnecessary laws and the administration thereof by a bureaucracy are a menace to constitutional government and a barrier to the extension of legitimate industry and commerce. With such an organization in existence the millions who now are mute would have the courage to express in actions their deep convictions.

H. J. CANTWELL.

St. Louis, Mo., Jan. 15, 1915.

The Union Sulphur Refineries in France

As a reader of the JOURNAL I would like to make correction of a statement I find in the number of Nov. 21, 1914, under the heading, "By the Way." This is an article referring to the sulphur refineries of the Union Sulphur Co. at Marseilles and Cette. Your correspondent has certainly exaggerated very much the risk to those works by speaking of their possible destruction. In France we have not destroyed nor injured any industrial establishment owned by a foreigner. The industries owned by enemies have been put under close supervision, but not confiscated nor destroyed by the Government. Those owned by foreigners not enemies have not been subjected to any special treatment.

The destruction and ruin of foreign industrial works and enterprises has remained the monopoly of the German army, in its operations.

I have written you, because I do not wish to see a misstatement about my country in the JOURNAL, which is so influential and usually so correct and careful in its statements. Perhaps it would have been better to give the direction of these works to Americans, or in their absence to Frenchmen rather than to Germans; but that is outside of the intention of my letter.

H. KNOERTZER,
Engineer of Mines.

Paris, Dec. 16, 1914.

* * *

The Uses of Brothers-in-Law

Misther Editor: Have ye iver noticed that manny a convaynient minin' tool is niver mintioned in the textbooks an' other sich compindiums av misinformayshun?

Wan av these is the *cuñado*. A *cuñado* niver occurs ixcipt as a byproduct av the most important industry. Some fellies commit matrimony with the delib'rate intinshun av manufacturin' thim into minin' tools; while other fellies may acquire *cuñados* unbeknownst an' use thim as makeshifts.

'Tis most distressin' for a felly to use a *cuñado* jist to make its sister happy, usin' it kind an' gintle, feedin' it lib'ral salary, playin' the minin' game fair an' square an' accordin' to the rules; an' thin all at wance, whin the *cuñado* l'arns a little, it goes off an' plays dirty tricks av its own invinshun, givin' folks an incorrect impreshun av its early trainin'.

But the most convaynient thing about a brother-in-law is the hind-name bein' different. A promoter can use his *cuñado* for ingineer or superintendent av the mine, an' no wan but the inishyated need know. What a cinch old Brigham Young wud have had as a minin' promoter.

BILL MCGINTY.

New York, Feb. 1, 1915.

* * *

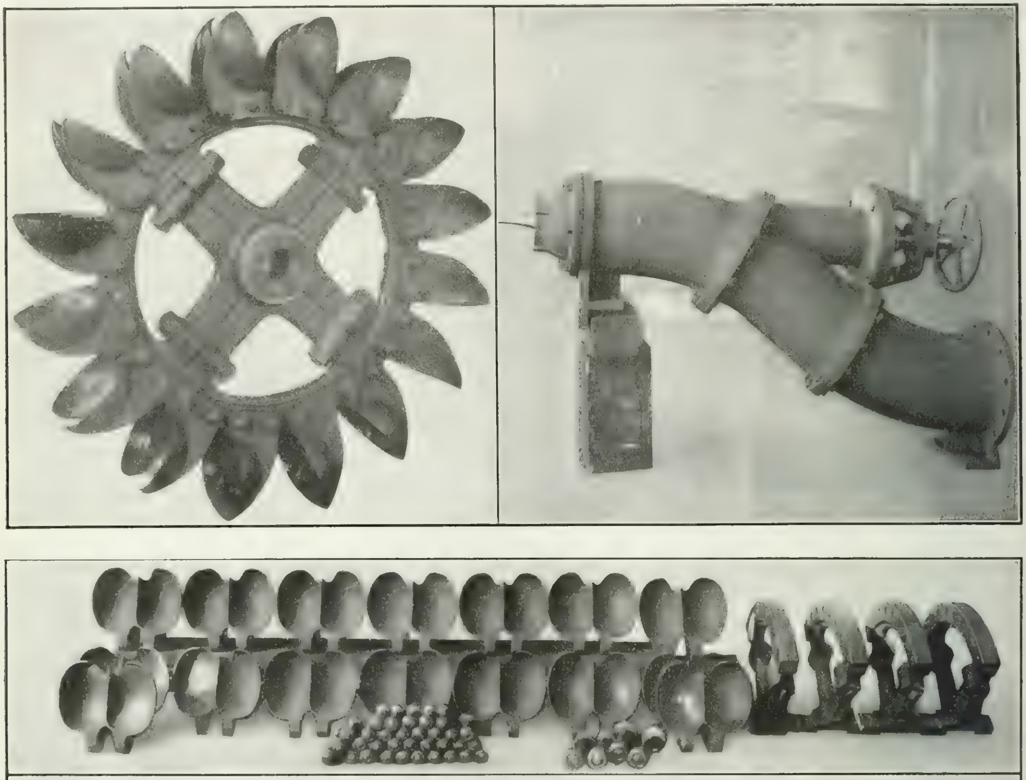
Mining in Colorado

In the article on "Metal Mining in Colorado in 1914," I spoke of the Wanakah orebodies at Ouray as being replacement deposits in quartzite. This is an error and should read "limestone" instead of "quartzite."

GEORGE E. COLLINS.

Denver, Colo., Feb. 1, 1915.

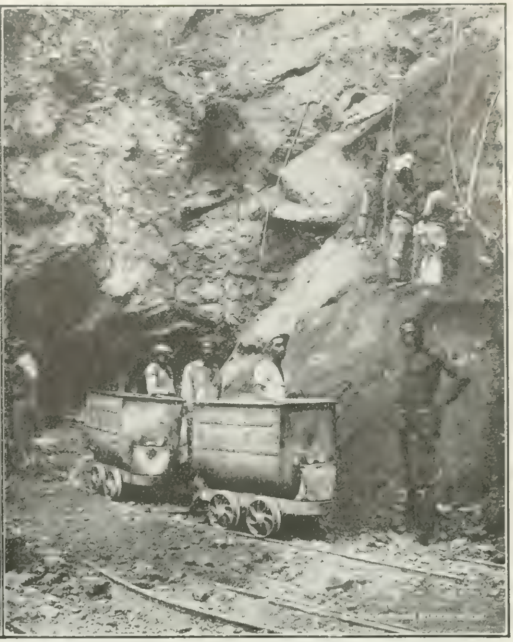
Photographs from the Field



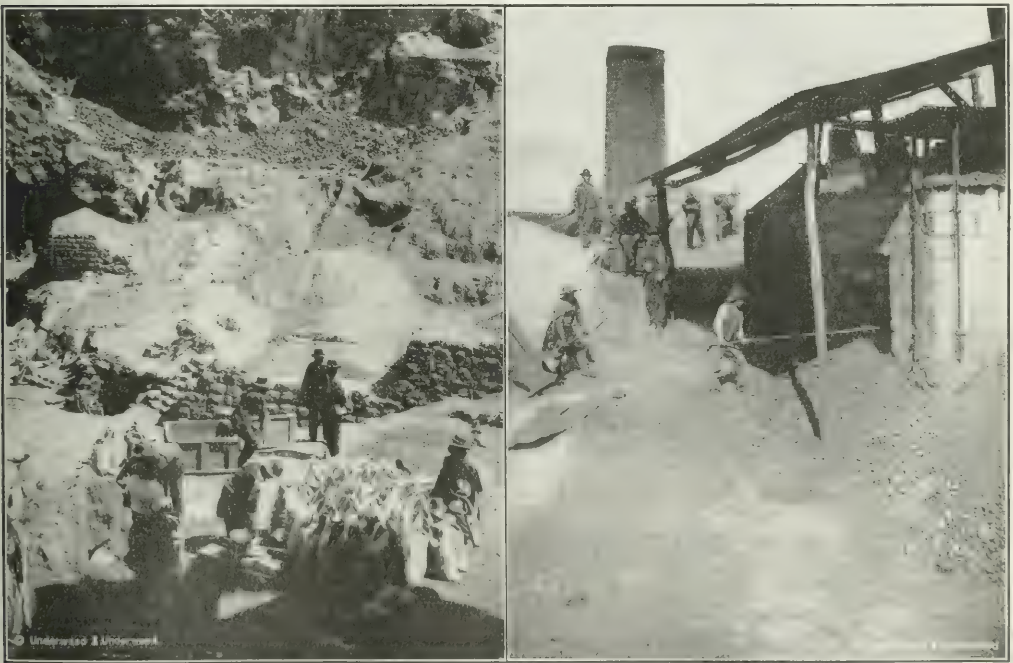
PACKING MACHINERY FOR MULE-BACK TRANSPORTATION

An example of how machinery should be packed for export and mule-back freighting. A Pelton wheel and nozzle shown in the upper illustrations, the wheel dismantled, and the whole packed

MORENCI SOUTHERN R.R. JUST BELOW MORENCI



WESSELTON DIAMOND MINE, KIMBERLEY, S. A.



NATIVE COPPER MINING IN PERU

Carrying ore in leather bags

A native smeltery

NEW PUBLICATIONS

ELECTRICITY IN COAL MINING. By David R. Shearer. 6¼x9¼, pp. 84, illus.; $1.50. McGraw-Hill Book Co., New York.

HANDBUCH DER MINERALCHEMIE. Vol. III, Part 5. 7x10, pp. 159, paper; 6.50 marks. Theodor Steinkopff, Dresden, Germany.

THE PRESERVATION OF STRUCTURAL TIMBER. By Howard F. Weiss. 6x9½, pp. 312, illus.; $3. McGraw-Hill Book Co., New York.

THE PETROLEUM YEAR BOOK, 1914. Compiled by Sydney H. North. 5½x8¾, pp. 104, illus.; $2. The Technical Book Shop, London, Eng.

HANDBUCH DER MINERALCHEMIE. Vol. II, Part 6. By C. Doelter. 7x10, pp. 160; 6.50 marks. Theodor Steinkopff, Dresden, Germany.

MINERAL PRODUCTION OF CALIFORNIA FOR 1913. By E. S. Boalich. Pp. 140, illus. Bull. 63, California State Mining Bureau, San Francisco.

LEAD AND ZINC DEPOSITS OF NORTHWESTERN ILLINOIS. By G. H. Cox. Pp. 120, illus. Bull. 21, Illinois State Geological Survey, University of Illinois, Urbana, Ill.

THE PRODUCTION OF PETROLEUM IN 1913. By David T. Day. Mineral Resources of the United States, 1913, Part II. Pp. 355, illus. U. S. Geological Survey, Washington, D. C.

THE MINING INDUSTRY IN NORTH CAROLINA DURING 1911 and 1912. Joseph Hyde Pratt, State Geologist. 7x10, paper; pp. 342, illus. North Carolina Geological and Economic Survey, Chapel Hill, N. C.

THE CEMENTATION OF IRON AND STEEL. By Federico Giolitti. Translated from the Italian by Joseph W. Richards and Charles A. Rouiller. 6½x9¼, pp. 407, illus.; $4. McGraw-Hill Book Co., New York.

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1912. (Short Papers and Preliminary Reports.) Part II, Mineral Fuels. By Marius R. Campbell. Pp. 532, illus. Bull. 541, U. S. Geological Survey, Washington, D. C.

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE. REPORT OF OPERATIONS AND PRODUCTION DURING 1913. By D. H. Newland. Pp. 111. Bull. 580, University of the State of New York, Albany.

JAHRESBERICHT 1913 DES KOENIGLICHEN MATERIALPRUEFUNGSAMTES DER TECHNISCHEN HOCHSCHULE ZU BERLIN IN BERLIN-LICHTERFELDE WEST. 7¾x10½, pp. 72, paper. Julius Springer, Berlin, Germany.

CONTRIBUTIONS TO THE STUDY OF THE GEOLOGY AND ORE DEPOSITS OF KALGOORLIE, EAST COOLGARDIE GOLDFIELD. Part II. By F. R. Feldtmann and R. A. Farquharson. Pp. 83, illus., including maps under separate cover. Bull. 51, Geological Survey of Western Australia, Perth.

MANUAL OF HYDRAULIC MINING. T. F. Van Wagenen, 4x6, pp. 123; $1. D. Van Nostrand Co., New York.

A revised edition of this well-known reference book. The work has been brought up to date and a chapter on dredging added. The original plan of avoiding technical terms and explanations has been adhered to, and the language is clear and simple.

MAP OF THE CRYSTAL FALLS DISTRICT MICHIGAN. Compiled by George S. Rollin, Crystal Falls, Mich. 25x32 in., unmounted; $1.

This is a map which will prove most useful to those interested in the district covered where development has been exceedingly vigorous of late. The map shows the mines and the properties under exploration. Mr. Rollin's intimate acquaintance with the district is sufficient warrant for the accuracy of the map.

GYPSUM IN CANADA: ITS OCCURRENCE, EXPLOITATION AND TECHNOLOGY. By L. H. Cole. Pp. 256, illus. Canada Department of Mines, Mines Branch, Ottawa.

This is another of the excellent series of monographs issued by the Canadian Department of Mines, dealing with the occurrence of gypsum, the theories concerning its formation, statistics of the production, including reviews of the Canadian producers, mining methods used, and complete treatises on the methods of working and uses both of gypsum and plaster of paris.

LABORATORY COURSE IN ELECTROCHEMISTRY. By Oliver P. Watts. 5x7½, pp. 115, illus.; $1. McGraw-Hill Book Co., New York.

A carefully designed course of 133 experiments, which covers the general theory of electrochemistry, and its practical applications of electroplating, electroanalysis, electrolytic refining, and electrolytic oxidation and reduction processes. It is difficult to see how any student could perform these experiments and fail to gain a good working knowledge of the subject.

NOTES ON QUANTITATIVE CHEMICAL ANALYSIS. By Charles William Foulk. Third edition. 6x10¼, pp. 250; $2. McGraw-Hill Book Co., New York.

A treatise intended for beginners in quantitative analysis, [illegible] more to teach general principles than specific methods. For this type of book it seems excellent, and for the student taking chemistry as a "required course," or the engineering student studying it as an adjunct to his main course, the presentation seems excellent. It would seem, however, to require supplementing for those going into chemistry as their life work, and it is not in any way a reference book for the practicing chemist.

THE MINING CONGRESS JOURNAL—The first issue of this publication, recently started by the American Mining Congress, has just been issued. Its purpose, as announced by the Congress, will be to keep its members better informed concerning legislative matters, both at the national capital and in the various state legislatures, to carry information concerning important legal decisions and administrative rulings of interest to the mining industry; to carry discussion of the economics of mining and to demonstrate the real relation which exists between mining, agriculture, manufacturing transportation and commerce. Its pages will be devoted to the economic, administrative and commercial rather than to the technical phases of the mining business. Subscription price is $2 a year. Orders may be sent to the American Mining Congress, Munsey Bldg., Washington, D. C.

THE METALLURGY OF THE NON-FERROUS METALS. By William Gowland. 6x8¾, pp. 496, illus.; Charles Griffin & Co., London; J. B. Lippincott Co., Philadelphia, Penn.

The subjects treated are: Refractory materials; roasting, fluxes and slags, copper, lead, gold, silver, platinum, mercury, zinc, cadmium, tin, nickel, cobalt, antimony, arsenic, bismuth, aluminum. There is a vast amount of information in this book in very small space, but it has the disadvantage of the old-fashioned professorial treatise, in that everything is given equal weight, whether it be an obsolete process, or the latest wrinkle in electrolytic refining. However this may not be unmitigated evil, for on reading over these pages, it becomes evident that anyone comprehending the essentials of the old Patera and Kiss processes would understand clearly the Holt-Dern and Knight-Christensen methods of 1914. As a students' textbook and as a cheap substitute for Schnabel there seem to be a wide field of usefulness for this volume.

EXAMINATION OF LUBRICATING OILS. By Thomas B. Stillman. 6x9, pp. 125, illus.; $1.25. Chemical Publishing Co., Easton, Pennsylvania.

Contents: Specific gravity; cold test; viscosity; iodine absorption; flash and fire test; acidity; Maumene's test; color reactions of oils with nitric and sulphuric acids; separation of mineral oil from a vegetable or animal oil; gumming test; sulphur test; test for water; gasoline test; microscopical examination; carbon residue test; fixed carbon in oil; estimation of paraffin in mineral oils; soap test; determination of tarry matters in petroleum products; greases; coefficient of friction; specifications for various lubricating oils; graphite as a lubricant; remarks on lubricating oils; the calorific power of petroleum oils and the relation of density to calorific power; fuel oil specifications; the analysis of lubricating oils containing blown rape-seed and blown cotton-seed oils; the analysis of cylinder deposits; technical examination of petroleum; table of products obtained from Pennsylvania crude petroleum when distilled destructively, and apparatus for the examination and study of the behavior of valve and cylinder oils and other petroleum and lubricating oils in saturated and superheated steam, carbon dioxide, air and other gases.

THE CANADIAN MINING MANUAL, 1914. A Handbook of Information Concerning the Mineral Resources and the Mining Industry of Canada. Edited by Reginald E. Hore. 7x9½ in, pp. 280, illus.; $2. Mines Publishing Co., Toronto, Canada.

The "Canadian Mining Manual" was founded by the late B. T. A. Bell, but the publication was discontinued after his death, no one at that time being willing to take it up. The Mines Publishing Co. has now revived it, under the editorship of R. E. Hore, who is also editor of the "Canadian Mining Journal." A book of this kind can be criticized fairly only after months of use, but it must be said that the first volume of the new issue makes a most creditable appearance. It is a volume of 280 pages, of which 75 are devoted to brief summaries of the chief mineral products of Canada and their history, 60 pages to statements from the Dominion and the various provinces, and the remainder of the book to lists and brief descriptions of the mines and mining companies of Canada. These are arranged by provinces, and are followed by an alphabetical list of companies with references to their products and geographical position. The "Manual" is bound to be useful to anyone interested in Canadian mines. The statistics given are from official sources, and are therefore in marked contrast to those in the old "Manual," whose brilliant editor had a standing feud with statistics and those whose business it was to collect them.

Annual Meeting of the Institute

SYNOPSIS—Brief outline of the sessions devoted to first-aid, non-metallic minerals and general mining; also of the business session and the dinner.

The annual New York meeting of the American Institute of Mining Engineers was held in the Engineering Societies Building, Feb. 15 to 17, inclusive. The meeting began actively at 10 o'clock Monday morning, with a technical session held under the auspices of the committee on safety and sanitation with Arthur Williams in the chair. Four papers were presented and a rather unusual amount of discussion testified to the interest taken in this live subject. The papers were, "Safeguarding the Use of Mining Machinery," by Frank H. Kneeland; "Safety Methods and Organization of United States Coal & Coke Co.," by Howard N. Eavenson; "Housing and Sanitation at Mineville," by S. LeFevre; "Enlarging the Worth of the Worker and the Perspective of the Employer," by J. Parke Channing.

Among others discussing Mr. Kneeland's paper were Doctor Tolman of the American Museum of Safety and B. F. Tillson of the New Jersey Zinc Co.; the latter called attention to the fact that at the Franklin mine, at least, accidents from machinery underground were practically negligible. Mr. Eavenson's paper provoked a rather lengthy and interesting discussion; this was, of course, confined chiefly to coal-mining practice, but Mr. Tillson reported the really excellent results obtained at the Franklin mine by a thoroughgoing safety-first campaign, and received considerable applause. Mr. LeFevre's paper on conditions at Mineville was particularly interesting from the fact that it was illustrated by a series of moving pictures taken at Mineville by the U. S. Bureau of Mines. These pictures interested rather by the charm of familiarity than by that of novelty—to use the phrases of literary critics. Operations of lowering men and material were shown; two miners were seen setting up a two-man piston drill on a tripod and spotting the hole in about 20 sec., which is probably record time—pictures, of course, cannot lie. The rough handling by the cage tender of some miners prone to unsafe practices produced amusement and applause. The preparation of fuses and primers was shown, together with a proper rebuke administered by the foreman to a miner caught tamping his powder with a crowbar—save the mark! As usual the program overran the time allowed to it, and Mr. Channing's paper, in some ways the most interesting of all, from the breadth of its view and the authority of long and successful experience back of it, was presented very briefly and a discussion of it was practically confined to a short talk by Fred H. Rindge. The paper described the work of the Industrial Service branch of the Y. M. C. A., of which Mr. Rindge is secretary. The Industrial Service movement aims to bring together working men and students in schools of engineering to the mutual benefit of both, particularly of the student. Mr. Channing was justifiably enthusiastic as to the aims of the movement, its actual accomplishment and its possible ultimate influence.

On Monday afternoon, there were technical sessions, one by the iron-and-steel division and the other on nonmetallic minerals. At the iron-and-steel session, Albert Sauveur presided and papers were read by title or in abstract as follows: G. K. Burgess and Sir R. A. Hadfield, "Sound Steel Ingots and Rails." F. C. Langenberg and R. G. Webber, "Structure and Hysteresis Loss in Medium-Carbon Steel." W. R. Shimer, "Effect of Finishing Temperatures of Rails on Their Physical Properties and Microstructure." James F. Kemp, "The Mayari Iron-Ore Deposits, Cuba." Walther Mathesius, "High Blast Heats in Mesabi Practice." Henry M. Howe and Arthur G. Levy, "Are the Deformation Lines in Manganese Steel Twins or Slip Bands?" Arthur West, "A Modern Gas-Power Blower Station."

Professor Kemp's paper on the "Mayari Iron-Ore Deposits of Cuba" was illustrated by slides and also by a series of motion pictures. The nonmetallic-mineral session was presided over by C. P. Berkey and Heinrich Ries. Papers by William B. Phillips, Thomas L. Watson and J. Sharshall Grasty, Joseph Hyde Pratt and Edward G. Norton were read by title. Chairman Ries read in abstract N. B. Davies' paper on "The Plasticity of Clay and Its Relation to Mode of Origin." The papers attracting the most discussion were those of Charles H. MacDowell on "German and Other Sources of Potash Supply," and of Joel H. Watkins on "White Burning Clays of the Southern Appalachian States," in which the possibility of supplanting some of the imported china clays was brought out. The use of a plurality of circular shafts for mining the soft kaolin veins was also an interesting feature to many.

W. L. SAUNDERS

At the business meeting about 1100 votes were cast, which were practically unanimous for W. L. Saunders for president and S. J. Jennings for vice president. The proposed amendments to the constitution were carried by about 80% of the votes cast.

The report of the membership committee showed a total gain during the year of 1002, making a total of 4958 on Dec. 31, 1914. Among the disbursements, the largest are: *Transactions,* $19,768; *Bulletins,* $16,470; editorial and office, $22,942; principal and interest on mortgage, $30,206. The receipts for the year totaled $118,087.

SYNTHETIC "CRUDE OIL"

The sensation of the Tuesday afternoon session was reserved till the very end when the chairman, Capt. A. F. Lucas, called upon Dr. Walter O. Snelling, of Pittsburgh, to tell about his experiments in the production of synthetic "crude oil." The afternoon session began with two coal papers; one by Douglas Bunting on "The Limits of Mining Under Heavy Wash" was read by title only; the other, "Recent Developments in Coal Briquetting," was read by Charles T. Malcolmson and showed that coal briquetting was making substantial progress in several sections of this country where economic conditions were favorable.

SYDNEY J. JENNINGS

The remainder of the afternoon was devoted to the division of petroleum and gas, and as heretofore this young division of the Institute showed itself an active and sturdy youngster. Lively discussion followed the reading of papers by Prof. Roswell H. Johnson on the "Rôle and Fate of the Connate Water in Oil and Gas Sands"; "Depreciation as Applied to Oil Properties," by Philip W. Henry; "The Use of Mud Ladened Water in Drilling Wells," by I. N. Knapp. Written discussions of the latter paper included a description by A. Beebe Thompson of a difficult drilling problem in which "heaving" occurred at about 500-ft. depth, due to gas pressure on mud; Mr. Lewis directed attention to some early uses of mud-laden water in drilling in Holland and elsewhere on the Continent. Papers were read by title from Alfred H. Brooks, Howard R. Hughes, S. J. Hardison, M. L. Requa, M. E. Lombardi, F. Julius Fohs and C. W. Washburne. Some slides showing some of the work of the oil-and-gas laboratories of the University of Pittsburgh were presented by Professor Johnson; these showed the oil-gas ratio and the relation of strike to the elongateness of the pools in Pennsylvania and West Virginia.

Chairman Lucas then announced that Doctor Snelling would present the results of his experiments in the production of gasolene from synthetic "crude oil," a development from the result of an abortive experiment made about five years ago. This proved to be the bomb of the session and galvanized the meeting into life at its fag end by the injection of a brand new idea that was not fully accepted by some and brought others to their feet for further information as soon as the speaker finished his announcement. Further details of Doctor Snelling's discovery are given elsewhere in this issue.

ANNUAL DINNER LARGELY ATTENDED

At the annual dinner at the Hotel Astor on Tuesday evening, there was the largest attendance in the history of the Institute, about 300 members and guests being present. On the front cover of the menu were printed Doctor Raymond's metrical paraphrase of three verses from Job xxviii, 1, 5, 6, and an illustration of a mining operation beneath the "peaceful field." Doctor Raymond's paraphrase, written in 1878, is as follows:

Above, the peaceful field and fold;
Beneath, the flame reaps harvest old,
Whose grain is gems, whose soil is gold.

He drives his shaft; men come and go
Above his head, and do not know
Who swings suspended far below.

At the conclusion of the dinner, Retiring President Thayer reviewed the great success of the past year in the Institute's history, and before closing announced that at a meeting of the board of directors, during the afternoon, Prof. James F. Kemp had been elected an honorary member of the Institute. President-Elect W. L. Saunders then assumed the duties of toastmaster and with characteristic wit introduced the other speakers of the evening, who were: Gano Dunn, president of the United Engineering Society, Job E. Hedges, Dr. Rossiter W. Raymond and John C. Montgomery. Technical sessions were continued on Wednesday, the morning being occupied by the division of nonferrous metallurgy and the afternoon session being devoted to mining and the application of electricity to mining. On Thursday, there were trips to inspect construction work of the Catskill aqueduct and new subways in Greater New York. On Friday, many of the members attended the session of the American Institute of Electrical Engineers at which there was a demonstration of and a discussion of the Cottrell system of electrical precipitation.

Oklahoma's Petroleum Legislation

The New York *Evening Post* reports the passage by the Oklahoma House of a law which prohibits bringing to the surface more oil than can be cared for and sold at a reasonable price. The new law puts the state in control of all Oklahoma's shipments to the market: new wells cannot be drilled except by special permission, storage is limited, and the pipe-line runs from each producer prorated. This is a step far in advance of Oklahoma's previous law, and those of California and Indiana, whic touched only methods of drilling and plugging. A re markable phase of the matter is that the Interior Department, the state government, and the oil-well owners all conferred upon the proposed legislation, and the great extent of the powers entrusted to the State Conservation Commission represents their agreement.

* * *

Gasoline from Synthetic Oil

Perhaps the most startling announcement made at the technical sessions of the American Institute of Mining Engineers in New York, this week, was that of Dr. Walter O. Snelling, of Pittsburgh, who reported to the division of petroleum and gas the results of his experiments in the production of synthetic "crude oil" from various hydrocarbons such as vaseline, rod wax, gas oil, fuel oil, etc. From these hydrocarbons, low in hydrogen, there was repeatedly obtained a synthetic crude oil from which gasoline aggregating from 50 to 70% was distilled after successive reconversions of the residue into synthetic crude oil, the excess carbon separating out as mud. In the conversion of the hydrocarbons into the synthetic crude oil, there is a concurrent production of "natural gas" to the extent of about 2 per cent.

Doctor Snelling's discovery followed an abortive experiment made for a different purpose about five years ago. A vessel partly filled with a heavy oil had been heated to about 450° C. and when opened, was found to contain a product that looked like ordinary crude oil. It was green by reflected light and a rich, red-brown by transmitted light and when subjected to fractional distillation gave about 15% of gasoline. Further examination indicated that it was as similar to crude oil in its constitution as in its appearance.

Difficulty was experienced in attempting to reproduce the conditions to give the accidental result above obtained. However, after considerable experiment, it was found in making the synthetic crude oil that a certain relation between the size of the vessel and the volume of the starting hydrocarbon was necessary. When the vessel was three-quarters full, or one-half full, reaction failed almost wholly, but when the vessel was about three-elevenths full and heated until the pressure gage indicated 800 to 900 lb. per sq.in., the result was invariably a greenish oil containing about 15% of gasoline and other distillates in approximately the same percentages as in crude oil. This result was obtained when starting with vaseline, rod wax, gas oil, fuel oil and presumably other hydrocarbons. A remarkable feature is that the synthetic crude oil can be repeatedly distilled and reconverted so that first 18% of gasoline, then 15%, then 12%, etc., are successively obtained until 50 to 70% of the original hydrocarbon was obtained as gasoline of about 70° Bé. When starting with paraffin, the eventual yield was 70% of water-white gasoline and about 30% of natural gas.

Doctor Snelling concluded from his experiments that when a hydrocarbon body occupying more than one-tenth and less than one-half of a vessel is heated to a pressure of 800 to 900 lb., a fundamental change occurs; the hydrogen and carbon atoms seem free to rearrange themselves and form a more or less definite mixture of hydrocarbons in appearance and constitution not unlike crude oil. There is a residual pressure of about 150 lb. in the vessel after cooling, due to the formation of about 2% of natural gas. Doctor Snelling suggested that natural crude petroleum might in some instances have been produced by nature by some process related to his experiment, perhaps by lower temperatures acting through geologic agents; also that the natural gas associated with petroleum might have a related origin analogous to that invariably produced with the crude oil by his process. Time has practically no effect on the reaction, which is fairly quick under these conditions; at least, the reaction was complete in vessels that were quenched in water as soon as the gage reached 800 lb. Questioned as to the percentage of coke left in the vessel, Doctor Snelling said there was practically none, but that there was a pasty mass of separated carbon insoluble in the menstruum. The synthetic crude oil formed contains proportionately more hydrogen than the heavier oils, and as the latter were already deficient in hydrogen, much of the carbon finds no hydrogen to combine with and hence separates out as "mud."

The gasoline distilled from the synthetic crude oil is normal in color, but different in odor, though nothing like that of the "cracked" volatile products. The odor of the Snelling synthetic crude oil and of all the distilled products thereof is milder and sweeter than that of natural petroleum and its products. Doctor Snelling exhibited to the members of the Institute samples of a yellow lubricating oil and the products made therefrom which, in appearance, resembled crude oil and its distillates, but were all much milder in odor. The gasoline produced is reported to be suitable as motor spirit and other customary uses of normal gasoline. The Snelling gasoline is water-white in color and notwithstanding that some of it has stood over one year and has never been treated with acid or alkali, it had not changed color nor altered in any other respect during this period. Complete tests have not been made of the various products.

While the process has not yet been developed to definite conclusions as to many points, Doctor Snelling announced that through the interest of a well known mining man, John T. Milliken, of St. Louis, further research had been made possible, and that commercial experiments had now been undertaken by the Milliken Refining Co., of St. Louis, at its refinery at Vinita, Oklahoma.

* * *

The Copper Seizures

The New York *World* recently published the allegations of the copper producers as filed with the Department of State. Among the more interesting statements are the following:

> That since the outbreak of the war, and up to Jan. 1, 1915, thirty-one shipments of copper from the United States to neutral Continental ports have been seized by Great Britain. These seizures aggregate 19,350 tons, of which this amount 9350 tons are piled up at Gibraltar alone. Four of the shipments were destined for Holland, 11 for Italy and 13 for Sweden.
>
> American owners consented to sell four small lots to the British Government at a loss rather than undergo the expense and delay of prize court proceedings. On these four shipments the British Government, the shippers declare, caused the Americans and their insurance brokers to [illegible] loss of $30,000 by forcing the sales at a price far below that offered by the original consignee.
>
> That a small group of British agents have seized and are dominating all America's foreign market under the regulations laid down for the movement of copper by the British Government, forcing the United States to sell through these agents. This group of half a dozen men is levying a 1% toll upon every ton of copper exported from the United States.

In addition to the commission, British agents are taking a warehouse toll of $1.10 a ton on all copper embargoed by Great Britain.

One of the largest concerns involved—the United Metals Selling Company—is transacting business with neutral countries freely through Charles S. Henry & Co., while unable to make a single sale direct.

A representative of Henry R. Merton & Co., the largest dealers in metals in England, came to New York about Dec. 15 and proposed to the large copper concerns that they pool all their trade, agree to sell only through Merton & Co., and Merton & Co. would guarantee delivery of all cargoes, avoiding troubles due to the British Admiralty's stringent regulations. The proposition was declined by the United States copper interests on the ground that Britain's contraband regulations should not be used to deliver America's entire export trade into the control of English merchants.

On Jan. 1 a director of Merton & Co. cabled the American Smelting and Refining Company, the United Metals Selling Company and the American Metal Company as follows:

> Referring your Government's protest, I renew my proposals to you, which will obviate practically all your difficulties. Am ready take reasonable care your agents.

This proposition was briefly and firmly declined, the American concerns maintaining their right to do business without Merton & Co.'s permission.

Two weeks later Merton & Co. cabled:

> Have signed explicit agreement British Admiralty; file with it certified copy of every contract by or through us for shipments American houses.

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New Publication on the Smoke Problem

With the idea of bringing about a better understanding between the metallurgical industry and agriculture as to the troublesome smoke problem at smelting and ore-roasting plants, the United States Bureau of Mines has just issued Bulletin 84, "Metallurgical Smoke," by Charles H. Fulton, consulting metallurgist.

The problem of smoke control is peculiarly difficult in this country because of the large tonnages of material that must be handled. The solution is not yet at hand and much work remains to be done. As the mineral industry is one of the great basic industries of the country, it should be accorded freedom to work out the smoke problem to the greatest benefit of all concerned. The effort is made in this paper to present the problem of metallurgical smoke as it actually exists, without bias of any kind.

The author says: "It is evident that the solution of the problem lies in its study by disinterested commissions, such as the one recently appointed by an agreement between the Department of Justice and the attorneys of the Anaconda company to study the smoke question in Montana in its relation to the forest reserves.

"It is interesting to review the general situation in this country. Mining and metallurgy are often the advance agents of civilization and the pioneers in establishing industrial centers. In many localities the miners and the smelters supplied by them were essentially the only locators within great stretches of territory. Around them grew communities and cities dependent upon them for a livelihood. Agriculture was of relatively small importance. But conditions changed with the increasing population of the country and the closer settlement of the West and, coincident with this increase, an agricultural industry has grown which, in the vicinity of the smelting plants, naturally suffers in some degree from smoke. Still, the area damaged is comparatively small and even this damage can be much lessened by the adoption of proper means. Since some plants have installed devices to remove sulphuric acid from the smelting smoke and have the smoke diluted with air, conditions have been much ameliorated.

"It has been customary to discharge the smelter smoke by means of very tall chimneys, on the assumption that if the noxious gases are discharged at considerable height they will have opportunity to diffuse more thoroughly and thus become so diluted as to be comparatively harmless, but the efficiency of this method is now being questioned. There is reason to believe that the use of high stacks increases the area to damage, whereas low stacks may intensify the damage but concentrate it within a smaller area."

Copies of Bulletin 84 may be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

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Mine-Rescue Stations and Cars

The U. S. Bureau of Mines announces the following assignment of its rescue cars and stations with the personnel of each:

Car or Station No.	Headquarters	Engineer in Charge	Foreman Miner	First-Aid Miner
Sta. 1	Wilkes-Barre, Penn.		(See Car 1)	
Sta. 2	Pittsburgh, Penn.	J. W. Paul	W. J. German	
Sta. 3	Knoxville, Tenn.	E. B. Sutton	J. M. Webb	
Sta. 4	Birmingham, Ala.	E. B. Sutton	W. T. Burgess	
Sta. 5	Urbana, Ill.	H. I. Smith		
Sta. 6	McAlester, Okla.	J. J. Rutledge	J W. Koster	
Sta. 7	Seattle, Wash.	H. M. Wolflin	J. J. Corey	
Sta. 8	San Francisco, Calif.	H. M. Wolflin	E. Steidle	A. A. Krogdahl
Sta. 9	Pittsburg, Kan.		K. H. Chisholm	W. W. Fleming
Car 1	Wilkes-Barre, Penn.	Charles Enzian	Jesse Henson	
Car 2	Denver, Colo.	J. C. Roberts	G. W. Riggs	C. S. Arthur
Car 3	Evansville, Ind.	H. I. Smith	G. T. Powell	*J. R. Fleming
Car 4	Pittsburg, Kan.	J. J. Rutledge	A. I. Young	J. H. East
Car 5	Billings, Mont.	J. C. Roberts	John Beardman	
Car 6	Pittsburgh, Penn.	J. W. Paul	C. O. Roberts	G. W. Grove
Car 7	Ironwood, Mich.	Edwin Higgins	W. W. Sullivan	
Car 8	Huntington, W. Va.	D. J. Parker Dr. W A Lynott	H. D. Jones	R. H. Seip

Note—Auto truck No. 1 attached to station 2 with C O. Roberts as foreman miner and auto truck No. 1 attached to station 4 *Permissible demonstrations

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALLOY—Iron, Boron, Carbon, and Copper Alloy. Edward D. Gleason, New York, N. Y., assignor, by mesne assignments, to Neu-Metals & Process Co., Long Island City, N. Y. (U. S. No. 1,126,629; Jan. 26, 1915.)

BLENDE—Process of Treating Ores. Joseph W. Emerson, Salida, Colo. (U. S. No. 1,126,965; Feb. 2, 1915.)

CLASSIFIER—Ore Classifier and Concentrator. Charles O. Michaelson, Omaha, Neb. (U. S. No. 1,126,819; Feb. 2, 1915.)

CONCENTRATOR — Mineral Concentrator. Charles O. Michaelsen, Omaha, Neb. (U. S. No. 1,126,818; Feb. 2, 1915.)

COPPER and Process of Producing the Same. William Marshall Page, Philadelphia, and Wirt Tassin, Chester, Penn., assignors to The Duplex Metals Co., New York, N. Y. (U. S. No. 1,125,164; Jan. 19, 1915.)

COPPER-CLAD STEEL—Clad Metal and Process of Producing the Same. William Marshall Page, Ridley Park, and Wirt Tassin, Chester, Penn. (U. S. Nos. 1,125,160 and 1,125,161; Jan. 19, 1915.)

CRUSHER. Albert E. Smith and Charles G. Simonds, Milwaukee, Wis. (U. S. No. 1,127,101; Feb. 2 1915.)

CRUSHING—Process of Wet Grinding. Henrik Emil Riisage, Frederiksberg, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,126,085; Jan. 26, 1915.)

DRILL—Fluid-Operated Percussive Tool. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. Nos. 1,126,943 and 1,126,944; Feb. 2, 1915.)

DRILLING—Walking Beam for Drilling Apparatus. George H. Copeland, Rich Hill, Mo. (U. S. No. 1,122,255; Dec. 29, 1914.)

DRILLING MACHINE. Albert Hossfeld, Lewiston, Minn. (U. S. No. 1,127,003; Feb. 2. 1915.)

DRILLS—Valve for Percussive Tools. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J (U S No 1,126,940; Feb 2, 1915.)

ELECTRIC FURNACE. James G. Marshall, Niagara Falls, N. Y., assignor to Union Carbide Co., Niagara Falls, N. Y (U. S. No. 1,127,475; Feb. 9, 1915.)

FLOTATION—Ore-Flotation Apparatus. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S No. 1,124,856; Jan. 12, 1915.)

FURNACE-BELL HOIST Thomas E. Brown, New York, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. (U. S. No. 1,127,351; Feb. 2, 1915)

FURNACE HOIST. David Larson, Berlin, Germany, assignor to Otis Elevator Co., Jersey City, N J (U. S. No. 1,127,361; Feb. 2, 1915)

Editorials

What May Happen to Spelter

That the recent rise in the price of spelter to a figure previously unheard of in the memory of a generation is an industrial calamity, most good judges are agreed. There is disagreement as to whether the rise has yet culminated. Some think that the price will go still higher. Others are of the opinion that the climax has been reached and that a declining tendency will exhibit itself in April or May. One man's guess is as good as another's. Conditions are extraordinarily confused, and no man is wise enough to weigh and measure them. Prophecies as to the course of the market are idle. However, there are certain coming events that may be foreseen with some clearness.

Production in the United States is going to be increased materially. In 1914, about 360,000 tons of spelter were produced in 22 works using about 83% of their capacity. Old works if operated at full capacity were consequently able to produce about 56,000 tons more of spelter than in 1914. In addition thereto there was new plant of 17,500 tons capacity (terms of tons of spelter) immediately available, and furnaces of nearly 11,500 tons capacity in construction and so far advanced as to become available early in 1915. There were also two inactive plants possessing a capacity of about 10,000 tons. We do not include the moribund works of Kansas, which may or may not be put into use. They had a capacity of about 62,000 tons. Stocking them with ore at present prices would be a hazardous venture, which conservative interests have not yet shown any disposition to risk.

The United States possesses therefore, or very soon will possess, first-class capacity for the production of 445,000 tons of spelter per annum; and second-class capacity amounting to 72,000 tons additional that may be used in emergency. These figures take no account of the dross and scrap smelters.

The estimate of a maximum capacity for 517,000 tons of spelter must be discounted, however, being based on the average yield in a year of low price when the ore treated was doubtless of a relatively high grade. The high price for spelter will draw out lower-grade ore and the average yield per retort will be lower. Moreover, the roasting capacity of American smelters is materially short of their distillation capacity, which means that they may not be able to attain the maximum use of their distillation furnaces unless they can secure all the calamine ore that they need, and calamine ore is generally of lower grade than blende. It is best not to undertake to draw fine points, but simply to assume that the smelting capacity of the United States is largely in excess of any use of it previous to the end of 1914.

That there will be sufficient ore supply for a largely increased capacity is reasonably certain. We learned in 1914 that a tremendous ore supply was available even on the basis of 5c. for spelter. The present prices will force production everywhere.

The New Jersey willemite that used to be exported to Belgium and Germany is of course now being smelted in this country. If we are unable to obtain sufficient calamine from our own sources, we may import it from Sardinia and elsewhere. Blende will doubtless be brought hither from Broken Hill.

The last may be a potent factor. A deterrent influence upon expansion is the great risk that a smelter incurs in laying in a stock of ore at the present level of price. The going concerns are running big risks and are exacting larger smelting margins, but the chances are worse for a beginner. The owners of certain of the idle plants have sought vainly to borrow the money needed to buy ore; the owners of others have restrained all temptations to resume. This situation would be quite different, of course, if some big mining company, like one of the Australian companies should lease these works or should supply the smelters with ore and guarantee them against loss.

Another certainty is that the high price for spelter will restrict consumption. In this respect, spelter is more vulnerable than almost any other metal.

Upward of 50% of the domestic consumption of spelter is for galvanizing, which, after all, is a more or less unnecessary use. Pipe is galvanized because it looks better and is cleaner than black pipe for interior use. The galvanizing of barbed wire affords a certain protection against the weather, but not a protection that is long or sure. As a structural material, there are many engineers who prefer painted black sheets to galvanized sheets, regardless of price, but when the premium for galvanized sheets becomes excessive, most people discontinue using them and content themselves with black sheets.

Increased production and diminished consumption are therefore two sure developments of the excessive price for spelter, and they will eventually bring about a collapse of the price. We shall then find ourselves with a greater surplus of producing capacity than ever and shall experience the long depression in this business that has invariably followed a period of intoxication when the price for spelter has been above 7c. per lb.

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Why Does Firebrick Cut Out?

Why does firebrick cut out when it is employed to contain molten slag? The answer is immediately that it scorifies with the acids of the slag, wherefore a siliceous brick should be used with a highly siliceous slag and a more basic brick with a less siliceous slag, etc. These are classic precepts of metallurgy and they seem to have been borne out by experience. Anyway, everybody knows that a brick-lined lead or copper blast furnace does not last long, while the lining of a combustion chamber that is merely heated and is not exposed to slagging may last a long time. Thus, certain of the distillation furnaces at Cherryvale, Kan., have lately been relined after a campaign of eight years. The temperature in those furnaces must have been 1300° to 1400° C.

The linings of the tanks of reverberatory smelting furnaces last for a fairly long time; at least the tanks do. Investigations with a sounding rod often reveal unexpected depths and excite the idea that the furnace may be simply a roof over a pool of molten matte standing in the earth with not much lining remaining up to the zone of natural chilling. The iron smelter continues to run his huge blast furnaces without the aid of water jackets.

The contempt of the lead and copper smelter for anything that is not water-jacketed has often caused wonder among other technologists who habitually perform fusions in clay vessels. Thus, the old-time glass-makers regularly melted easily fused glasses, or slags, in simple pots, and those who do not have tank furnaces still do so. The zinc smelter uses a clay retort only 1 in. thick, which rests in the furnace like a beam supported only at the two ends and is exposed to a temperature as high as 1550° C. He tries to keep the slag away from the walls, but sometimes is unable to do so.

C. W. Berry, in a recent paper in the "Transactions of the American Ceramic Society," says that the resistance of the firebrick of glass tank furnaces and of the pots of older practice to the action of fluxes depends more upon the physical structure of the firebrick than upon its chemical composition. The brick or clay should be of such density as to prevent the penetration of fluxes. Brick high in silica and brick high in alumina are both quickly destroyed if they be not sufficiently dense, while the addition of silica in order to obtain what is conceived to be chemically a desirable composition is inadvisable, inasmuch as it increases porosity. This is on the line of what every furnaceman knows, viz., that the eating of a firebrick lining begins at the joints. Therefore, he aims to lay his brick with the thinnest possible joints, even grinding the brick together in the most refined masonry. The porosity of the brick itself is not so often considered, but it is something well recognized by the zinc smelter, who aims to make the densest possible retort in order to reduce seepage of zinc vapor through it.

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Muckraker and Magnate

The United States Industrial Commission has come and gone, in so far as New York is concerned. What it learned here may not be of great use in its deliberations, but there was here a great opportunity for the stage manager, of which full advantage was taken. The appearance of a noteworthy succession of magnates on the stand, culminating in the great double bill with John D. Rockefeller and Andrew Carnegie, commanded front-page space for a fortnight and enabled the commission to depart with feelings of dramatic satisfaction if not of enlightenment.

We had a few surprising exhibitions, none of which was more interesting than the contrast between the views of Miss Ida Tarbell and Daniel Guggenheim. The former was one of the earliest of the muck-rakers; the latter is one of the most eminent of the great corporation magnates. We might reasonably have expected Miss Tarbell to rant and Mr. Guggenheim to uphold the old order of things. But not so. Mr. Guggenheim figured as an exponent of the uplift, while Miss Tarbell was the heartless economist, the scientific dissector of causes and effects, the abolisher of sentiment. Listen to Miss Tarbell:

"Does efficiency preclude the idea of democracy in the management of industry?"

"It is the most democratic thing you can think of. The men [illegible] goes right to the office and complains. If you ask if it precludes the idea of union organization I say that it does not. I think the unions are dead wrong in not going into the shops and learning all about it. To say at the start that it can't be done is wrong."

"Do you consider the union essential to the protection of the workmen where there is scientific management?"

"No; it is not essential. The managers who understand the inevitable reaction of injustice to their workmen wouldn't impose upon them any more than the union would."

"Why are the labor unions opposed to scientific management?"

"The testimony before this commission would indicate that one of the reasons is that they know so little about it and don't want to learn. Of course that is a very bad policy on the part of the unions."

"Hasn't the union a right to be shown that this scientific management is a good thing for the workingman?"

"Certainly. The trouble is that the unions are not trying hard enough to be shown."

"Miss Tarbell, isn't the safety expert and the efficiency agent a form of despotism that is being established over the workingman?"

"No. If he were, then the school teacher is the best known despot in this country. The worst despot I ever met was the woman who instructed me in calculus."

"Wouldn't the general installation of the efficiency system restore to the employer that despotism which he possessed before the labor unions took it away from him?"

"Not for a moment."

"Do you believe that the unions oppose scientific management because they fear an increase in production?"

"Yes. The fear of abundant production is very great. Union men have been trained to that idea in order to keep the price of labor high. The great trusts have the same idea with respect to prices of their commodities. There is an idea that keeping down production means prosperity, and it is natural for the workman to think that he should keep down his product so as to increase wages. I believe that work makes work, that you should get out as much as you can. The fear of abundance is a most pernicious thing. The worker must revise his ideas."

This is all sound sense and sound economics. Mr. Guggenheim was not so sound in his economics when he preached the reduction of great fortunes by inheritance taxes. Mr. Guggenheim did not express himself about labor unions, but he was earnest in his sympathy for the laboring men and radical in his ideas of what should be done to improve their lot. Indeed, the socialists present at the meeting were unable to disguise their astonishment and remarked that Mr. Guggenheim was outstripping them. However, his ideas reflected a kindness of heart that disarms criticism.

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The apex litigation at Tonopah, Nev., involves several points in connection with the mineral law and the troubles and questions of the apex and extralateral rights that have not heretofore been construed by the Supreme Court of the United States, wherefore the cases will probably have to be taken there before they are ended. The conditions of the mineral deposits of Tonopah are exceedingly complicated anyhow. This is one more example that the only safety from litigation under our present archaic and impracticable mineral-land law is the abolition of that law by common consent as has been done in many of our important mining districts. Everybody interested in the mining industry should unite in a grand effort to have a revision of the mineral laws.

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There has been a slight increase in the production of copper, which seems to be fully warranted by the present demand. There does not appear to be, however, the least indication that any of the large producers meditates cutting loose and expanding production to the rate of the middle of 1911. All seem to prefer to produce according to the demand and get 15@15½c. rather than to overproduce and take a less price.

BY THE WAY

Some of the difficulties now attending the formal proceedings of certain mining companies were illustrated at a recent meeting of the debenture shareholders of the Tanganyika Concessions. The meeting, held in London, had only the status of an informal gathering, because the trustees had been able to get no notice published in a newspaper in Brussels, and because, owing to the unavoidable absence of the Belgian shareholders, there was not a quorum present. The object of the meeting was to obtain the consent of the debenture holders to foregoing their interest until the present war is over. Among the debenture holders present, the sentiment was overwhelming in favor of carrying out the recommendations of the trustees.

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To supplement the "By the Way" of Feb. 13, there is a little story vouched for as true by a French mining engineer. In 1890-95, when mining had become quite active in the Amoor country, five or six prospectors strayed over into China—or Mongolia—and finally located some rich placer ground on a tributary of the Amoor, about 50 miles south of that river and 80 miles from Blagoviestchenk, the chief Russian town in that region. To them were gradually attracted others, until a community of 250 people, or thereabouts, had collected. They were a queer mixture of Russians, Tungoose, Mongolians and Chinese, but they got along pretty well together; under the leadership of two Russian escaped convicts they organized themselves into what they called the "Free Mining Republic" and enacted a mining law which served them well enough. Their prosperity at last came to the ears of the Chinese governor, who sent a military expedition to establish Chinese supremacy and collect taxes. The expedition, however, found conditions so much to their liking that it disbanded promptly and the whole force—mandarin, officers, soldiers and all—went to placer mining. A second expedition sent to hunt up the first speedily followed its example. The "Free Mining Republic" subsisted until the Russian governor of the Amoor province sent a force down there—nominally in coöperation with the Chinese governor of Mongolia—and scattered the people. Very few were brought back to Blagoviestchenk, most of them escaping southward into Mongolia.

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The New York "Sun" of January 17 prints a story from Fairbanks, Alaska, showing what an Alaskan miner can do when he has to. We assume that the story is correct; although somewhat wildly told in the newspaper, there is no reason it should not be true. It appears that Manley Mayhood and John Parquette were operating a drift mine as partners. Early one afternoon, just as darkness was falling, Parquette heard a crash in the shaft and rushed out to find that his partner and the bucket had fallen down together. The shaft was 45 ft. deep. Parquette tried to climb up a rope, but it slipped off the sheave and let him down again. He tried it with another rope, but this uncoiled from the drum. The shaft was cased with glare ice several inches thick. Parquette began shouting, but the shaft was off the main road and he was not heard. He saw he would have to adopt some desperate measure. First he went to the end of the workings where the steam points had left quantities of warm earth, brought this back, and packed it around his unconscious partner, after having wrapped him in his jumper and overshirt. Later he changed this as it became cold. A ½-in. steam pipe ran up one corner of the shaft, but he decided it wouldn't hold him, so he brought up from the drift a 1-in. board which he had been using as a wheelbarrow runway. He took everything heavy out of his pockets but left on his shoes so as to get a better foothold. At a point about halfway up the shaft narrowed from 12 ft. across to 8 ft. He climbed up to this point by cutting notches in the ice over the timbers with his knife, and then descended and carried up one of the steam points. He inserted one end of this in the hitch and let the other catch against the other side of the shaft. With the other point he repeated the operation. Meanwhile his candles were getting short. Using the steam points this way Parquette finally, after hours of hard labor and freezing cold, won the top of the shaft. He got to a roadhouse about half a mile away, and started a rescue party back to Manley, whose life, from last accounts, was hanging in the balance. Parquette, himself, escaped uninjured.

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The Shaftman

By Berton Braley

He's up and down on the cage all day
  With his oil-light flaming high,
And he works in a shower of falling spray
  For it's seldom a shaft is dry,
But with yellow slicker and yellow hat
  He's snug as a bug inside,
While he watches the timbers like a cat
  For a crack in a plate or guide.

It is up to him, and there's no excuse
  If a cage and its burden spill
When a wallplate springs or a guide works loose
  And the splinters smash and kill,
So you bet he is right on the job for fair
  Alert for each bulge or cave,
For every hour of his shift he's there
  Making that shaft behave!

The copper water will drip and drip
  And it's up to his nibs to see
That the cable which carries the cage and skips
  Is tarred as it ought to be
For that water gnaws at the naked steel
  And the miners' lives must hang
On the cable's strength and the loyal zeal
  And faith of the shaftman's gang.

No, it isn't the gates or the safety clutch
  That guard you in the shaft,
Mechanical aids don't count for much
  Except for the skill and craft
Of the boy who toils in the wet and murk.
  Watching for bulge or cave,
And always doing his daily work
  Of making that shaft behave!

PERSONALS

James MacNaughton, general manager of Calumet & Hecla, has returned to Calumet, Mich., after a visit to Boston.

Allan B. Calhoun recently changed his address from Frisco, Ariz., to 714 Mills Building, El Paso, Texas, care of the Mines Co. of America.

T. McCampbell, of New York, who is connected with the Harriman interests, has been inspecting Porcupine, Ont., properties with a view to investment.

Allan Strale has resigned as chief engineer of H. Koppers Co., of Chicago. Mr. Strale will be succeeded by W. F. Rust, now general superintendent of the Otis Steel Co., Cleveland.

W. A. Locke, who retired Feb. 1 from the presidency of the American Manganese Bronze Co., is now associated with the Taunton-New Bedford Copper Co., with office in New York.

R. M. Edwards, general manager of the Franklin, South Lake, North Lake and Indiana properties, has returned to Boston after a visit to the mines in the Lake Superior copper country.

Walter Whilton, for some time past connected with the Carnegie Steel Co., has been appointed superintendent of the new steel works of the Broken Hill Proprietary Co. in Australia.

Prof. A. P. Coleman has returned to Toronto, Ont., from a trip round the world, during which he narrowly escaped being captured by the German war ship "Emden," when traveling near the Straits Settlements.

J. J. Hasbrouck, formerly with the Cananea Consolidated Copper Co., has been appointed engineer of the Peruvian Expedition, which will start from New York, Feb. 24, under the joint auspices of Yale University and the National Geographic Society.

Wilfred Bancroft, treasurer and secretary of Mass Consolidated, has returned to Boston from Michigan after a week at the mine. He addressed a gathering of Mass, Greenland and Ontonagon business men and spoke optimistically of future of mine.

R. B. Oliver, engineer in charge of the Kasai diamond fields of the Société Internationale Forestière et Minière du Congo, has arrived in the United States and has gone to visit at his home in San Francisco. He will remain in this country until August or September.

H. M. Wilson of the U. S. Bureau of Mines is in San Francisco in the interest of the bureau exhibit in the Panama-Pacific Exposition. The model mine installed in the Mines and Metallurgy Building, while under direct superintendency of Edward Steidle, will be under the general supervision of Mr. Wilson.

Ralph Arnold, geologist and petroleum expert engineer, was elected to the board of trustees of Stanford University, Jan. 29. Mr. Arnold graduated from Stanford with the class of 1899. He is the second member of the alumni to be elected trustee, H. C. Hoover being the first. Mr. Arnold served as assistant in the mineralogy department of the University and also assistant in geology following his graduation. He became prominent in the California petroleum field as a field assistant of the U. S. Geological Survey, and later was geologist of the department. Mr. Arnold also has done private work for oil companies in Mexico and South America, maintaining offices in Los Angeles and New York. He is now consulting engineer of the City of Los Angeles.

OBITUARY

John Vivian, 60 years a resident of Lake Superior copper district, and a pioneer Cornish miner, died at Calumet, Mich., last week. His father was copper superintendent for John Henry Vivian, father of Lord Swanzey. John Vivian came from Cornwall to America and first worked at Greenwich mine in Connecticut, later at lead mines at Ellenville, N. Y. He had worked at Cliff mine in the Lake Superior country in 1854.

Livingston Gilson, one of the oldest mining engineers of the Pacific Coast, died in February at San Francisco. He was born at Reading, Penn., in 1831, and went to California in 1852. He was engaged for many years in developing and managing large producing mines in the southern districts of the Mother Lode region, chiefly in Tuolumne County. In 1870 he and Henry Janin had offices in San Francisco. Gilson went to London in 1896 as consulting engineer of the London Exploration Co. He was in Paris when the European War started and after suffering much hardship reached London and then returned to California. He leaves a widow.

SOCIETIES

Western Ontario Clay Workers' Association—At the annual meeting at Chatham, Ont., Feb. 11, the following officers were elected: President, Walter Clark, Sarnia; first vice-president, David Martin, Thamesville; second vice-president, R. W. Leatherdale, Dresden; secretary-treasurer, Alfred Wehlann, Cairo.

Mackay School of Mines, at Reno, Nev., is giving first short course for prospectors, beginning Feb. 1 and lasting four weeks. Course includes lectures on excavation of earth and rock, prospecting, geology, assaying and mining law; laboratory work in mineralogy, gas engines and first aid to injured.

Colorado School of Mines—First annual short course for practical prospectors began at Golden, Feb. 8, with an enrollment of 43. Ages of these students vary from 22 to 77 years. Only elementary subjects will be presented, the instruction being intended only to fit men to more intelligently search for and identify minerals of commercial importance.

University of California—Whitman Symmes, superintendent of the Mexican and Union Consolidated mines on the Comstock, recently delivered a course of five lectures for the senior class of the mining school. The subjects were the geology of the Comstock lode; mining methods; mine timbering; mining and pumping machinery on the Comstock; metallurgy of the Comstock.

The Colorado Scientific Society held its regular monthly meeting Feb. 6, at the State Museum Building in Denver. Dr. Livingston Farrand, president of the University of Colorado, delivered an instructive lecture on the American Indian, to a large and appreciative audience. Dr. Farrand discoursed upon the geographical distribution of the Indian, the theories in connection with migration and origin, and the Indian languages.

Colorado University Scientific Society—Dr. O. C. Lester, professor of physics in the university, on Feb. 8, at Boulder, addressed the society on the distribution of radium in the state. Accompanied by John H. Finney, an instructor in his department, he toured the state last summer in the interest of the Colorado Geological Survey, making field tests of every bubbling spring that was found. He reports orally that radioactivity was almost invariably evidenced, in some instances very pronounced. His detailed report will be published later and will be for free distribution.

The Teknik Klub of Denver, a society composed of metallurgists, mining engineers and chemists, its membership limited to 50, with a good waiting list, at its monthly banquet on Feb. 9, listened to and discussed two papers. One was "Technical Phases of Insurance," by A. R. Schroeder. The other paper was "Methods and Difficulties in Sampling Lots of Ore," by Walter E. Burlingame. The club has made arrangements whereby its founder, Dr. Lucien I. Blake, of Boston, will deliver a series of lectures, on succeeding Monday evenings beginning Mar. 1. These ten lectures may be said to cover the broad subject of Cosmic Physics. It is quite probable that Dr. Blake, during his visit to Denver, will deliver a distinct series of lectures before the upper classes of the Colorado School of Mines.

American Institute of Mining Engineers—On the evening of Feb. 5 the Montana Section held its semi-annual meeting at the Silver Bow Club in Butte. After an informal dinner officers were elected for the ensuing year as follows. Frank M. Smith, manager of the East Helena smelter, chairman; J. L. Bruce, manager of the Butte & Superior Co., vice-chairman; D. C. Bard, secretary and treasurer; Frederick Laist of Anaconda and W. C. Siderfin of Butte, members in charge of the local affairs of the society. Theodore Simons of Butte then read a paper on the "Concentrator of the Timber Butte Milling Co.," illustrated by flotation experiments on a laboratory scale and by a large flow sheet. Paul Billingsley followed with a paper entitled "The Boulder Batholith." About 60 members were present.

The next meeting of the Utah Section will be held at Salt Lake City, Feb. 25, at the Alta Club, to be followed by a business meeting and discussion of the program for the ensuing year

Editorial Correspondence

SAN FRANCISCO—Feb. 10

Heavy Storms prevailed over the state the latter part of January and the first part of February. There have been numerous floods in the rivers, but no large amount of damage reported, owing to the fact that the river levees have been improved in the past year and much of the land saved from overflow. The rain in the valleys and lower elevations has been accompanied by snow in the higher elevations. The indications at present are that there will be an abundant supply of water for mining purposes during the season. The amount of snow in the higher mountains has apparently been sufficient to withstand any ordinary melting by change to warmer weather. In fact, the entire outlook for mining water in the coming season is favorable.

North End Comstock conditions are graphically represented in a chart prepared by Whitman Symmes. There are shown the relative positions of the mines, the area unwatered since 1898 and the ore produced from the cleared area, both tonnage and value. The chart shows that the Con. Virginia, Ophir and Mexican have produced from the drained area $7,000,000. This encourages the belief that deep mining at the north end of the Comstock will prove profitable. The chart also shows that for every share of capital stock the yield in bullion has been: Con. Virginia, $7; Ophir, $20; Mexican, $6.50, since the unwatering was begun. These returns are from ground supposed to have been prospected by former managements of the mines.

The Yellow Jacket annual stockholders' meeting was held on Jan. 27 in San Francisco. The reëlection of the entire retiring board of directors was unanimous. The directors are Edward B. Sturges, Geo. S. Sturges, Edward S. Spring, Chas. H. Sooy and Dwight S. Prentice. Edward B. Sturges was reëlected president; George S. Sturges, vice-president, general manager and agent of the company in Nevada; Edward S. Sturges second vice-president and secretary; R. B. Worthington and Dwight S. Prentice, assistant secretaries; Chas. H. Sooy, general counsel. It has been decided, if the Belcher and Crown Point agree, to transfer the operations for working the 1500- and 1600-ft. levels of the three mines to the Yellow Jacket incline, which is being put in good order down to the 1500-ft. station; the Yellow Jacket will reopen the 1500-ft. level for regular extraction from the west quartz orebody on that level. While this work is in progress Crown Point and Belcher joint-incline reopening and repair work are going ahead, having reached below the 1450-ft. point where the recent fire occurred. Additional pumping and hoisting equipment is to be installed.

Southern Pacific Land to the extent of 6000 acres held as agricultural in San Bernardino County, has been awarded to the Government in a contest in the local land office at Los Angeles, on the ground that it is mineral in character. The land is situated northwest of Needles and west of the Colorado River in a mineral region well known but undeveloped. There are several mineral districts in this region along the eastern edge of the county where some promising prospects have been discovered. But as in most of the desert region, development is slow unless exceptional finds of high-grade ore in large bodies are disclosed. The Santa Fé and the San Pedro, Los Angeles & Salt Lake roads have opened up a good deal of this region and made possible the profitable development of mineral lands that for years were considered of small value for either mining or agriculture. The contested land contains proved deposits of gold, silver and copper. The Southern Pacific will appeal to the General Land Office.

In the Mines and Metallurgy building at the Panama-Pacific Exposition the chief features of the exhibit will include a model mine installed by the U. S. Bureau of Mines, the steel and iron exhibits of the U. S. Steel Corporation, the petroleum exhibit by the governing boards of the states and counties producing petroleum in the United States and others interested in the industry; an exhibit by the California State Mining Bureau, which will include a part of the bureau museum; and exhibits by counties or mine owners. This building has a floor space of 171,000 sq.ft. The model mine is situated nearly opposite the main entrance of the building and is easily identified by the tall headframe erected at the collar of the shaft. While the shaft is actually only 16 ft. deep, the slow-moving cage, with the aid of panoramas on two sides of the shaft, gives the illusion of having descended 200 ft. The panoramas are moved with sufficient speed to give the visitor the impression that the cage is moving rapidly. The panoramas illustrate a typical shaft, showing methods of cribbing and timbering, including the unlagged square sets. Two levels are shown, one at 100 ft. and the lower at 200 ft. At the lower level is shown a view of a crosscut just after a blast has been shot, giving the visitor the illusion of visiting a mine in actual operation. The several rooms on the bottom floor of the mine are occupied by exhibits from various properties including the Goldfield Consolidated, the Homestake, the Bunker Hill & Sullivan, the Copper Queen, and Jones & Laughlin Co. iron mines. The U. S. Steel Corporation and subsidiaries occupy the entire southern portion of the Mines and Metallurgy building, covering nearly one acre of space. Each subsidiary maintains its own section, but the whole is so arranged as to form a continuous exhibit of machinery, models, cabinets and photographs. These illustrate the products in every stage of manufacture and are assembled on a larger scale than ever previously attempted. Iron mining and lake transportation are features of the exhibit. The earliest installations used in the manufacture of iron and steel form interesting features compared with modern installations. A miniature mine location is shown, including shops, offices, clubhouse, and houses for employees. All the iron ranges are represented by samples of ore.

DENVER—Feb. 11

A Summary of the advances and pauses that have occurred in Colorado's metal mining is given by Dr. R. D. George, professor of geology and state geologist, Boulder, Colo., in a long article published in "The Commercial" of Denver. Answering the assertion frequently made to the effect that the state now affords no new fields for prospectors he says: "He [the prospector] carried on his search chiefly along stream courses and in the limited mountain areas which were bare of soil and but sparsely timbered. * * * Very large areas have never seen the prospector. Such regions are hard to prospect. * * * There are several sections in which the general geological and structural features are the same as those of Leadville. One of these, not yet carefully prospected, is large enough to make three or four Leadvilles." Doctor George deplores the way in which so many men have gone into mining, playing a luck-and-chance game with no advice from trustworthy engineers, placing wholly inexperienced men in charge of operations. Mismanagement, overmanagement, wildcatting, stock jobbing, all come in for scathing remarks. He then tackles the "depth bogy" and ridicules the notion so frequently propounded that "veins do not go down," saying, "there is good evidence that Cripple Creek will repeat the experience of Butte. It is criminal folly to condemn Colorado camps as shallow until some proof is at hand." He places the following factors as responsible for the recent dullness in Colorado mining: (1) Ignorance and unfounded impressions of the state's resources; (2) unbusinesslike methods; (3) wildcat promotion of the get-rich-quick variety; (4) transition from days of bonanza mining with its luck and chance, to staid, well-founded business methods; (5) dog-in-the-manger mining (?) men, who own prospects or mines of merit but are too lazy or shiftless to develop them and too greedy to sell or lease them on reasonable terms; their chief occupation is yarning about the good old days and kicking about taxes, while waiting for something to turn up; (6) state indifference and neglect; mining has been permitted to take its own course, whereas the state has done a vast amount to aid agriculture; now, however, the farmers need encouragement given to mining in order to build up a greater home market for their produce.

BUTTE—Feb. 11

An Increase in activity is being prepared for in the Butte mines and the smelting works at Anaconda and Great Falls. This revival is due mainly to the improved conditions of the copper market and the startling rise in the price of spelter. The latter not only has caused the Butte & Superior, the Elm Orlu and the Timber Butte companies to keep their output at the highest figure permitted by the capacity of the mills, but it has directed the attention of the older companies, of capitalists, leasers and prospectors to the possibilities of other zinc mines in the Butte district, mines which in past years have yielded large sums of money from the silver ores. Prominent among the old mines to be reopened is the Alice, owned since 1910 by the Anaconda and idle since 1893. A number of men have been put to work on this property to retimber the shaft down to the 300-ft. level. It is understood that this is for the purpose of extracting large quantities of rich zinc ore supposed to have been blocked out in past days. The hoisting machinery has been put in order preparatory to retimbering the shaft, work which will require six weeks at least. In the meantime much of the old machinery is being removed to make way for more modern equipment. Between 175 and 200 men are engaged on the numerous claims and leases in that section of the Butte district containing the Alice mine. Many are shipping ore regularly, others are improving their properties with modern equipment. For the most part the leasers are working claims on the Salvador, the Moulton and the Alice properties. Others leasers are doing development work on the Magna Charta, the Baltimore and the Home Run with more or less success in uncovering orebodies. Another zinc property, situated in the residence district of Butte, is the Emma, owned by the Butte Copper & Zinc Co. It was last operated in 1906. At that time large quantities of zinc ore were encountered which could not be mined at a profit then. The company is now making efforts to raise the necessary capital for reopening the mine. The North Butte has acquired about 1200 acres of ranch land in Silver Bow and Deer Lodge Counties, two miles north of Gregson Springs. Large and valuable water rights were purchased with the land; this has started the rumor that the land will eventually be used for a smelting site after the company's contract with the Washoe works has expired. The Anaconda has increased its output by operating its Butte mines on a six-day basis, begun a fortnight ago and to remain in force until further orders. The January output was 13,700,000 lb. of copper, about 55 to 60% of the company's normal output. At Great Falls the Anaconda has started work on its copper-refining plant and expects to have 300 men employed by the middle of April. This will consist of two steel buildings faced with brick. It will cost about $1,000,000 and will be completed by Jan. 1, 1916. This enlargement will give the Great Falls plant a capacity of 10,000,000 lb. per month. At the Washoe works, construction work on the leaching and the sulphuric-acid plants is in steady progress, and extensive experiments are being carried on for the recovery of copper from the slimes by flotation processes.

SALT LAKE CITY—Feb. 11

Mining Taxation Changes are the subject of certain joint resolutions introduced in the present session of the state legislature. One of these mentions that no special taxes or exemptions shall be applied to mines or mining properties and such mines and mining property shall be taxed the same as other property. The logical result of this will be that the county assessors will fix an arbitrary cash value on every mine in the state. This would cause serious injury to the industry, which is already bearing its full share or more of the state taxation. Under the present system the mines are not assessed on their net proceeds, as the state board of equalization will not allow a deduction for such expenses as insurance, interest, taxes, office expenses other than that at the mine, legal expenses, or, in fact, any ordinary general expense, so that the mines are paying taxes on an amount greater than their net proceeds. A meeting of mining men was held at the Hotel Utah, Feb. 6, to discuss the proposed bills, R. C. Gemmell presiding. The resolution was analyzed and discussed. It was pointed out that no property could withstand such taxation. It would also have the effect of discouraging capital from investing in the state. A committee consisting of R. C. Gemmell, M. P. Braffit, C. N. Doolittle, John Hays and Walter Fitch was appointed to meet with the committee on taxation relative to the measure. Another meeting of mining men will be held in the near future.

PORTLAND, ORE.—Feb. 10

The Bureau of Mines is asking the legislature now in session for an appropriation of [illegible] to carry on the work for the next two years, but there is great fear among mining men that the bureau will be given up since the members of the present legislature are pledged to a program of economy, and the new governor, a purely agricultural representative, has suggested that the bureau be abolished. Mining men all over the state are up in arms and trying to save the bureau, which during the last two years did good work in showing up the mineral resources of Oregon, and at an expenditure of only $37,500 out of an appropriation of $40,000 for the work.

JOPLIN—Feb. 13

The Pocahontas Mine, from which a rich body of soft-ground ore was mined during 1913 and 1914, and which was forced to shut down by the timbers' catching fire, will be unwatered and reopened by J. M. Short and associates. There is a large tonnage of ore remaining in the pillars and legs, which can be mined. After the fire the ground caved, filling all the old drifts. The system of mining the pillars and legs as outlined by Mr. Short will be to sink the shafts a few feet deeper than the old level, drift out under the floor of the old workings, tap the pillars from below and pull them to the lower level. This will require the driving of main haulage drifts, and from these drifts will be driven shorter laterals to each pillar. By employing this system of mining it will be possible to extract practically all of the ore remaining in the mine.

CHICAGO—Feb. 13

The Oro Belle Mine in California and the Tonopah Belmont Development Co. were involved in a transaction mentioned in the copper-country local press not long ago. Although it may not be generally known, the Oro Belle has been a Lake Superior undertaking from the start. The property, situated in the Hart mining district of California, was secured seven or eight years ago by Worth B. Andrews, a graduate of the Michigan College of Mines. While various people have interested themselves in the property at different times, certain ones have always been warm supporters of the mine, contending that it was a most promising property. Among these may be mentioned Prof. A. E. Seaman, head of the geological department of the Michigan College of Mines, who some time ago made an examination and report on the mine, and who now has an interest in it. From the start, work has been done underground and on surface in a systematic manner and to as great an extent as the funds available at any time would permit. For eight years Mr. Andrews and those associated with him in the enterprise have devoted their best efforts to development for the benefit of the stockholders, of whom there are many. The stock has never been listed on any exchange, so far as known, nor has any publicity ever been given to its operations. According to the press, the trasaction between the Oro Belle and Tonopah Belmont provides that the latter company shall have one year in which to develop the Oro Belle, at the end of which time it shall construct a mill of at least 50 tons per day capacity, and suitably equip the property for production, or shall install a mill and equipment of such larger capacity as the property may warrant. It is further reported than an aggressive plan of development has been outlined and that operations will be started by the Belmont company at the mine immediately. This is unquestionably good news for the Oro Belle stockholders, who have ratified the deal, and is testimony of careful, well directed exploration, unaccompanied by press exploitation.

HOUGHTON—Feb. 13

Production of refined copper from the Lake Superior mines will not be increased more than 2,000,000 lb. in February, notwithstanding the fact that every operating mine in the district is working full time. The labor situation is satisfactory despite rumors to the contrary. Two of the mines, Wolverine and Mohawk, announced an increase in pay dating from Feb. 1, and all the mines of the Calumet district are now paying practically the same scale as the Calumet & Hecla and subsidiaries, and all are working full time. While pay is not up to normal as yet, the policy of the district is to increase wages 10% when the metal market is established on a 15c. basis. This will be followed in the present case. Production of refined copper for the month of February probably will reach 17,500,000 lb.

TORONTO—Feb. 13

The MacLean Nickel Bill, introduced into the Canadian Parliament, Feb. 8, to prohibit the export of nickel during war time, was objected to by Premier Borden on the ground that being a measure affecting trade and commerce it should have been preceded by a resolution adopted by a committee of the whole. The objection was sustained by the Speaker, who ruled the bill out of order.

The Nickel Demand continues to be satisfactory, and the International has given orders to start the remaining blast furnaces at Copper Cliff and run them to capacity. This will give them six blast furnaces in operation, so that production will be about the same as before the war. The only department that will not be operated is the reverberatory plant. It is understood that the cost of blast-furnace operation has been greatly lowered during the past year. In addition to the Creighton mine, which has been operated steadily, the Crean Hill and No. 2 mines will be reopened, and only No. 3 will remain closed.

The Mining News

ALABAMA

GULF STATES STEEL CO. (Shannon)—Shaft which is being sunk to intersect Big seam now down 1900 ft. on angle of 50°. Shaft started in May 1913, will be about 2600 ft. deep when completed.

ALASKA

E. H. BARTHOLF and associates of Seward will erect stamp mill on property in Willow Creek district.

NO. 8 ABOVE, LITTLE ELDORADO CREEK (Fairbanks)—Ellinger, layman, reports discovery of pay averaging $2.50 per sq.ft. of bedrock. Paystreak is narrow. Nugget worth $112 recently found.

ZIMMER & HANSEN (Chatanika)—These operators, laymen on Ward & Matthison ground in Chatanika Flats, have had much trouble with seepage water from old drift. Difficulty overcome by plugging hole.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Hoatson shaft opened for active work again after August shutdown.

PHELPS-DODGE profit sharing plan in various districts, put into effect after wage-cut last year, by which employees received rebate on store purchase, to be discontinued now that wages are increased.

Santa Cruz County

GOLD COIN (Amadoville)—Wm. Carnett has given up lease on this prospect, as mill he installed failed to show encouraging amount of gold.

MINERAL HILL (Tubac)—Work on this shipper opening good body of ore. Ed Casteneda, owner, will start shipments during coming month.

GLOVE (Amadoville)—Sheehy Bros., owners, will start shipping from this zinc mine at once. Mine was worked by O. K. Mining Co. until war stopped shipments; negotiations for new lease fell through.

GRINGO (Patagonia)—A. W. Houcks, manager, has crew overhauling mill and unwatering shaft, milling will be resumed as soon as supplies arrive from Coast. Mill had long run at one time; now hoped to make operation permanent. Formerly some high-grade gold ore was taken out of mine, but intention now is to use mine run. Latest development of this vein was of value in putting large amount of ore in sight.

CALIFORNIA

Amador County

GRITTON MINING CO. (Volcano)—Contract to advance tunnel 50 ft. let.

Kern County

TUNGSTEN PROPERTY one mile south of Randsburg being developed by David Thompson, by driving at 80-ft. point.

SUNSHINE (Randsburg)—Rich vein of sulphide disclosed in Stringer district showing permanency and indications of widening out into greater orebody than expected. Recovery value of ore about $50 per ton.

BUTTE (Randsburg)—William Dissman, V. Belt, I. Duffy, operating under lease, now prospecting on 200-ft. level. Number of improvements will be made. Mine has always been good producer under leasing system.

RED ROCK CAÑON near Mojave attracting attention from report that Dave Bowman recently found a 10-lb. nugget of gold. This cañon and Last Chance and Nugget Gulch including Goler and Garlock placer grounds were among early producers of large values in placer mining. Believed ground has not been worked out, although occasional finding of large nuggets stimulates prospectors to look for other nuggets more than it induces investors to take hold and develop ground.

Sierra County

ELDORADO (Allegheny)—Another rich strike made at this quartz mine, Armstrong Bros. and Fessler Bros., owners.

KATE HARDY (Forest)—Shaft here to be sunk deeper in order to drift under six oreshoots found in upper works. Several rich pockets extracted two years ago. Indications that high-grade is coming into face of present drift.

NORTH FORK (Forest)—After four years of steady development work, overcoming many obstacles, this quartz mine has again come into prominence, with indications of permanency. Oreshoot first discovered in 1877 by gravel miners running bedrock tunnel, and $100,000 was taken out; 40-ft. shaft failed to show more gold and work was abandoned. North Fork Mining Co., having property under contract, ran 1000-ft. incline, then 700 ft. drift, before recovering vein. Upon sinking to depth of 75 ft., ordinary milling ore was found. After sinking 100 ft. farther and drifting 100 ft. to northeast, edge of rich shoot was struck. Vein there had turned over and pitched to east, as in Tightner vein, of which the North Fork is believed to be continuation. Near point of discovery "feeder" 2 ft. wide, carrying rich arsenical sulphides, joins main vein. Main vein has been crosscut for 8 ft. without striking foot wall. Assay average of samples taken at random, $250 per ton. Stamp mill will be erected in early spring. George F. Stone in charge.

COLORADO

Clear Creek County

GARDNER (Idaho Springs)—Development work resumed; mine being worked through Newhouse tunnel.

LINCOLN GROUP MINES CO. (Idaho Springs)—Main adit, near Two Brothers tunnel at head of Virginia Cañon, being cleaned out and retimbered. Adit will be advanced to intersect Ben Franklin vein. Drifting in progress on Lillie Bell vein, breast in 4 ft. of $5 ore. Company plans considerable new development. H. A. Wimbush president of company and LeRoy Diltz superintendent.

Gilpin County

FIFTY (Black Hawk)—J. B. Selvidge and Arthur J. Hoskin of Denver and Louis L. Davis of Elgin, Ill., have been inspecting this property that has lain idle six years; indications are they will soon place 80-stamp mill in service to treat custom ores.

CARR (Central City)—Randolph mill at Black Hawk has been remodeled by Arthur C. Most, manager, to handle Carr output by amalgamation and concentration. Machinery includes crusher, feeders, ten 750-lb. stamps of slow drop, two Gilt Edge concentrators, settling cone and two Wilfleys. Capacity 30 tons.

Lake County

PAGE TUNNEL (Leadville)—New bore, being driven to prospect and drain Prospect Mountain, now in over 350 ft. without finding solid formation. Much delay experienced in catching up timbers after frequent slides of wash, but work is proceeding.

RAINBOW (Leadville)—Leasing company of Colorado Springs men secured this property, contiguous to Ibex, three months ago. Under management of George Campion, drift driven at depth of about 200 ft. has encountered what may prove to be extension of Little Jonny vein. Where opened, vein is thin but rich. Will be developed by new level below point of discovery.

Routt County

COPPER KING (McCoy)—Orders placed for materials and equipment for 50-ton mill to treat 4% copper ore by crushing, leaching and electrolysis. Orebody is steeply pitching, 8-ft. bed of sandstone in Red Gorge. In zone of present development, disseminated copper minerals are carbonates. Incorporators of new company are A. W. Hille, John R. Wood and A. L. Briggs, of Denver. Spur built at Yarmony Creek on Denver & Salt Lake railroad to serve camp.

San Miguel County

MOUNTAIN FLOWER (Telluride)—Main crosscut adit in 1000 ft. and approaching Delta vein. Company plans erection of mill next summer to treat ore from veins now disclosed. One vein about 150 ft. thick runs $8. Another 22 ft. thick assays $5.

Summit County

JUANITA MINING & MILLING CO. (Breckenridge)—Validity of title to mining property secured through tax deed is ground for argument in suit brought against American Metals Co., of New York. Lanyon Zinc Co., lessees, removed from Country Boy mine of plaintiff certain lots of ore having net value of $67,000. Juanita claims tax title was void; Metals company demurs that mere possession of premises was evidence of clear title. Judge R. E. Lewis of Denver overrules demurrer.

Teller County

SOUTH BURNS (Victor)—Acacia company will erect fireproof buildings to replace shafthouse recently burned.

GRANITE (Victor)—Company has purchased Dead Pine mine, including all surface improvements.

HONDO (Cripple Creek)—Surface plant and improvements being installed. R. G. Mullen manager.

DRAINAGE TUNNEL—Flow of water averages about 8600 gal. per min. Work will be resumed on main heading as soon as El Paso surface plant is replaced, about Mar. 1.

VINDICATOR (Independence)—Construction will soon begin on new shafthouse at No. 2. This will replace plant recently destroyed by fire. Steel headframe ordered and new building will be fireproof.

DEXTER (Cripple Creek)—Construction of concrete foundations for new compressor plant well under way and new Leyner compressor has been delivered. Company hopes to have plant in operation within two weeks.

EL PASO (Elkton)—Reconstruction of buildings destroyed by fire a few weeks ago well under way. New compressor house will have brick walls and steel roof. Shafthouse will be fireproof throughout. Five sets of lessees at work on development.

BLUE BIRD (Altman)—Since securing lease, two months ago, John Price and Nelson Franklin have been prospecting ground heretofore neglected. Short crosscuts have been driven north from main shaft on each level from 12th to 26th inclusive and have disclosed one continuous, large shoot, full extent still unproved.

EMPIRE STATE (Victor)—Ward Bros., who are carrying on development work on seventh level of this Bull Hill property, have opened body of ore 10 ft. wide. Several carload shipments made from new orebody which has average value of $19. Ore mined and shipped without sorting. Shoot now opened for length of about 200 ft., about 100 ft. of untouched ground above level.

JERRY JOHNSON (Victor)—Erection of 50-ton mill planned to be ready about now, has been seriously delayed. Grading finished and orders for equipment placed but plant will probably not be finished inside of three months. Stated amalgamation will be included in treatment. If so, it will prove interesting experiment, process having signally failed in district during early operations.

MICHIGAN

Copper

CENTENNIAL (Kearsarge)—Wages of underground employees raised to standard of other C. & H. subsidiaries, Feb. 1.

WOLVERINE (Kearsarge)—Work confined to Kearsarge lode mining. No exploration. Tonnage of rock running below average. Contents maintaining well.

OSCEOLA CONSOLIDATED (Osceola)—Production for February will total 1,500,000 lb. refined copper. By March it should reach 200,000 lb. more

WHITE PINE (Ontonagon)—To commence milling rock within three weeks, unofficially reported. Has tonnage opened for four years. Looks good in rock content but officials not given to bugle blasting.

FRANKLIN (Demmon)—Operations confined to exploration of Allouez conglomerate which continue satisfactory. Occasional rock shipments sent to Point Mills plant of Calumet & Hecla.

ISLE ROYALE (Houghton)—Two additional shafts, No. 1 and No. 7, will be reopened this spring. No. 1 will require much repairing. Stamp mill rebuilding progressing rapidly; all inclosed now and machinery installation to commence soon.

MISSOURI-KANSAS-OKLAHOMA

TWIN CITY MINING CO. (Webb City, Mo.)—This company recently incorporated with a capital stock of $50,000 to mine lead and zinc. Incorporators, Geo. W. Moore, W. D. Burns and John Wingfield

C. C. MONLUX MILL on Brinkerhoff land was completely destroyed by fire Feb. 1; loss partly covered by insurance. Mr. Monlux stated he would begin building another mill at once, larger and more modern than that destroyed. Property in Galena district.

PORTORIA MINING CO. (Galena, Kan.)—This company which leased New Century mill and 40 acres of mining land has 19 mines in operation now and keeps 300-ton mill going steadily one 19-hr. shift. One of best mines on tract operated by Fred Grester & Co. Mr. Grester recently purchased interest and installed steam hoist and other modern mining machinery in order to operate more profitably.

MONTANA

Silver Bow County

ANACONDA GUARD shot and killed Feb. 12 by Harry Robinson, vice-president of new Mine Workers' Union and an I. W. W. agitator.

GAGNON (Butte)—Serious cave in old inclined shaft resulted in death of Joseph Faber, J. R. Fay, Mike Zerc and Andrew Evison, and in slight injuries to Richard Tiddy and Richard Rodgers, who survived to tell story of accident. Cave occurred at 9 o'clock, Feb. 6, according to estimate of Rodgers, who looked at his watch at a quarter of 9. Shaft is 72° incline. Great mass of rock, about 10 sets long, fell from hanging wall, crushing timbers and carrying five men, who were retimbering, down some distance, where they were buried in mass of broken timbers and rock that plugged shaft. Fall occurred short distance above 1400-ft. level. Tiddy, though struck by rocks and timbers, escaped cave, extricated himself, climbed shaft ladder and reached level above. Only Zerc was killed outright. Fay and Faber died after many hours of frantic rescue work, when they were taken from débris. Rodgers and Evison were working two or three sets above floor of 1400-ft. level. Below them on floor were Faber and Zerc. Above them a set or two were Fay and Tiddy. Having been told by shift boss that ground was shaky, men took all possible precaution to brace it well and double-stull it. In spite of this, cave came without warning. Lights went out, air connections were broken and men were left in dark, with timber and rock jammed about them. Evison and Rodgers were standing on same plank when cave came. Rodgers was knocked down under footwall, Evison was down below him complaining of feeling numb. Tiddy was on same stage as Fay. Latter was knocked down but Tiddy got out. Supt. O'Neil, Foreman Dan Sullivan and force of miners started rescue work. This was slow for reason that quarters in shaft were so cramped by broken timbers and rocks that but one miner could work at a time. Moreover, there was imminent danger of further caving, compelling the rescuers to brace and shore shaft effectively as they removed the débris. Fay being near the top of slide, kept calling to rescuers that he was all right. By Sunday morning he was freed to waist of timbers and rock but it was impossible to get him extricated until 9 that night after 24 hr. imprisonment. He refused food and hot drinks, and began growing weak an hour before he was rescued. He was still breathing when taken out, but soon died of exhaustion. Rescuers worked both from above and below, and Faber's body was taken out at noon Sunday. He was still alive when dug out of débris. His cries could be heard, but soon ceased. His death was caused by internal injuries, shock and exhaustion. Rodgers was not reached till 7 Sunday night, when he had been under débris 22 hr. He had frequently called to rescuers to hurry, but in spite of frantic efforts it was 10 hr. later when he was reached, given some warm coffee and removed to surface. Some time before, he had informed rescuers that Evison was probably dead, having ceased to reply to calls. Evison's feet were brought into sight a few hours after accident, but great mass of timbers and earth to be removed and difficulty and danger of task made extrication of his body slow. It was finally recovered Sunday night, found in standing position with chest crushed by timbers and rock. Body of Zerc was last one reached by rescuers, 63 hr. after accident. Was found in recess in wall timbers of shaft on floor of 1400-ft. level, in a sitting position with one arm around lunch bucket. He was evidently killed by falling timbers.

NEVADA

Clark County

ORE SHOWING VISIBLE GOLD in considerable amount recently discovered about 10 miles west of Platina by H. J. Jarman; numerous locations made in vicinity.

ORO MINGO (Platina)—Ore containing platinum discovered in this mine several months ago; considerable development work being prosecuted.

MOBILE (Goodsprings)—Property now shipping about 400 tons of zinc ore monthly, using aërial tram to deliver to foot of mountains, thence by motor truck to Jean.

ANCHOR (Goodsprings)—Shipments increased, owing to high zinc market; about three cars per week now going forward to Eastern smelters. R. W. Moore in charge.

NEW TOWNSITE, PLATINA, laid out near site of old town of Sandy. Several hundred people have come to new town, attracted by discoveries of high-grade gold-platinum ore in Boss and adjacent properties.

YELLOW PINE (Goodsprings)—Milling at full capacity will be resumed about Mar. 1. At present property ships monthly about 500 tons of high-grade zinc-carbonate ore, mill having been closed in November through accident to locomotive.

POTOSI (Arden)—New roasting plant in successful operation for past six weeks, treating 20 tons of zinc-carbonate ore daily. Oil now being used as fuel, expected capacity of plant will be considerably increased in near future. Property shipping about 800 tons of zinc ore per month.

FREDRICKSON (Goodsprings)—Property under bond to Dividend Mining Co., which is erecting dry concentrating plant, using Plumb jigs and Sutton, Steele & Steele tables, to treat mixed lead-zinc-silver ores developed in mine. Expected plant will be completed before Mar. 1.

GOLDEN SCEPTRE (Las Vegas)—Law-suit which closed property shortly after high-grade gold ore was discovered last summer, was settled at last term of court in favor of original owners, who will proceed with development. Opening of this property will add life to new town of Quo Vadis, started near mine shortly after discovery of ore.

BOSS (Platina)—Platinum-Gold Mining Co., which recently purchased this property from Boss Gold Mining Co., is erecting small plant for experimental treatment of gold-platinum ores. Understood experimental work is to be in charge of Pacific Platinum Works of Los Angeles. Force at mine increased, and property being rapidly developed. Copper ore being shipped, but all platinum ore extracted being held pending completion of tests.

Esmeralda County

YELLOW TIGER (Goldfield)—New compressor and motors will be in operation soon. Oreshoot assaying $50 opened on 700-ft. level.

LONE STAR CONSOLIDATED (Goldfield)—Hoisting equipment to be installed at two shafts; sinking to 700-ft. level will be done.

JUSTICE GOLD MINING CO. (Goldfield)—Company operating property of Goldfield Daisy Mining Co. under 2½-year lease. Shoot of high-grade ore opened on 265-ft. level of main shaft.

GOLDFIELD CONSOLIDATED (Goldfield)—Rumors that Aurora Consolidated was to be closed for three months emphatically denied by officials. Stated mill will be closed about 10 days for installing new filters.

GOLDFIELD CONSOLIDATED (Goldfield)—Treatment of mill tailings will begin soon; Lidgerwood cableway with steel towers and grab buckets installed for transporting this material from pond to mill. Development work in Mohawk mine progressing satisfactorily; several faces in good-grade ore. Stated Aurora Consolidated now operating at profit.

MERGER MINES CO. (Goldfield)—Drift run on 1265-ft. level of Goldfield Consolidated's Grizzly Bear shaft across northern end of St. Ives claim into Merger ground for exploratory purposes. Crosscut now being driven with expectation of cutting downward extension of Jumbo Extension oreshoot. Exploratory work will be resumed on 1330-ft. level.

ATLANTA (Goldfield)—Carload shipment of ore made from 1750-ft. level to Millers sampling plant of Western Ore Purchasing Co.; first shipment since resumption of deep-level work. In north drift on 1750-ft. level small oreshoots assaying $9 to $36 opened, most promising being 2-ft. shoot assaying $17. Ore in winze from southwest crosscut and raise from north drift of 1750-ft. level assays $15.

GOLDFIELD MERGER (Goldfield)—Action taken in San Francisco will delay for 20 days hearing in U. S. district court in Seattle on receivership. After series of conferences between Frederick Bausman, counsel for minority stockholders, and Henry M. Hoyt, counsel for George Wingfield, and C. O. Whittimore, of Los Angeles, stipulation signed by which both sides agree to postponement of hearing from Feb. 8 to Mar. 1. Carl N. Johansen, appointed receiver, will remain in legal charge until later date.

Humboldt County

MINNEHAHA (Rochester)—Oreshoot 7 ft. wide, 3 ft. of it shipping grade ore, opened recently.

LINCOLN HILL MINING & MILLING CO. (Rochester)—Stated ore worth $50,000 blocked out and development work progressing with satisfactory results. Two-stamp mill saving $6000 to $8000 in bullion monthly.

Lander County

PLACER STRIKES near Hilltop made in Mud Springs district and Crumb Cañon. On Nelson property, at atte place, shaft sunk 60 ft. and pump installed; gold coarse and in nuggets.

AUSTIN-NEVADA (Austin)—Development work in Hiawatha tunnel progressing satisfactorily; oreshoot, opened on surface, cut and silver chloride exposed. Development work on deeper levels will be done; stated sufficient funds on hand for year's work.

Lincoln County

NEVADA-DES MOINES (Pioche)—New building for steam-boiler plant built.

Mineral County

HIDDEN TREASURE (Luning)—Property being examined for purchase. Stated milling plant may be built. Ore silver-lead.

SHIPPER COPPER CO. (Luning)—Development work will be resumed soon. Property chief producer of Luning district in past.

HILL MINE (Acme)—Property sold to Frank Everett of Luning. Stated 10-stamp mill will be built. Development work opened good tonnage milling-grade gold ore.

BOVARD & MENKE (Lappan Cañon)—Lease and bond on this gold property taken and work commenced. Shaft down 60 ft., will be sunk to deeper level before lateral development is done. Oreshoot 2 ft. wide opened.

Lyon County

SMITH VALLEY MINES CO. (Yerington)—Mine being examined by stockholders; property in hands of receiver.

WHEELER (Yerington)—Mill, operated by lessees, closed recently on account of continued cold weather. Development work continued.

NEVADA-DOUGLAS (Ludwig)—Foundations for leaching plant completed and work on tank building under way; tanks being assembled. Mine cars will dump into bins, ore then conveyed by belt to crusher and then by second conveyor-belt to leaching building.

Nye County

VALLEY VIEW (Manhattan)—From this new producer operated by Pannion & Anderson first milling made recently demonstrated good milling grade of ore mined by tunnel.

SEYLER HUMPHREY MINING CO. (Manhattan)—Recent small milling made by Wann & Reed, lessees on April Fool claim, shows average of $50 per ton. Lease has steadily netted profits of better than wages to its owners for more than two years of development work.

MONITOR-BELMONT MINING CO. (Belmont)—Brick machinery in operation and construction of milling plant progressing rapidly; expected to be in operation June 15. Mill will contain gyratory crusher, ten 1600-lb. stamps, 10x6-ft. tube mills for regrinding and Deister tables. Power line extension from Manhattan in operation. Ore said to assay 60 oz. silver and a little gold. Property in successful operation from 1864 to 1884 when costs were $40 per ton, silver then being over $1 per oz.

Washoe County

PRODUCTION FROM JUMBO DISTRICT, southwest of Virginia City, will be resumed in spring. Development work on several properties progressing with satisfactory results, and stamp mill will again be placed in commission.

STEAMBOAT SPRINGS MINING & DEVELOPMENT CO. (Reno)—Franchise granted company to lay pipes under streets of Reno to supply steam and hot water to residences and buildings.

White Pine County

OLD EXCHEQUER (Cherry Creek)—Work resumed at this silver property and shipments will be made soon. Was large silver producer in '70s.

OREGON

GRANTS PASS CITIZENS and mining people near that place making effort to get proposed custom mill in operation; said one can be constructed for $25,000 to $30,000, that will handle all ores available at this time.

HIGHLAND GOLD MINES CO. (Rock Creek District)—Circuit Judge Anderson of Baker overruled demurrer of Daniel Grabill, trustee, one of defendants in suit brought by Eastern Oregon Light & Power Co. and gave the defendant 10 days further in which to answer.

DEEP GRAVEL (Waldo)—This mine operated by H. L. Herzinger has just commenced operation at full capacity, preliminary work having made it possible for management to put through boxes double amount of dirt previously handled.

IMPERIAL MINE (Cable Cove Dist.)—Otto L. Simons recently secured bond and lease on this mine, understood arrangements are being made to operate. Mr. Simons arranged with C. L. Arzeno to take over active operation under lease. George Bailey mine superintendent.

LOGAN PLACER (Waldo)—J. R. Harvey returned from trip to this mine bringing last cleanup, which amounted to $9000. Mr. Harvey says that ditches in Waldo district are all running full of water and mining operations are being carried on at all placer mines with good results.

JOHN R. SMITH, who last year opened black sand deposits on South Inlet near Marshfield, reports finding big placer deposit near Agness postoffice. Is in San Francisco for machinery to work mine and showed in Marshfield over $3000 in coarse gold nuggets, taken from new discovery. Smith says find is in district where miners prospected 50 years ago and that he and his son took $3000 out in less than two months with only common miners' tools and in deep snow most of time. Mr. Smith still controls South Inlet black-sand mines and says he will put machinery on them this year.

ALMEDA MINING CO. (Galice)—New officers and directors for this company: Thomas J. Burley, Portland, president; Nat P. Ellis, Waverley, Ia., vice-president; H. Thurman, Portland, secretary and treasurer; S. C. Spencer, Portland; L. E. Crouch, Portland; C. C. Aler, Columbus, Ohio; G. A. Grossman, Waverley, Ia.; Oscar Young, Springfield, Ohio, and John F. Wickham, Portland, directors. Mr. Burley has paid up all debts of company, $89,000, since he was appointed receiver and application to county court has been made to discharge receiver and turn management of property over to new directors. Will be about 60 days before receiver can be discharged and during that time arrangements are being made for future operation of mine. New management will install concentrating plant with daily capacity of 200 tons. There is already smelting plant on property capable of smelting 100 tons daily. Service line to be built from mine to California-Oregon Power Co. plant, 16 miles, to bring in current. This line will cost about $1300 per mile. Improvements to be put upon property will amount to $75,000 and mine will be operated in businesslike manner in future.

SOUTH DAKOTA

ORO HONDO (Deadwood)—Station being cut on 1400-ft. level and auxiliary hoist on 1000-ft. level will be moved. Shaft down 1600 ft.

HIDDEN TREASURE (Deadwood)—Sinking continues; shaft has reached depth of 275 ft. Gasoline compressor and hoist are used.

DEADWOOD-HEIDELBERG (Deadwood)—Recent shipment to Golden Reward mill gave returns of $18 per ton. Several lower-grade orebodies were encountered in sinking shaft.

WASP NO. 2 (Flatiron)—Owing to heavy fall of snow only day shift being worked in mine. Cleanup for January shows ore averaging $2 per ton. As soon as weather conditions permit, operations will be returned to normal.

ECHO (Maitland)—Electric compressor set up and supplying air for two machine drills. Shaft house completed and heating plant installed. Electric hoist being added to equipment.

ANACONDA (Roubaix)—Removal of hoisting plant from old workings to new site completed; will be put in operation soon. Three-compartment shaft being sunk has reached depth of over 50 ft. Will be continued to 500 ft. and connections made with old workings.

PAHASA (Custer)—This and associate companies have conveyed to C. H. Kamman all rights and interest in properties situated in Pennington and Custer Counties. Property includes large acreage of lode ground as well as placer. Surface equipment consists of two 250-ton concentrating mills and several hoists and machinery. Some of most promising tin and lithia mines in southern Hills included in property.

UTAH

Juab County

EAGLE & BLUE BELL (Eureka)—About 80 ft. of work done on the orebody recently opened on the 1700 level. What is thought to be new body off of the main ore-channel found by crosscutting. Some of ore runs unusually well in lead and silver. Connections nearly completed between raise from 1700 and winze from 1550.

WISCONSIN

Zinc-Lead

WEIGLE (Linden)—Platteville-Linden Co. has been reorganized and will reopen this mine.

GLANVILLE (Linden)—Levi Pollard and Saxe Bros., Milwaukee, have taken over the old Glanville mine.

SMITH & SINGER (Linden)—Found good cuttings by churn drill and is sinking a shaft on the Smith and Heathcock land.

OPTIMO (Linden)—Has struck a rich deposit that is turning out raw concentrates assaying between 50 and 55% zinc.

CANADA

New Brunswick

LAKE GEORGE—This old antimony mine in York County is to be reopened. Was abandoned some years ago, as it did not then pay, but present scarcity and high price of antimony have changed conditions.

Ontario

SENECA SUPERIOR (Cobalt)—Declared the regular bimonthly dividend of 10%, regarding which there has been considerable speculation.

McINTYRE (Porcupine)—Treated 8125 tons of ore in January averaging $7 and recovered bullion valued at $55,581. Total costs $4.65 per ton.

LUCKY CROSS (Swastika)—Negotiations are under way to have this gold property reopened. It has possibilities as a low-grade mine.

DOME (Porcupine)—Milled 23,220 tons of ore in January, and recovered bullion to the value of $82,727. December production was $81,660 from 23,090 tons.

NIPISSING (Cobalt)—Earned $1,610,000 net in 1914. Ore reserves are 10,000,000 oz., largest in the history of the company. Annual meeting will be held in April.

REA (Porcupine)—Declared 6% dividend, first ever paid by this company. The mine is operated by a leasing company and the original shareholders have a very small interest.

DOME LAKE (Porcupine)—Produced $11,000 in January, a total of $14,580 since mill started operation. Annual report shows capital of $1,000,000, $910,312 issued. The company owes Hudson Bay Mines $77,906. Proposed to double the mill capacity. Hudson Bay owns 600,000 shares of issued capital of Dome Lake.

The Market Report

Metal Markets

NEW YORK—Feb. 17

Copper, lead and spelter have all been stronger, but in each case the situation is confused. Tin has been stationary.

The Treasury Department has revoked the previous customs order demanding collectors of customs to keep secret for 30 days the manifests of outgoing vessels. The collectors were notified that they are to follow the same practice regarding the publicity of the manifests as was in effect prior to the issuance of the special order last October.

Copper—The market for this metal has been confused, uncertain and difficult to quote. The conditions attending shipments to Europe are in themselves sufficiently erratic to explain all uncertainties in the export business, and there are also uncertainties in the home trade. In the first part of our week of record scarcely any business was reported done. On Feb. 15 there were some rather important transactions for shipment abroad which were figured as netting the equivalent of 14.22½@14.25c., cash, New York. On the following day there developed some buying by American manufacturers, and as high as 14¾c., regular terms, was reported realized, but at the same time there were sellers at 14½@14⅝c., regular terms.

Reports in the newspapers of the foreign business in copper being put on a dollar basis are not quite correct. Certain producers have tried to put their business on that basis for some time back, and in certain cases have succeeded in so doing, but not generally. The ability to make the change has depended chiefly on whether it happened to be a buyers' market or a sellers'. Foreign sales in terms of cents per pound have been to customers in countries like Italy and Sweden, no English business having been otherwise than in sterling, so far as we know. It would be desirable if the whole export business in copper could be put on the basis of cents per pound, f.o.b., New York.

Copper sheets base price is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15@15¼c., carload lots at mill.

The Department of Commerce reports copper exports for the week ended Feb. 6 at 9,714,979 lb.; the larger items being 5,376,203 lb. to Great Britain, 1,613,099 lb. to Sweden and 1,526,627 lb. to Italy. For the 10 weeks, Dec. 5 to Feb. 6, the total exports were 118,500,727 lb. metal and 1268 tons ore and matte. Imports for the week were 5,047,212 lb. metal and 817,716 lb. in ore and matte; 5,864,928 lb. in all, chiefly from Chile, Peru and Canada. Imports for the 10 weeks were 33,231,518 lb. in all forms.

Brass Prices were again advanced on Feb. 15, base prices as given by the American Brass Co. being as follows: Sheets, high brass, 17¼c. net per lb.; low brass, 18½c. Wire, high brass, 17c.; low brass, 18½c. Rods, high brass, 17c.; low brass, 19¼c. Tubes, brazed or open seam, 20⅞c. Angles and channels, 20⅞c. Scrap allowances are 11¾c. net per lb. for high brass; 12½c. for low brass.

Tin—Business has been very dull. There has been a nearly complete absence of inquiry and a general mistrust of the present market situation.

Shipments of tin from the Straits in January were 5100 long tons, a decrease of 227 tons from last year.

Arrivals of tin concentrates in Great Britain in January were: Bolivia, 4188 tons; Nigeria, 447! South Africa, 308; total, 4943 tons, estimated as equal to 3012 tons fine tin.

Lead—Reports agree pretty well that domestic consumption of lead is poor, but that there is a continuation of an important demand from abroad, and the latter is the backbone of the market. It stiffened up to such an extent that on Feb. 16, the A. S. & R. Co. advanced its price to 3.85c., New York, but as to whether that advance is an indication of confidence in the market position, or was simply a market maneuver, opinions differ diametrically.

Late in December last, the Broken Hill mining companies made arrangements for the shipment of refined lead to Great Britain, the ore being smelted and the bullion refined at the Port Pirie works of the Broken Hill Proprietary Co. in Australia.

Spelter—Conditions described in our recent reports continue unchanged, but there has been a further advance in prices all along the line. A little spelter in lots of a carload or so was reported sold as high as 8⅝c., basis St. Louis, and may have sold even above that figure. There are nothing but stray and trifling lots of prompt spelter available anywhere, and these may command almost any price, according to the exigencies of the buyer. Transactions for wholesale tonnages were done for April-May delivery, realizing about 8¼c. Smelters are very anxious to make sales for April and later deliveries, but have a good deal of difficulty in finding buyers. Contracts calling for deliveries running from April to July, inclusive, were reported taken at 7¾c., while spelter has been sold for July delivery at 7½c. The situation is

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Feb.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb
11	4.83	48¾	*14.15 @14.25	36¼	3.80	3.65 @3.70	7.92½ @8.67½	7.75 @8.50
12						3.65 @3.70		7.75 @8.50
13	4.8238	48¼	*14.15 @14.25	36	3.80	3.65 @3.70	8.17½ @8.67½	8.00 @8.50
15	4.8163	48½	14.20 @14.30	36¼	3.80 @3.85	3.65 @3.70	8.17½ @8.80	8.00 @8.62½
16	4.7925	48¾	14.30 @14.50	36	3.85	3.70 @3.75	8.17½ @8.80	8.00 @8.62½
17	4.8038	48⅝	14.40 @14.55	36	3.85	3.72½ @3.77½	8.17½ @8.80	8.00 @8.62½

*Nominal

The quotations herein are our appraisal of the markets for copper, lead, speltes and tin based on wholesale contracts; and represent, to the best of our judgment. the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb	£ per Ton	Cts. per Lb
11	22 13/16	63¼	13.74	63¾		177	154¼	18 13/16	4.09	39¾	8.64
12	22	63⅛	13.71	63⅝		174	153	18⅞	4.10	39¾	8.64
13	22 11/16	–									
15	22¾	63⅛	13.71	63⅝		178	155	19	4.13	39¾	8.64
16	22⅝	63¾	13.85	64		178	153½	19 1/16	4.14	39½	8.58
17	22⅝	63⅜	13.77	63⅞		176	154	19 3/16	4.17	39⅞	8.66

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

unparalleled, and is generally recognized as being dangerous Sooner or later, however, there will be relief in the form of increased production.

Zinc sheets are quoted today at $12 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

According to Mr. McKelvie, president of the Butte & Superior, the ore contract with the American Metal Co. is based on $28 per ton of 50% blende delivered at smelteries when spelter is at 5c., with $7 per ton rise per 1c. rise in spelter, the argentiferous residuum being returned to the mining company. This corresponds to (T-8)—$14@16.80, the latter being the smelting charge—the lower figure corresponding to 5c., the higher to 7c. for spelter.

We have heard that a foreign buyer tried last Thursday to obtain 500 tons of spelter for February shipment, offering 8½c. per lb., and could not find any producer who could supply it.

The Butte & Superior Copper Co. is straining every effort to make the maximum possible production of zinc ore, and for the moment is naturally and wisely sacrificing maximum extraction for the sake of maximum production.

The disruption of the German Zinkhüttenverband was caused, in part, by the defection of one Dutch and one Belgian zinc-smelting company. The other members of the union, with the exception of the Weinmann Works in Teplitz, reorganized at Berlin Jan. 12, 1915, as the Zinkhüttenvereinigung. The new organization is to run until Mar. 31, 1916.

Through a mistake in proofreading the price of spelter at St. Louis for Feb. 6, 8, 9 and 10 was given at 7.22½@8.12½c. The correct figures are 7.62½@8.12½c. for those days.

Other Metals

Aluminum finds increased inquiry and considerable sales on contract, but only moderate new business—**Antimony** is still active and in good demand with sales both for domestic use and for export. Ordinary brands sell at 17¾@18c. per lb.; while 20@21c. is asked for Cookson's—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** continues strong and prices are advancing. Early in the week some negotiations were conducted on the basis of $55 per flask, but no sale resulted. Large dealers are quoting today $60 per flask of 75 lb., New York. San Francisco, $58 for domestic orders. London price is now £12 5s. per flask.

Gold, Silver and Platinum

Gold—A transfer of $2,500,000 gold from Ottawa to New York was noted last week. The gold was from the fund which the Bank of England established at Ottawa at the beginning of the war. Exchange on London has reached such a low point at New York that further transfers or imports of gold may be expected at any time.

Receipts of gold bullion at the Dominion Assay Office at Vancouver, B. C., in 1914 are reported from 1015 depositions, the total weight being 166,150 oz., and the total value $2,029,500. This shows an increase of $580,875, or 40%, in value over the preceding year.

Platinum—The market remains very quiet and sales are on a very moderate scale. Prices have still an unusually wide range, sales of refined platinum being reported at $38@42 per oz.; while hard metal is quoted at $45@49 per oz., according to quality.

Our Russian correspondent writes under date of Jan. 21 that since the New Year the market has improved. The State Bank now advances 23,000 rubles per pood on platinum held by producers and dealers at Ekaterinburg. The price there is 8 rubles per zolotnik—$30.08 per oz.—for crude metal, 83% platinum; none can be bought below that figure. In Petrograd no transactions are noted.

Silver—The market continues on a very narrow footing, but the undertone remains good and the price has shown an advancing tendency the past week. London closes at 22⅞d. bid for shipment. The Indian bazaars still continue active buyers.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 13

Blende, high price, [illegible]; assay base, 60% zinc, $60@70; metal base, 60% zinc, $61@67; calamine base, 40% zinc, $40@46; average, all grades of zinc, [illegible] per ton. Lead, high price $49, base $47 per ton of 80% metal content; average, all grades of lead, $47.27 per ton.

SHIPMENT, WEEK ENDED FEB. 13

	Blende	Calamine	Lead	Value
Total this week	9,536,170	1,595,250	1,826,540	$405,580
Total this year	70,881,760	6,561,990	10,658,180	2,330,250

Blende value, the week, $328,460; seven weeks, $1,973,870.
Calamine value, the week, $33,980; seven weeks, $106,810.
Lead value, the week, $43,140; seven weeks, $249,570.

PLATTEVILLE, WIS.—Feb. 13

The base price paid for 60% zinc ore was $68@69 per ton. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED FEB. 6

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb
Week	5,075,620	......	509,600
Year	24,456,640	226,000	2,546,300

Shipped during week to separating plants, 4,045,920 lb zinc ore.

Iron Trade Review

NEW YORK—Feb. 17

Business continues to improve slowly but the change from the lowest point is considerable, as shown especially by the Steel Corporation statement below.

Structural business is improving and orders are coming in more freely. There is quite a demand for plates and shapes for shipbuilding. Wire business is reported quite active.

The pig iron market also shows improvement. There is more call for foundry iron, and also a demand for basic. There are quite a number of inquiries for pig iron for export, but they have not resulted in much actual business so far.

The United States Steel Corporation reports unfilled orders on its books Jan. 23 at a total of 4,248,551 tons of material, an increase of 411,908 tons during January, and of 923,959 tons since Nov. 30 last.

PITTSBURGH—Feb. 16

The Carnegie Steel Co. is this week operating 65% of its steel-ingot capacity, against an average of 40% in December. Its plate mills are operating at fully 90% of capacity, but this is chiefly on some excellent orders for plates for oil tanks and oil and gas lines, which will soon be worked out. The Pittsburgh Steel Co. is operating in full, but is stocking considerable quantities of wire products. The American Sheet & Tin Plate Co. is operating 92% of its tinplate mills, but is stocking some of the product, against the usual spring rush for deliveries. Galvanized sheets have advanced over $10 a ton, but this is due altogether to the phenomenal advance in spelter and its scarcity.

The steel market is today in such condition that it is within the possibilities for it to experience a sharp further improvement, perhaps a veritable boom, and it is also quite within the possibilities for it to slump off again. On the one hand, the mills have no business ahead, and are making up their rolling schedules almost from day to day, so that while their present enlarged operations reflect the improved buying of late they would just as promptly reflect any decrease in buying. On the other hand, the increase in mill operations, by which the steel industry as a whole is now operating at fully 55% of capacity, against less than 35% in December, has occurred without there being any pronounced buying in any quarter, and without the railroads taking hold to any extent, so that there is plenty of room for further improvement. It is pointed out in some quarters that it requires time for the industry to limber up to operating at full rated capacity, and that if a rate of 75 or 80% were reached deliveries would begin to fall behind and then buyers would probably rush to cover and restore their stocks, now at probably the lowest ebb in years. Even the ferromanganese situation may become so acute as to cause buying of steel to cover possible shortage later.

Pig Iron—Struthers furnace, which was making basic, is out for a few weeks on account of an accident. The Buffalo Union Furnace Co. at Buffalo is this week putting in an idle stack. On the whole there is no change in merchant pig-iron.

NEW YORK—Feb. 17

The general market has been rather quieter, but business is still on a moderate scale.

Arsenic—The market is dull and unchanged. Quotations remain at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady, about as usual. Prices have been again advanced 25c., and are now $5 per 100 lb. for carload lots and $5.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is fair, but a little irregular. Quotations are 2.12½c. per lb. for spot and up to June 30, [illegible] for July-December, and [illegible] for later deliveries.

Assessments

Company	Delinq	Sale	Amt
Belcher Silver, Nev	Feb 8	Mar. 1	$0.10
Booth, Nev	Jan 25	Mar 1	0.02
Brunswick Con., Nev.	Feb 16	Mar. 9	0.01
Caledonia, Nev.	Mar 8	Mar 31	0.05
Carbonate, Ida	Jan 28	Feb 28	0.001
Cedar-Talisman, Utah	Feb. 8	Mar. 1	0.005
Clear Grit, Ida (post.)	Feb. 9	Mar. 3	0.0015
Confidence, Nev	Mar. 11	Mar. 31	0.10
Con Virginia, Nev	Feb 24	Mar. 18	0.10
Emerald, Utah (three instal.)		June 9	0.01
Gethin Le Roy, Utah (post.)	Feb 16	Mar. 7	0.02
Index, Ida	Feb 27	Mar 27	0.005
Indiana, Mich	Feb. 4		1.00
Iron King, Ida	Feb 18	Mar. 19	0.001
Jack Waite, Ida	Mar 1	Mar 24	0.01
Keystone, Utah (post)	Feb 23	Mar. 23	0.02
King Pine Crk., Ida	Feb. 12	Mar. 13	0.002
Majestic-Idol, Nev.	Dec. 15	Jul. 20	0.005
Manhattan Con., Nev	Feb. 30	Mar. 1	0.01
Moonlight, Ida (post.)		Feb 28	0.005
Nor. Bnkr. Hill, Ida	Jan. 30	Mar 6	0.002
Ophir, Nev	Feb 11	Mar. 5	0.10
Overman, Nev	Mar. 8	Mar 26	0.05
Pioche Coalition, Nev	Feb. 10	Mar 1	0.025
Reindeer-Queen, Ida	Feb. 15	Mar 8	0.003
Rescue-Eula, Nev	Feb. 11	Mar 22	0.01
Sheba, Utah	Jan. 12	Feb. 24	0.05
Sierra Nevada, Nev	Feb. 8	Mar. 2	0.05
Snowstorm, Ida	Feb. 19	Mar 22	0.003
Sunset Dev., Ida	Jan. 18	Feb. 18	0.0025
Syndicate, Ida. (post.)		Jan 28	0.001
Tarbox, Ida. (post.)	Jan 28	Mar 11	0.0025
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr 12	0.01
Torino, Ida	Feb 20	Mar 20	0.001
Utah-United, Utah	Feb. 20	Mar. 15	0.01
Verde May, Ida	Feb. 1	Mar 1	0.001
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

Of interest in metallurgical-corporation financing is the announcement that the Lackawanna Steel Co. has placed an issue of $6,000,000 of 6% two-year notes to refund its $10,000,000 of debentures due Mar. 1. The remainder will be paid off from surplus earnings.

COLO. SPRINGS Feb. 16		SALT LAKE Feb. 16	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	05½	Beck Tunnel	.06½
Cripple Cr'k Con	.01	Black Jack	09¾
C. K. & N.	.06½	Colorado Mining	10
Doctor Jack Pot	10	Crown Point	01½
Elkton Con	.45	Daly-Judge	5.25
El Paso	1.66	Gold Chain	09
Findlay	.02½	Grand Central	60
Gold Dollar	.04½	Iron Blossom	96
Gold Sovereign	04⅛	Little Bell	10
Isabella	16¾	Lower Mammoth	06
Jack Pot	.08	Mason Valley	1.10
Jennie Sample	02	May Day	12
Jerry Johnson	03¾	Opohongo	01½
Lexington	‡.009	Prince Con	31½
Old Gold	‡.01	Seven Troughs	.03
Mary McKinney	.31	Silver King Coal'n	2.97½
Pharmacist	.01½	Silver King Con	1.92½
Portland	1.15¾	Sioux Con.	.03
Raven B. H.	03½	Uncle Sam	05
Vindicator	1.28	Yankee	.07½

TORONTO Feb 16			
Bailey	01½	Dome Exten	06
Coniagas	4.50	Foley O'Brien	15
Peterson Lake	20	Hollinger	22.25
Right of Way	02	Imperial	01
Seneca Superior	1.00	Jupiter	09
Silver Queen	02½	McIntyre	30
T. & Hudson Bay	30.00	Pearl Lake	02
Timiskaming	16	Porcu. Gold	25
Wettlaufer-Lor	04	Preston E. D.	01
Big Dome	6.00	Rea	12

SAN FRANCISCO Feb 16			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	11	Belmont	3.62½
Belcher	23	Jim Butler	66
Best & Belcher	06	Lone Star	08½
Caledonia	22	MacNamara	.03
Challenge Con	‡05	Midway	07
Confidence	‡10	Mont.-Tonopah	47
Con. Virginia	06	North Star	13
Crown Point (Nev.)	19	Rescue Eula	07
Gould & Curry	03	West End Con	52
Hale & Norcross	04	Atlanta	26
Julia	01	Booth	30
Mexican	44	C. O. D. Con	06
Occidental	84	Comb. Frac.	06
Ophir	.13	Jumbo Extension	81
Overman	06	Pitts.-Silver Peak	12
Potosi	02	Round Mountain	40
[illegible]	04	Sandstorm Kendall	09
Sierra Nevada	13	Silver Pick	09
Union Con.	24	Central Eureka	[illegible]
Yellow Jacket	28	So. Eureka	‡2.25

N. Y. EXCH. Feb. 16	
Name of Comp.	Clg.
Amalgamated	53¾
Am.Sm.&Ref.,com	64¼
Am. Sm. & Ref., pf.	100¾
Am. Sm. Sec., pf. B.	78
Anaconda	27
Batopilas Min	.50
Bethlehem Steel, pf.	104½
Chino	35½
Colo. Fuel & Iron	25¾
Federal M. & S., pf.	26
Great Nor., ore., ctf.	31⅜
Guggen. Exp	50¾
Homestake	115
Inspiration Con	18¾
Mex. Petroleum	70
Miami Copper	18⅝
Nat'l Lead, com	49¾
National Lead, pf	108½
Nev. Consol	12¾
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf	1¼
Ray Con	17
Republic I&S, com	20
Republic I&S, pf	74
SlossSheffi'd, com	25
Sloss Sheffield, pf	‡82
Tennessee Copper	29½
Utah Copper	52½
U. S. Steel, com	43⅜
U. S. Steel, pf	104½

N. Y. CURB Feb 16	
Name of Comp.	Clg.
Beaver Con	26
Big Four	08
Blue Bell	05½
Braden Copper	6⅞
Buffalo Mines	.75
Can. Cop. Corpn	1⅜
Can. G. & S.	04
Caribou	.50
Chambers Ferland	12
Con. Ariz. Sm.	⅜
Coppermines Cons	‡1¼
Davis-Daly	1$\frac{1}{16}$
Diam'field-Daisy	10
Dia. Black B.	04
Ely Con	‡01
Florence	61
Goldfield Con.	1½
Goldfield Merger	25
Greene Cananea	26
Kerr Lake	4$\frac{11}{16}$
La Rose	⅝
McKinley-Dar-Sa	45
Mines of Am	2¼
Mutual Min., pf	‡2½
Nevada Hills	30
New Utah Bingham	‡$\frac{7}{16}$
Nipissing Mines	5½
Ohio Copper	06
Oro	11
Pacific Smelt	$\frac{1}{32}$
South Utah	10
Stand'd Oil of N.J.	402
Standard S. L.	1¼
Stewart	1¼
Tonopah	6¾
Tonopah Ex	2½
Tonopah Merger	37
Tularosa	.25
West End Ex	03
Yukon Gold	2½

LONDON Feb 2	
Alaska Tre'dwell	£7 12s 6d
Camp Bird	0 8 0
El Oro	0 9 9
Esperanza	0 9 6
Mexico Mines	4 6 3
Oroville	0 12 0
Philippine Dr.	1 0 0
Santa Gert'dis	0 11 3
Tomboy	1 3 9
Tough Oakes	0 13 9

BOSTON EXCH Feb. 16	
Name of Comp.	Clg.
Adventure	1
Ahmeek	275
Alaska Gold M.	28⅜
Algomah	50
Allouez	42½
Am. Zinc	21⅜
Ariz. Com., ctfs.	4½
Bonanza	31
Butte-Ballaklava	2¾
Butte & Superior	46¼
Calumet & Ariz.	54
Calumet & Hecla.	390
Centennial	17
Cliff	‡1
Copper Range	34½
Daly West	2
East Butte	9½
Franklin	5¾
Granby	69
Hancock	11⅜
Helvetia	25
Indiana	3½
Island Cr'k, com.	44
Island Cr'k, pfd.	88
Isle Royale	21½
Keweenaw	2¾
Lake	6¼
La Salle	4
Mass	4⅝
Mayflower	4¾
Michigan	60
Mohawk	56½
New Arcadian	5½
New Idria Quick.	‡3½
North Butte	23¾
North Lake	1⅜
Ojibway	‡.70
Old Colony	4¼
Old Dominion	42½
Osceola	70½
Quincy	56¼
Santa Fe	1¼
Shannon	5½
Shattuck-Ariz	22¼
Superior	27⅜
Superior & Bost.	1⅝
Tamarack	31½
Trinity	2⅝
Tuolumne	.25
U. S. Smelting	22
U. S. Smelt'g, pf.	41
Utah Apex	2
Utah Con	10
Victoria	1⅛
Winona	1¼
Wolverine	46½
Wyandot	50

BOSTON CURB Feb. 16	
Name of Comp.	Bid.
Alvarado	70
Bingham Mines	‡3⅜
Boston Ely	12
Butte & Lon'n Dev.	20
Calaveras	1
Calumet-Corbin	.12
Chief Con	70
Corbin	‡1
Cortez	25
Crown Reserve	.73
Eagle & Blue Bell	.80
First Nat. Cop.	1
Houghton Copper	1½
Iron Cap Cop., pf.	‡5
Majestic	14
Mexican Metals	13
Nevada-Douglas	38
New Baltic	1⅜
Oneco	‡60
Raven Copper	07
Smokey Dev.	10
So. Lake	4½
Tonopah Victor	‡17
Trethewey	10
United Verde Ext.	2$\frac{1}{16}$

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506		28.357	26.573	
March	57.870	58.067		26.669	26.788	
April	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver. London pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	......	65.259	......	70.188	
March	14.131	......	64.276	......	69.170	
April	14.211	......	64.747	......	69.313	
May	13.996	......	63.182	...	67.786	
June	13.603	...	61.836	...	66.274	
July	13.223	.	60.540	...	64.955	
August	*		‡	......	‡	
September	*		‡	..	‡	.
October	*		‡	......	‡	....
November	11.739		53.227	......	*	....
December	12.801		56.841	.	*	...
Year	13.602		61.524		68.168	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830		181.556	
March	38.038		173.619	.
April	36.154	.	163.963	
May	33.360	..	150.702	
June	30.577	.....	138.321	
July	31.707	...	142.517	
August	*	.....	‡	
September	32.675	...	‡	
October	30.284	....	‡	.
November	33.304	.....	139.391	
December	33.601	.	147.102	
Av. year	34.301		156.564	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048		3.937	..	19.606	
March	3.970	...	3.850	......	19.651	.
April	3.810	....	3.688	....	18.225	
May	3.900	....	3.808	.....	18.503	..
June	3.900	...	3.810	.....	19.411	.
July	3.891	....	3.738	.....	19.051	...
August	3.875	...	3.715	..	‡	..
September	3.828	...	3.658	...	‡	...
October	3.528	...	3.384	.....	‡	.
November	3.683	..	3.585	......	18.500	..
December	3.800		3.662	....	19.097	......
Year	3.862	.	3.737	..	19.079	....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377		5.228		21.413	
March	5.250	..	5.100	..	21.460	
April	5.113	..	4.963	..	21.569	
May	5.074	.	4.924		21.393	
June	5.000		4.850		21.345	.
July	4.920		4.770	.	21.568	
August	5.568		5.418	.	‡	
September	5.380		5.230		‡	
October	4.909	.	4.750		‡	
November	5.112	.	4.962	.	25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06		14.12		14.08	
March	15.07		13.94		14.10	
April	14.90		13.90	.	14.13	
May	14.90		13.90		14.27	
June	14.90	....	13.90		13.96	
July	14.90		13.90		13.90	
August	14.90	..	13.90		14.08	
September	14.90	..	13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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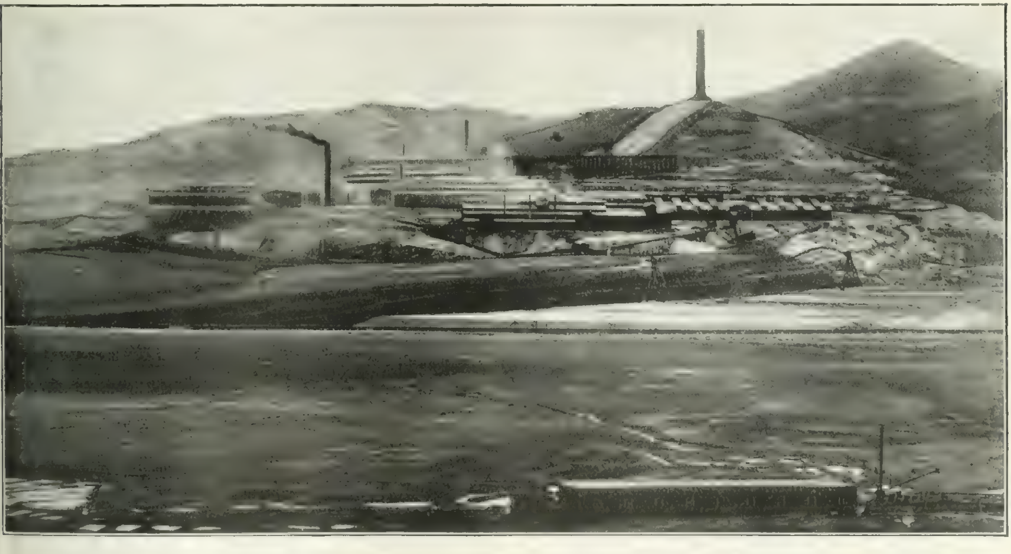
Oxyacetylene Welding in Mining

SYNOPSIS—Oxyacetylene welding is being used by some of the important mining companies, but its field for the prevention of lost time from breakdowns seems not yet generally appreciated. One of the largest repair jobs ever made with oxyacetylene apparatus was done by the Anaconda company in repairing its main dust flue; this work involved over 10 miles of welding. About 35,000 lin.ft. of welding was also done in the construction of the new round-table plant at Anaconda. A summary of what some of the large mining operators are doing with the oxyacetylene torch and what they think of its work.



THE ROOF OF THE 120-FT. DUST FLUE AT ANACONDA WAS WELDED BY THE OXYACETYLENE PROCESS

This was probably the largest single repair job ever done with the oxyacetylene apparatus, in replacing the roof of this flue, over 10 miles of welding was done, requiring 350,000 cu.ft. of oxygen and 40,000 lb of calcium carbide

Oxyacetylene welding by reason of its wide adaptability is particularly suited to mining repair work. It has already found a place at a number of important mines and some of the largest repair jobs ever made have been executed by mining companies. Yet the adoption of oxyacetylene welding is by no means as general in mines as it might be.

Today there are few general machine shops or foundries that have not made some application of autogenous welding both for emergency repairs and regular work. The work that it is possible to do with the oxyacetylene torch is so varied in character, the outfits so readily portable, and the time and money saved by their use are so evident that such outfits seem particularly suited to the requirements of mines generally. Many mines are distant from centers of supply; breakdowns to machinery unless promptly repaired mean a direct loss of income and perhaps a general increase in the cost of operation under part capacity while waiting for the broken pieces to be replaced or a new part to arrive from manufacturers. With a reliable repair outfit at hand, this situation may be avoided. The oxyacetylene outfit has found a place in other industries which need it less and hence seems destined to find a wider application at mining plants.

The apparatus consists essentially of a torch fitted with a tip and a mixing chamber connected by suitable tubes to the oxygen and the acetylene tanks or other sources of supply for these two gases, the combustion of which supplies the heat necessary for welding or cutting. The heat obtained is said to approach 6300° F. and is sufficient to melt readily any of the metals. The gases may be purchased in tanks or may be generated at the place where used, depending on conditions of supply and transport.

CHARACTER OF WORK DONE AT THE MINES

A few mines installed oxyacetylene welding and cutting apparatus when it was first put upon the market, and have found these outfits extremely useful. In response to an inquiry, the managers at some of the important mines have reported their experience with the oxyacetylene outfits; in general, the apparatus has given excellent satisfaction; in a number of cases the managers have written that they would not be without a welding outfit hereafter. Repairs reported from these mines have included welding the dies and throttle handles of a drill sharpener, repairing valve handles, feed screws, front-head caps and air-chest stoppers for rock drills, a steel crusher pitman, welding a crack in the valve box of a pump, an engine cylinder head, brake arms on a hoisting engine, a spoke of a 14-ft. sheave wheel, welding in a piece 16 in. in length that was broken out of the rim of a 5-ft. gear wheel, a crack in the frame of a compressor, cutting the manganese-steel lips of dredge buckets that did not articulate properly, trimming the ragged edge of a cast-steel converter shell, welding converter windboxes and tuyeres, blast-furnace water jackets, welding a large smelting flue to prevent water leaking in and to increase draft, welding launders and classifying cones, straightening buckled wire screens and many other repairs of a miscellaneous character such as arise from day to day at the mines and reduction plants.

Among the well known mining companies already using oxyacetylene welding for repair work are the Anaconda Copper Mining Co., Alaska Treadwell Gold Mining Co., Empire Mines of Grass Valley, Calif., Conrey Placer Mining Co., Pato Mines (Colombia), Ltd., of Oroville Dredging Co., Copper Queen Consolidated Mining Co., Nevada Consolidated Copper Co., Desloge Consolidated Lead Co., Republic Iron & Steel Co., Shenango Furnace Co., Butte & Superior Copper Co., New Jersey Zinc Co., Ray Consolidated Copper Co. Some mines, situated in camps having repair shops, do not maintain a welding outfit of their own, but find it more economical to have their welding done in the nearby shops which may have more regular work for the apparatus. For example, in Butte, the Mountaineer Welding Co. with its Vulcan apparatus makes a specialty of repairs for Butte mines and works, and also does miscellaneous work for mines throughout the state.

WELDING THE MAIN DUST FLUE AT ANACONDA

Perhaps the largest single repair job ever made with oxyacetylene apparatus was the welding of the roof of the main dust flue at Anaconda, Mont. The engineers of the Anaconda Copper Mining Co. report that they have occasion every day to make various repair jobs by means of oxyacetylene welding. The company has Davis-Bournonville apparatus with the following generators and accessories: Twenty-four electrolytic oxygen-generating cells, one purifier, one pressure regulator, two gasometers with regulators, one 2-stage compressor, one 300-lb. per sq.in. compressor and one 3-stage 2000-lb. compressor, 27 tanks for oxygen at 300-lb. pressure, 15 tanks for oxygen at 2000-lb. pressure. When using the welding apparatus, the oxygen consumption at Anaconda is about 1000 cu.ft. per day.

The original roof of the 120-ft. dust flue at Anaconda was composed of plates riveted to supporting I-beams; this was considered an exceptionally good roof and for years gave no trouble, but owing to the fact that an absolutely tight roof was impossible by this method, water would leak around the rivets and where the plates lapped. The moisture coming in contact with the dust underneath formed sulphuric acid, which in time corroded the sheets; the roof finally became so badly honeycombed that outside air being drawn in was responsible in great measure for the loss of draft in the flue.

So it was proposed to remove the old roof and put on new plates, welding them together to make an absolutely tight roof. The work was begun in October, 1913, and completed about 12 months later, during which time 53,365 lin.ft. of welding was done, using 350,000 cu.ft. of oxygen and about 40,000 lb. of calcium carbide. Owing to the large amount of welding involved, a plant was installed for furnishing oxygen. The first equipment was for 12 cells and later this was duplicated, making a total of 24 electrolytic cells for generating oxygen. The oxygen was compressed to 300 lb. per sq.in. and sent in tanks to the flue. For furnishing the acetylene gas, two generators were used. Work was started at the upper end of the flue near the stack and these generators were placed at convenient points beside the flue. The generators had to be moved three times during the progress of the work; when it was desired to move them they were put on cars on an incline hoist and lowered to new positions where they were placed on platforms previously prepared.

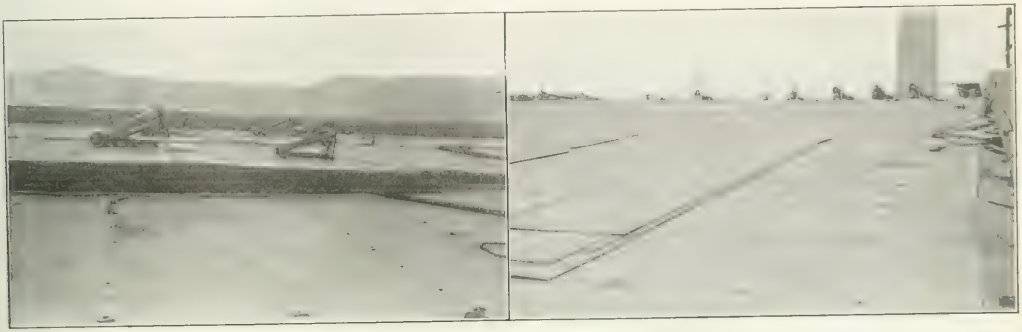
The manner of placing the steel plates may be described as follows: The 7-in. I-beams were drilled and tapped for ⅝-in. bolts; the plates were placed on the 7-in. beams and bolted on with ⅝x1-in. machine bolts and washers; the washers were welded to the roof plates to fill in the V-shaped holes that were made for the expansion of the sheets. The plates were placed ⅛ in. apart for welding. Some data regarding this large repair job are listed below:

Number of plates used	1711
Size and thickness of plates	No. 9—40x240 in.
Number of washers used	16,000
Size of washers	2 to 3½ in.
Linear feet of welding	53,365
Cubic feet of oxygen used	350,000
Pounds of calcium carbide used	40,000
Feet of [illegible]-in. round Norway welding rod	100,000
Average number of men employed	11.5
Time required to complete work	12 months

AUTOGENOUS WELDING OF NEW WORK

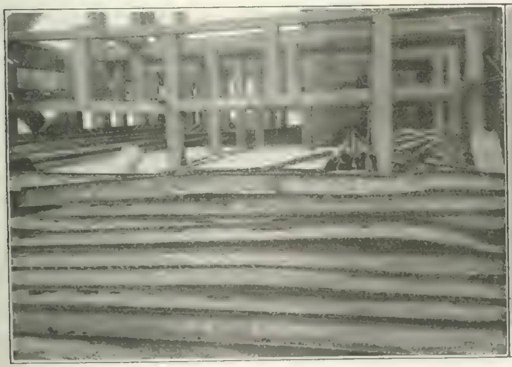
Another large welding job at Anaconda was in connection with the installation of the round-table plant. This plant comprises 20 tables of 20 decks each; the circular launders for collecting the discharge from each two decks were made of No. 10 steel and it was necessary to weld the bottom to the sides of these circular launders. The amount of welding in this job amounted to approximately 35,000 lin.ft. This method of making the launders was found to be cheaper than riveting and much more satisfactory, as it made an absolutely water-tight job.

The Anaconda Copper Mining Co. has used the oxyacetylene apparatus for welding water jackets, but has since discontinued doing so because the oxyacetylene weld on the fire sheet would open and cause the jackets to leak. This failure of water-jacket welds does not seem to be in consonance with the experience at some of the other smelting works; some of the large manufacturers of water jackets also use the oxyacetylene apparatus for welding. The repair welding jobs done around the Anaconda plant are of a general character, such as repairing castings, welding hoppers and other broken parts of cast and wrought metal. One of the accompanying illustrations show a "smoke box" used for experimental purposes; this particular work is interesting because the rather intricately shaped box was welded from very thin material, namely, 14-gage steel. In general the welds are regarded as possessing from 50 to 75% of the strength of the material welded, depending upon the conditions under which welding is done and also upon the skill and care taken by the operator.

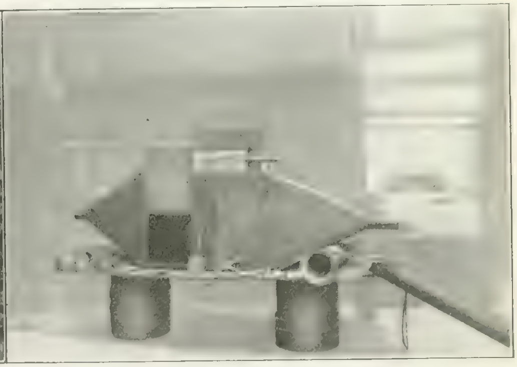


ON THE FIRING LINE AT ANACONDA

The howitzer-like apparatus are the gas-supply tanks used in welding the roof of the main dust flue at Anaconda, Mont.



SOME 7-IN. I-BEAMS REMOVED FROM THE OLD ROOF OF THE ANACONDA FLUE



AN EXPERIMENTAL "SMOKE BOX" MADE WITH THE OXYACETYLENE TORCH AT ANACONDA

At the Boston & Montana reduction department at Great Falls, Mont., the Anaconda company uses a Sanford portable welding machine purchased in 1910; also a Vulcan automatic acetylene generator added last year. At times the apparatus is used day and night for a week or more. The equipment is used not only for repairs and breakdowns, but also in the construction of new apparatus, such as water-jacketed blast-furnace spouts, blast-furnace jackets, converter windboxes and tuyeres, and classifying cones for the concentrator. The oxyacetylene-welding apparatus was extensively used at this reduction plant when changes were being made during reconstruction. With the oxyacetylene torch, it is possible to cut any kind of steel work quickly and accurately in place and the apparatus is useful in the field for cutting holes in or fitting parts to large pipes, tanks, furnace shells, etc. It is especially valuable where it is necessary to connect old equipment in place or in putting in new equipment, the exact connections for which are difficult to calculate and fabricate in the office or shop. It is also useful to repair such apparatus as converter shells on which large patches may be welded while the vessel is in place.

Among other work done in Montana by the Mountaineer Welding Co. was the manufacturing of 37 water jackets for the East Butte smelting works, the tuyeres in this case being welded with the oxyacetylene torch as well as the corners. The oxyacetylene torch was also used at this works to cut a straight line around the edge of the cast-steel converters, so that they could be lined up to the very edge with brick, the fused condition in places around the edge having previously prevented laying brick close to the shell. Numerous small castings and machine parts in cast iron, steel and bronze have also been welded for this company. At the Butte-Alex. Scott Mining Co. a compressor frame was broken, the crack extending for a distance of from 5 to 6 ft.; this was welded in one day and was thereafter in constant service.

At Corbin, Mont., a roll bedplate belonging to the Boston & Corbin Copper & Silver Mining Co. was dropped 30 ft., breaking out nearly all of one side. The cast-iron bedplate weighed 7 tons, and the thickness of the metal varied from 1 to 3 in., and the total length of the break was about 10 ft. The work of welding was commenced at 10 p.m. by the crew of the Mountaineer Welding Co. and was finished at 10 p.m. on the following night, successfully. In preheating the bedplate, 29 sacks of charcoal were used.

Acetylene welding has been done at many of the Anaconda mines at Butte; at the Tramway mine a spoke of a 14-ft. sheave wheel was welded, the break having been approximately 7x9 in.; at the Mountain View mine a piston jammed into the cylinder head, breaking the head and carrying off the flange of the cylinder; the cylinder was 20 in. in diameter by 66 in., but the flange was welded back on successfully. At the Leonard mine two brake arms were welded on the hoisting engine between shifts, so that no time was lost in hoisting. A 5-ft. cast-steel gear wheel on one of the pumps at the Original mine was broken for about 16 in. along the rim. This was welded in a few hours' time; other pump parts, including those of phosphor-bronze, have been welded with the oxyacetylene apparatus.

ACETYLENE TORCH FOR GOLD-DREDGE REPAIRS

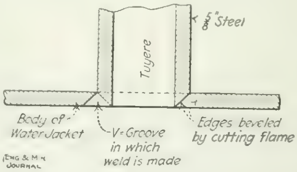
At one of the dredges of the Conrey Placer Mining Co., the Mountaineer Welding Co. reports using a Vulcan apparatus to cut off the manganese-steel lips of 84 dredge buckets which did not have enough clearance, each bucket striking the bottom of the preceding bucket. The lips of the buckets were 20 in. across and the dimension of the cut was from 1¼ to 2¼ in. by 20 in., making a total of 140 lin.ft. This work eliminated the striking of the buckets, and the total cutting time is reported as 6 hr., whereas to have done this work by any other method would have tied up the dredge for several months—an extremely expensive delay both in the matter of interest on investment and in the loss of yield from the dredge. Acetylene welding has also been done for the Marysville Dredging Co., Marigold, Calif., the Pato Mines, Ltd., in Colombia, and possibly by others, as no inquiries were made among dredging companies.

EXPERIENCES OF VARIOUS COMPANIES

The Empire Mines at Grass Valley, Calif., has an oxyacetylene-welding outfit purchased from the Great Western Cutting & Welding Co. and the manager reports that it was satisfactory in welding cast iron, but that good results were not uniformly obtained in welding hard steel or in getting the welded steel to hold a temper. The apparatus has been used to weld dies and throttle handles of the drill sharpener, a lug on the brush holder of a dynamo, building up a brass nut on a lathe, repairing gas burners, welding copper plates for the amalgamating mill, valve pots of pumps, feed screws, valve handles, front-head caps and air-chest stoppers for rock drills, besides various small repair jobs on cast-iron parts of different machines around the mines. The largest piece of welding this company has done was in repairing the cylinder of a locomotive for the Nevada County Narrow-Gage Ry. One of the follower bolts of the piston head broke and dropped between the piston and cylinder head, causing the piston to pound and knock out the cylinder head, carrying away a large piece of the cylinder; the cylinder was 18 in. in diameter, and the break extended about 3 in. into the bore of the cylinder and about one-half way around, tapering out at the end. The piece was welded and the cylinder ground out, and the job considered an entire success. The cost of replacing the cylinder would have been several hundred dollars, while the cost of welding was only $13.87, and the time of preparing and welding only eight hours.

The Copper Queen company at Douglas has an oxyacetylene outfit made by the Alexander Milburn Co., of Baltimore, Md., and uses it principally for welding soft steel, such as for water jackets, pipe work, etc. The company also does repair work for the Calumet & Arizona smelting works at Douglas. Welds are figured to have a strength of about 50% of the original sheets. The Nevada Consolidated Copper Co. uses a Fouche welding apparatus mainly on small work, such as sample cutters, small tanks and small broken castings. The management reports that the oxyacetylene flame is extremely useful in cutting openings in heavy plate, such as converter shells, etc., and would not be without an apparatus of this kind, notwithstanding the company has for a long time used Thermit welding also. The latter is used on heavy work such as large shafts, etc.; a satisfactory weld was made on an impeller of a No. 10 Connersville blower with Thermit, after failing with oxyacetylene.

The Desloge Consolidated Lead Co., in southeastern Missouri, has had emergency welding done by the oxyacetylene method on numerous occasions. Last autumn a steel crusher pitman was broken; two men in 56 hr. of practically continuous work restored the pitman to virtually normal condition and saved a long delay on the crusher. The company up to the present has not purchased an equipment of its own on account of its proximity to St. Louis, where it is possible to get men and material on short notice. It has had welding of both steel and cast-iron parts done, such as repairs to engines, pumps, Hancock jigs, and other small parts, and has found these parts to hold as well as they did originally.



⅝" Steel
Tuyere
Body of Water Jacket
V-Groove in which weld is made
Edges beveled by cutting flame
Eng & M. Journal

WELDING A FURNACE TUYERE FOR THE EAST BUTTE WORKS

The Shenango Furnace Co. at Sharpsville, Penn., uses an Oxweld Acetylene Co.'s outfit to weld various jobs both of cast iron and cast steel, and has had no trouble with any welds, some of which were made two years ago. The Republic Iron & Steel Co., at Thomas, Ala., has had oxyacetylene welding done, although it has never purchased a welding apparatus; it has applied this process mainly to cast-iron controller handles and cast-iron scale beams, which up to date have proved satisfactory.

The Alaska Treadwell Gold Mining Co. has purchased an oxyacetylene-welding apparatus from the Davis-Bournonville Co. of New York, but at the time this inquiry was made, had done no work therewith, except experimentally.

The Butte & Superior Copper Co. has a Bermo oxyacetylene-welding apparatus; though the first jobs were more or less unsuccessful, at present it is unusual to have a defective or unsatisfactory weld. The work is of course intermittent and irregular in character, but there are times, according to the mill superintendent, when a small weld is necessary on a big casting where welding will show a large economy, both in time and money over the purchase of new parts.

The New Jersey Zinc Co. has an oxyacetylene apparatus at its Palmerton plant and has loaned this on several occasions to the mines at Franklin Furnace, N. J. It has been used there for cutting off plates in inaccessible places and repairing a cylinder head; the latter job was unsatisfactory, but the company reports good results in replacing broken teeth on gear wheels and other minor parts, but states that not enough work has been done at the mines as to warrant definite conclusions as to the durability of the work.

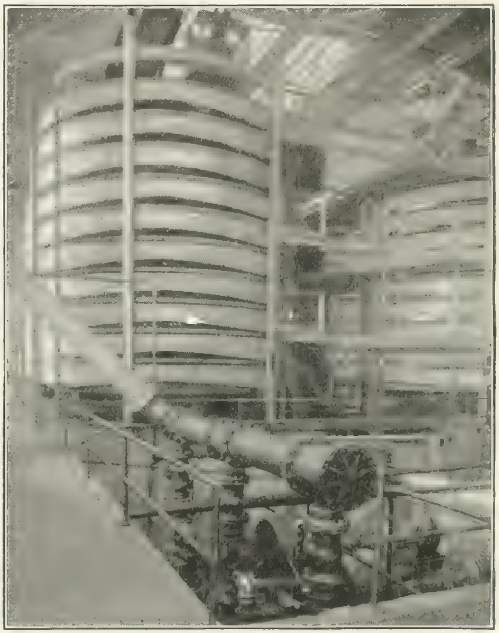
The Ray Consolidated Copper Co., at Ray, Ariz., has installed an oxyacetylene-welding machine made by the Economy Welding Machine Co., Kansas City, Mo. This is used almost daily on small jobs welding various parts made of cast iron, steel and brass. No large jobs have yet been undertaken. Mr. Cates directs attention to the fact that "the insurance underwriters claim that 10% of the oxyacetylene machines explode each year" and that in installing them a concrete building should be provided, and that the oxygen generator should be housed in one cell and the acetylene generator in another so that there shall be no mixing of these gases except through the proper tubes.

STRENGTH OF WELDS

Concerning the strength of oxyacetylene welds, A. Campion and W. C. Grey reported[1] at the Conference of Shipbuilders and Engineers the results of a series of experiments which they made. They state that the tensile strength of welded mild-steel bars (0.25% C) varied considerably, showing an average strength of about four-fifths and a ductility of about one-fifth of the unwelded steel. Repeated impact tests made in a Stanton machine also gave variable results. Hammering was the most effective treatment for increasing the fatigue-resisting properties of the material, but the hammering should be done with the metal at full red heat (800° C.) to remove strains and brittleness which might result from hammering the comparatively cool metal near the weld. Reheating and annealing alone did not increase the fatigue resistance of the welded portion. The form of treatment which gave the highest strength in tension gave the lowest results in impact tests. Fracture tests in the overheated portion of the metal adjacent to the weld gave even more variations than the test at the weld itself, but reheating to 800° C. restored the material nearly to its original strength. Impact tests on places of different thickness showed clearly that the thicker the plate the less reliable the weld and the greater the reduction in strength. These investigators concluded that autogenous welds must always be regarded as somewhat uncertain and therefore should be accepted with extreme caution, if not entirely prohibited, in cases where failure would tend to endanger life or limb.

The experience of the mining operators varies as to the strength of oxyacetylene welds, some estimating them at 50%, while others considered them as strong as the original parts as no further breakage occurred. Much undoubtedly depends on the skill and care of the operators. Welds that look good on the outside may not be at all well done and may fail in service. The application of the heat and the complete fusing of the metal without burning require a high degree of skill, and the success of a weld is almost wholly in the hands of the operator.

The enumerations of the work performed by the above mining companies with the oxyacetylene torch are sufficient to show that it has an important place in mining work, not only in getting operations going again after a breakdown but also in new construction, as reported at Great Falls, and in the building of the circular launders for the round-table plant at Anaconda. Contractors in laying pipe have used oxyacetylene apparatus for joining the lengths, instead of couplings, and this may indicate possibilities in connection with the water supply of mining companies, and especially in making changes in the pipe line without waiting for new fittings to arrive. New buildings have been piped in this way without the use of any fittings, but it is impracticable within the scope of this article to indicate all the possibilities of acetylene welding. It is merely desired to show what some mining companies are doing with acetylene welding and where others may profitably apply this process.



THE CIRCULAR LAUNDERS WERE CONSTRUCTED WITH THE OXYACETYLENE TORCH

There were about 35,000 lin.ft. of welding done with the oxyacetylene apparatus in constructing the launders for the 20-deck tables in the round-table plant at Anaconda. This method was found cheaper and better than riveting, as it makes a water-tight launder.

*

Chino Copper Co.

The report of the Chino Copper Co. for the last quarter of 1914 shows a production of 8,935,585 lb. of copper: 3,060,000 lb. in October, 3,047,694 lb. in November and 2,827,891 lb. in December. Total production of copper in concentrates for the year was 51,748,254 lb. There were no crude-ore shipments in the last quarter, but from previous quarters of the year 2,093,723 lb. were thus produced.

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[1] "Times Engineering Supplement," July 31, 1914.

Of the 347,200 dry tons of ore treated in the fourth quarter, 35% came from the North orebody, 2.1% from the Northwest orebody and 62.9% from the South orebody. Average copper content of the ore treated during the quarter was 1.8612%, and average extraction was 69.14%, corresponding to a recovery of 25.736 lb. of copper per ton of ore treated.

Cost per pound of net copper produced, after allowing for smelter deductions and without allowing any other credits, was 8.14c. By allowing all credits from miscellaneous sources, the cost of copper is reduced to 7.71c. per lb. These costs include all charges, together with 30c. per ton of ore treated for the extinguishment of mine development and stripping expense.

Net surplus over dividend requirements for 1914 was $1,024,449. During the last quarter 603,871 cu.yd. of material in place was moved, of which 413,099 cu.yd. were stripping and the remainder ore. Earnings are based on a carrying price of 11.08c. per lb. for copper, during the quarter.

*

Economics of the War

In an address on "The Political Economy of the War" at Sheffield, Jan. 22, Francis W. Hirst, editor of the *Economist*, said that at the commencement of the war he estimated that it would cost the leading belligerents about $50,000,000 a day, made up roughly as follows:

Russia	$12,500,000
Germany	12,500,000
France	8,750,000
Austria	8,750,000
Great Britain	7,500,000

Now that 170 days of the war had passed, Mr. Hirst said, it meant that the war had cost Europe $8,500,000,000, of which amount Great Britain had contributed $1,275,000,000. This was only the direct financial cost.

The computation left out the expenditures of the Belgian, Servian and Japanese Governments, as well as the millions which had been raised by various neutral countries in mobilization and war preparations. It left out altogether the indirect losses of commerce all over the world and the actual destruction of property in Belgium, France, East Prussia, Russian Poland and Austrian Galicia.

Worse still, it omitted that awful item, the capital value of men killed or maimed or dead of disease in the prime of their manhood. Actuaries whom he had consulted put the average value of an English soldier at not less than $1000.

On the Paris Bourse, at the end of 1914—business having then been resumed since Dec. 7—the average price of fixed-revenue securities, as figured out by the *Economiste Francais*, was 12 to 15% lower than at the end of 1913. The *Economiste* assumes this to mean a rise of at least ½% in the average cost of capital. But it adds:

> A decline of 12 to 15% in prices does not seem anything enormous, if one considers the huge emissions of home and foreign government securities which are under way. In October it was estimated that, if the war were to continue seven months (which would have fixed its termination around the end of February), the direct war expenditure of all the belligerents combined would have been 50,000,000,000 francs.
>
> The outlook now is that the war will last four or five months longer—say to the end of June. It is undoubtedly impossible to make anything like exact calculations in such matters. But the direct losses of the war up to such a date, combined with the public loans of belligerents and neutrals arising from the war, seem bound to reach at least 80,000,000,000 francs, and they may approach a hundred thousand millions.

In American values, this would be $20,000,000,000. In 1907, when explaining the reason for the strain which then existed on all the world's stock exchanges and money markets, M. Leroy-Beaulieu, in the *Economiste Francais*, estimated that new capital accruing in the civilized world each year, available for investment in securities, was $2,400,000,000. There had been, in 1907, he added, a demand for much more; "but the world has not got it; therefore, it cannot provide it." Yet in this present season, since the end of August, the German Government has borrowed $1,100,000,000 on a war loan and the British Government $1,750,000,000; so that in hardly half a year, more capital has been called for, by only two governments, than the French economist's estimate of a full year's available sum of new capital in all the world.

A writer in the New York *Evening Post* is an exponent of more optimistic views. He says that it is possible to view the extraordinary financial contingencies of Europe with something of equanimity. Reverting to the question of human initiative, it is a fair assumption that the burdens of debt and taxation which Europe is now assuming may prove a stimulus rather than otherwise. It is at least an admissible theory that the more the European Governments take from their subjects in the way of taxation, the harder their subjects will work to offset such a burden by increased industrial gains. This was certainly the case in England after 1815 and in France after 1871. To sum it all up, the best sentiment is that this is a very rich world and that it is not going to be disastrously impoverished by this war; that both here and abroad, everyone is going to be keener than ever before to get down to work; and that Europe, instead of selling us out, will be eager to cultivate closer and more binding financial and industrial relations with us than in the past. This is looking at the situation in the largest way. If one looks at it in any other way, he finds himself in a maze.

The fairly prosperous situation of Russian industries, as reported by the Minister of Finance, and the highly beneficial results of the prohibition of vodka have recently been mentioned.

We have upon several occasions referred to the economic aspects of prisoners of war. Bearing upon this subject it was announced from Essen, Feb. 11, that the Westphalian coal-mine owners had reached an agreement with the military authorities for supplies of prisoners of war to work their mines, this step being taken in order to relieve the scarcity of labor, which has become acute within the last few months. The mine owners have been trying in vain to keep the production of coal equal to the requirements of the market. These have increased as a result of the big demands for military purposes. The owners have not been able to produce coal as fast as it was wanted, and they will now be supplied with prisoners of war to help. The military authorities purpose to select from among French, Belgian and Russian prisoners men who have previously worked in mines. Camps for their accommodation already have been established in the coal-mining districts.

*

A Short-Line Railway in Chile is planned between Talagante on the San Antonia, Melipilla and Santiago line, and Paine, on the Longitudinal Ry., according to "Commerce Reports."

Effect of Increased Reduction on Blake-Type Crushers

By Milton W. Heller*

SYNOPSIS—Reduction of the size of crusher product by setting the jaws close together is wasteful of power. A more economical installation is a machine adjusted to crushing requirements and operated at maximum efficiency. Much error is current regarding the capacity of crushers when making different products.

At few mills has it been necessary to work crushers up to their maximum capacity. The fact that in most cases the crushers are fed by an amount of material limited by the capacity of the following machinery, is perhaps the most significant reason for this. In other instances, a liberal allowance has been made in the selection of the crusher.

Whether the crusher be worked to capacity or not, a saving in power cost can be effected by the installation of the smallest possible machine. The crusher at its best is a cumbersome piece of machinery with heavy moving parts. It has been found that approximately 70% of the power used on the crusher is used when the machine is running empty. If it is considered that perhaps 50% of the run-of-mine material requires no breaking on the large first crusher, the possible capacity, indicated by the mouth size of the crusher, is not used, and for a great part of the time the crusher turns over doing no work and there is a consequent loss of power.

The disregard of these facts has led to the installation of larger crushers than required. To economize this lost power some plants have tried to increase the amount of reduction. As the machine was originally underloaded, no doubt it would handle the load put on it, but this condition was long since expressed by W. P. Blake:

"When importance of getting a finer product leads in many cases to setting the jaws closely together, which, of course, increases the friction and wear upon the lower parts of the faces of the jaws, and it may be said that although by setting the jaws very close together . . . a larger amount of fine stuff can be produced by an ordinary rock breaker, it is not an economical use of the machine, which was never designed to be so used."

What then are the factors controlling this degree of reduction and along what line should crushers be designed to meet these demands in the most satisfactory way?

Admitting that a crusher working all the time at breaking rock is working more economically than if it were running idle for part of the time, it is essential to have a crusher of the smallest size which will have the required capacity.

Heretofore it seems that mill men have closely connected "mouth-size" with the capacity of the crusher, and manufacturers have followed lines that would satisfy this idea. Only vague guesses are given as to the effect of a variation in the size of product upon the output, and in all instances, these guesses favor the machine. Of several standard types, the actual gap fails to meet the stated mouth-size, the measurement having been taken between favorable points, and a "trade" standard given. This is more apparent in the larger sizes, where the increase of mouth-size greatly increases the amount of iron put into the machine. One 13x24-in. machine was found to measure 11½ in., and a 15x24-in. measured only 13½ inches.

Given a certain size crusher operating at a given speed and power, the capacity of the machine will depend only upon the time necessary for the rock to pass through the jaws. This time depends upon three factors; the time consumed before the jaw makes the first break; the breaking character of the rock, i.e., the number of pieces formed per break, and the size of the discharge opening.

The relation of the amount of fine stuff going through compared to the amount that must have actual work done upon it, would not influence the result appreciably, for at the high rate of vibration of the machine, 300 r.p.m., the fine stuff cannot cling to the larger pieces, but has free passage.

Obviously in a machine making 300 r.p.m and traveling but a short distance, the effect of the impact of the jaw is not great enough to break the piece. If the piece is not gripped and squeezed, perhaps the maximum result is breaking of the edges so that this grip can take place. The time taken before a piece is nipped is of greater importance than is generally recognized. A few seconds at most on one piece will rapidly amount to something as thousands of pieces go through.

Richards, in his "Ore Dressing," Vol. I., p. 94, shows mathematically that with a coëfficient of friction of 0.3, rolls will take a particle when the angle of nip is approximately 16°. The theory holds likewise in a Blake-type jaw crusher when the resultant breaking force passes below the center of gravity of the piece. It should be remembered that whereas in the rolls the force keeping the piece in the zone of action is the difference of frictional force on the roll and the component of the normal force tending to throw the particle out, the force keeping the piece in the crusher in the zone of action is likewise the difference of the frictional force, holding the piece against its movement up the jaw and the component tending to throw it up.

When it is observed that the material fed to crushers is for the most part wet, as it comes from the mine, or dampened to reduce the dust, it is apparent the water exerts a lubricating effect, which is further augmented should any clayey material be present. This condition might at any time bring the coefficient of friction down to 0.2. Again using Richards' formulas, the angle of nip would have to be 11° or under before a bite would occur.

The great variety of shapes and sizes fed to a crusher, as compared with the rather uniform product to the rolls, would indicate that whereas a roll operating with an angle of nip of 16° is just on the danger point, a crusher so operated would have exceeded it. From this reasoning it would appear correct that the angles between the jaws of a crusher should not exceed 12° to work near its utmost capacity.

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By referring to the accompanying table, it is readily seen what degree of reduction under present standard measurements of construction will bring the jaw angle about this limit:

DEGREE OF REDUCTION AND JAW ANGLE

Size of Crusher, In	Actual Width Opening, In	Length Vertical Jaw, In	Set to Crush to, In	Angle Between Jaws
4x 7	4	12	½	15° 50′
			1	13° 45′
			1½	11° 50′
			2	9° 25′
7x10	6¼	17½	1	16° 30′
			1½	15° 0′
			2	13° 15′
			3	10° 30′
9x15	8¼	24	1½	15° 25′
			2½	13° 10′
			3	12° 0′
			4	9° 30′
10x20	8½	26	1½	14° 40′
			3	11° 30′
			4	9° 40′
13x24	11½	33	1½	16° 30′
			3	14° 15′
			4	12° 30′
			5	11° 0′
15x24	13½	33	1½	22° 30′
			2	21° 45′
			3	20° 30′
			4	18° 30′
			5	17° 15′
			6	15° 20′
			7½	13° 30′

The manufacturers, no doubt, have exceeded this angle because it gave them the mouth-size that was sought for the least cost. The direction that has been taken to increase crusher capacity has been to make a wider jaw. It would have been better if the jaw angle had been made smaller, and the additional iron put into the height of the jaw, rather than the width. The second point, the breaking character of the rock, is important, but is a character outside of our control.

It is readily admitted that a decrease in the size of the discharge opening will reduce the capacity. This amount of reduction is, however, greatly underestimated. Extending the principle given by Richards in Vol. I, p. 35, of his "Ore Dressing," we may argue that in a 15x24-in. breaker, if one 15-in. cube reports at the mouth in 125 3-in. cubes, then the capacity at the mouth is 125 times that at the throat when breaking to 3 in. If, now, the crushing be reduced to 1½ in., there would be 1000 cubes produced, and the capacity would be 1000 times greater at the mouth than at the throat. The capacity, then, in the second case would be theoretically but one-eighth of that in the first case.

With the smaller opening there would be a proportionally larger amount of material that would have to be worked on, as with a smaller opening the probability of more stuff being smaller than that opening would be increased. This would have an added effect in reducing the output. As an illustration of how much this capacity reduction is underestimated, apply the principle stated to the catalog capacity of a 15x24-in. crusher:

COMPARISON OF CAPACITIES

Approximate capacity for 24 hours

Break to	3 in	2½ in	2 in
Tons	600	480	420

THEORETICAL

Break to	3 in	2½ in	2 in	1½ in.
Tons	600	347	177	75

An analysis of a catalog table will show the error of basing estimates upon the figures given.

APPROXIMATE CAPACITY IN TONS PER DAY OF 10 HOURS

Size	Tons	In	Tons	In	Tons	In	Tons	In
I 7x10	50	2	40	1½	25	1	15	¾
II 9x15	120	2½	100	2	80	1½	60	1
III 11x18	200	3	175	2½	150	2	100	1½

In case I it is seen that a change from 2-in. to 1-in. product gives 0.5 the output; from 1½ to ¾ in., 0.37 the output. In case II, a change from 2 in. to 1 in. gives 0.62 of the output. In case III, a change from 3 in. to 1½ in. gives five-tenths (0.5) the output.

There is no consistency in the table, the intermediate size showing less cut than the one larger and the one smaller. The table is in all probability no more than a guess.

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The Rennerfelt Electric Furnace

A type of electric furnace that is making great progress in Sweden, Norway and Russia is the Rennerfelt, which is an economical small furnace for crucible works, steel foundries, copper, alloys and chemical processes requiring high temperatures. The principle is applicable to small units of 100 kg. as well as to larger sizes, and it is claimed that it may be applied to the really large steel

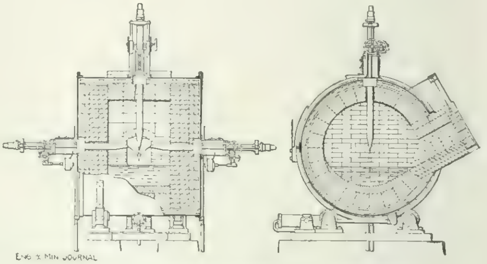

Fig. 1. Arrangement of Electrodes

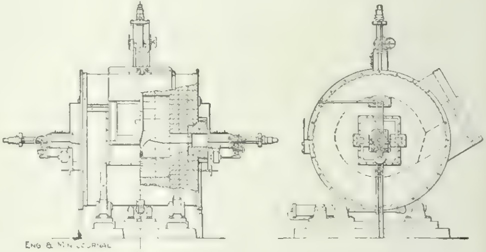

Fig. 2. Side and End Elevation

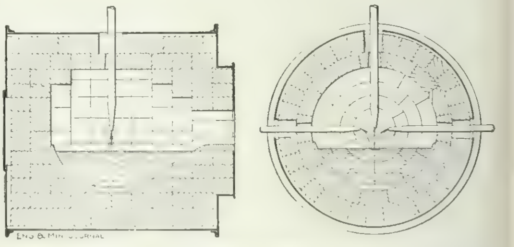

Fig. 3. Modified Form of Furnace

furnaces of 50 tons or even more. It is due to Ivar Rennerfelt, a Swedish engineer who in 1912 constructed at Hallstahammar, in Sweden, a type of furnace which operated so successfully that within a year a steel foundry containing four of them was erected, and up to January, 1914, 15 furnaces ranging in size from 300 kg. to 3 tons capacity were put into operation or ordered in various parts of Europe.

The construction of the Rennerfelt furnace may be studied by reference to Figs. 1, 2 and 3. It is preferably built with a horizontal cylindrical steel shell rolling in cradles or tilted round the horizontal diametrical axis. The furnace is lined with silica, coke or magnesite brick, according to the work for which it is intended, and a closely fitting charging and casting door is placed in one side or at each end of the furnace. The current is admitted by three electrodes. One central electrode descends vertically from the crown of the roof, and on each side of it is a horizontal electrode entering through the sides of the furnace. In Fig. 1 will be seen an arrangement of electrodes with the side electrodes sliding in fixed holders, but adjustable axially by hand or power. In the cross-section of the furnace in the same figure will be seen the charging and casting door placed in the circular wall. Fig. 2 shows the furnace in side and end elevation. Electrodes adjustable vertically are preferably used where the furnace is employed for melting light scrap requiring considerable space below the arcs before it is melted. This arrangement allows the operator to run the furnace with free-burning arcs independent of the volume of the charge, or with arcs in contact with the metal if it is required to use the method of heating employed in the types of arc furnaces previously constructed. A modified form of the furnace is shown in Fig. 3. Here the charging door is at one end and the horizontal electrodes are placed on the shell in the position shown by the transverse section. In ordinary practice, the electrodes do not come into contact with the slag or steel, the arcs being free burning and ensuring smooth working when melting cold scrap. This has always been a difficult operation, especially if the furnace is supplied from a small power plant.

Three-phase current of any voltage or frequency is passed into a transformer arranged for Scott's methods of phase transformation, changing the energy into a balanced two-phase current delivering single-phase current to each of the horizontal electrodes, a return cable connecting the common points of the two phases with the central electrode. Where possible, of course, two-phase current can be directly used. The currents entering through the horizontal electrodes neutralize one another, but the action of the returning current into the central electrode generates a field of force deflecting the arcs into an inverted arrow-head. This form of arc is one of the reasons for the success of the Rennerfelt furnace, as the heat generated in the arcs is more concentrated down upon the bath, although the electrodes do not touch or even approach the slag or metal. The arcs sweep or brush all over the central spaces underneath the points of the electrodes, heating the charge uniformly and rendering the slag fluid and chemically active. The height of the arcs from the point of the electrodes to the surface of the bath can be adjusted, but is usually kept from 6 to 12 in. Smaller furnaces are tilted and discharged by hand lever and a ratchet movement, while larger ones are operated by power.

This furnace is really a large internally heated crucible capable of being charged either with cold or liquid metal. If the former, the metal is charged into the preheated furnace either with or without flux, and during the charging, in order to prevent injury of the electrodes, the latter can be drawn back or raised. When charged the electrodes are adjusted to their proper position, the door closed and current turned on. The cold charge chills the furnace considerably and therefore a good deal more power is used at the start, this being gradually reduced as the brickwork is heated to avoid injury to the lining by overheating. Rapid melting takes place, the metal being covered by an unbroken sheet of slag, protecting it against any oxygen in the furnace. As a rule, however, the atmosphere is either neutral or strongly reducing, since it is charged with carbon monoxide. As the door is closed outside, air is not admitted during operation until the charge is ready for testing. Samples of the steel are then taken and alloys added as may be required. Lime, slag, sand or fluorspar, together or separately, are added, fused and skimmed off, absorbing practically all phosphorus and sulphur. The number of slag renewals depends on the quality of the raw material and the results required. When the heat is ready, it is poured, this being at a temperature much higher than is obtained in an openhearth furnace, so that the steel has often to be cooled in the ladle to a temperature at which it can be cast without burning the molds or spoiling the castings. Perfect deoxidation is then easily obtained, and hence splendid castings or ingots free from blow-holes or piping are obtained. After tapping the heat, the bottom and slag line are fettled, if necessary, with ground dolomite or ganister, the fettling is sintered by turning on the power, and a new heat is charged. For an output of 20 or 30 tons per day of 24 hr., one melter and two laborers per shift are required.

In the strongly braced steel shell is an insulating lining of asbestos board; either silica or first-quality firebricks in rings are built up against the board forming the bedding for the actual acid or basic lining, which is made of special bricks set in rings of different diameters, forming an egg-shaped interior melting chamber. The bullseye round the charging door is fitted into the lining, and where the electrodes enter, special bricks are provided to form circular openings. The furnace with basic roof and hearth has run 102 heats on cold charge without needing any repairs beyond the ordinary fettling, and a furnace with acid roof and lining, operated continually day and night for 2½ months on cold scrap for acid tool-steel, ran not less than 174 heats. The temperature in the basic was kept considerably higher than in the acid furnace. Although the radiating heat from the arcs is reflected on to the bath from the entire incandescent inner surface of the vault, the arcs are at such a distance from the roof that the danger of melting it is minimized, and the shadow of the vertical electrode has a protecting influence on the portion round the entrance opening for the electrode, which is a most vulnerable point.

The roof, side walls, and bottom are all built together in one continuous curve. The arch is strong, and the effects of expansion and contraction of the lining are much reduced. The furnace is small compared to its capacity, and to facilitate relining, the cylindrical shell is divided into an upper and lower half, bolted together after lining. The electrodes are held with a loose fit in water-cooled insulated phosphor bronze or copper boxes or holders, those for the horizontal electrodes being preferably adjustable in the vertical plane. The power cables are attached to the electrode holders, current being transmitted by means of sliding contacts or brushes. For a 600-kg. furnace the electrodes measure 2 in. in diameter, and for a 2-ton furnace 3 and 4 in. They are Acheson graphite electrodes, that is, of amorphous carbon, electrically converted into graphite. The electrodes are turned to diameter and made continuous by threaded sockets and dowels, the new section of electrode being screwed on to the section at work. For smaller furnaces the electrodes, which can be touched without shock, are fed by hand, while in the larger furnaces automatic feeding is used. In a 600-kg. furnace running continuously on charges of cold scrap and pig, the average electrode consumption is about 2.8 kg. per ton of steel. Even when melting pig iron and afterwards decarbonizing it by means of ore, the consumption of electrodes has not exceeded 3 kg. per ton of steel in spite of the highly oxidized slag carried on the charge. The wear of the side electrodes in a small furnace with acid lining using side electrodes of 2-in. diameter, amounts to about 1 in. of electrode per hour. Three such electrodes being used, the wear of the electrodes in 24 hr. equals about 6 kg. With the furnace at full power, five heats of 600 kg., or three tons of steel, are produced per 24 hr., making a consumption of electrodes of two kilograms per ton.

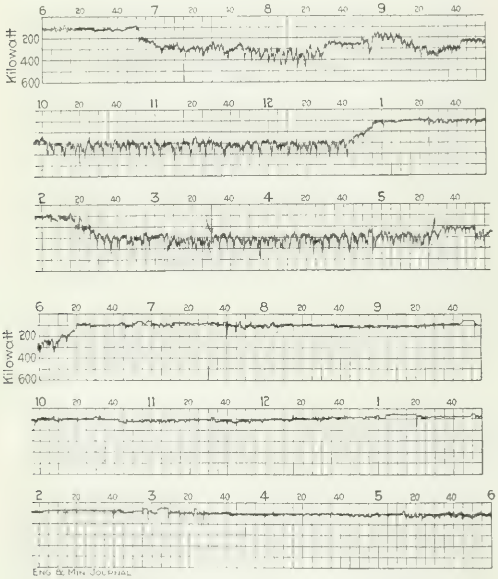

Fig. 4. Performance Curves with Furnace Running on Tool Steel

Fig. 4 shows curves of the performance of the furnace when melting cold scrap obtained from a 600-kg. furnace running on tool steel at Trollhättan. The furnace is normally rated at 125 kw. but only about 100 kw. are required. It runs night and day on cold charges, drawing power from an adjacent government power plant. Certain portions of the curve are affected by the operation of some rolling mills, causing strong fluctuations in the power curve in spite of heavy flywheels. The curve is rather peaky when the rolling mills are on, but comes down almost to a straight line at night and noon, when the furnace alone is working. The peaks of the furnace are comparatively low and rarely exceed 50% of normal load. The $1\frac{1}{4}$-ton furnace is rated at 200 kw. and is operated without automatic regulators or similar protective apparatus, receiving the surplus energy from a hydro-electric power plant of about 800 hp. capacity. An ordinary oil switch with time relays is used to give sufficient protection to the generators, a circuit-breaker being set to work at 400 kw., or double normal furnace load. The furnace works like a large inclosed arc lamp practically without any disturbing influence from the charge underneath the arcs. As regards phase displacement, in one instance $\cos \phi = 0.97$, with a furnace operating with a current of 50 periods. With regard to efficiency, a small furnace of 600 kg. at the Ljusne Iron Works melts and refines a full charge of cold scrap with not more than 700 kw.-hr. per ton. The normal rating of a furnace of this capacity is 125 kw., but according to records 80 to 90 kw. are enough to complete a 600-kg. heat in five hours. This gives a satisfactory thermal efficiency even when running with only 75% of full load. White pig iron has been melted in the same furnace under similar conditions with 405 kw.-hr. per ton. In one instance, gray pig iron was melted and overheated with 425 kw.-hr. per ton including the melting of 22 kg. of basic slag per ton of iron, indicating a furnace efficiency of about 70%. Under very favorable conditions, it has been found possible to melt gray pig iron with about 300 kw.-hr. per ton in a 600-kg. furnace, equal to a thermal efficiency of 85 to 90%. This high figure for such a small furnace can be explained by noting that the efficiency of the electric furnace is greater at lower than at the higher temperatures required for refining steel. If pig iron is rapidly melted in a high-power furnace designed for melting steel, the furnace efficiency shows a marked increase on account of the shape and position of the arcs. Owing to the circular form of the vault and the thermal insulation used, the Rennerfelt furnace is particularly suited for rapid melting with a minimum loss and it constitutes an important contribution to the apparatus applicable to electrometallurgical work. We are indebted for the above information to the Aktiebolaget Elektriska Ugnar, of Stockholm, Sweden, which has successfully developed this new type of furnace.

Forfeiture of Mining Claims

By A. L. H. Street*

The rule that where the locator of a mining claim fails to perform required assessment work during a year, he cannot by afterwards doing it restore his rights, where in the meantime the claim has been relocated by another person, was applied the other day by the Arizona Supreme Court in the case of McDonald vs. McDonald, 144 *Pacific Reporter* 950. In this case it was held that claims became forfeited midnight, Dec. 31, where work for the preceding year was not done until Jan. 16 following, and in the interim defendants had made a relocation.

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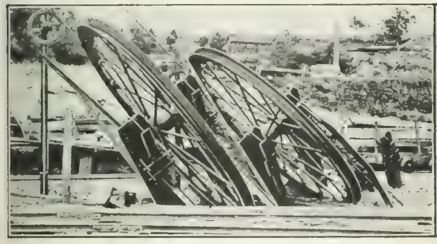
Design of Angle-Sheave Frames--II

By Floyd L. Burr*

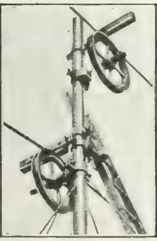
SYNOPSIS—Examples of recent construction at the Penn shafts. At a West Vulcan shaft a double turn required one type-1 and one type-2 frame. Ropes passed through old dump in discarded steel stacks as conduits. Old frames had to be kept in service while construction proceeded and the old ropes were carried through holes cored in the new concrete piers. At Curry shaft a type-1 frame carries sheaves high in the air. At the East Vulcan a type-4 frame entirely of concrete has just been completed; unusual method of establshing the position of the members.

A recent installation at "C" shaft of the West Vulcan mine gives an illustration of angle-sheave frames of type 1, following the classification presented in the first installment of this article, and also of type 2. The hoisting ropes emerging from the hoist house travel about 80 yd. toward the east, thence a similar distance to the north to a point near the base of the headframe and thence in a westerly direction to the headsheaves. There are the cage rope and the skip rope to care for at present; and it was necessary to make provision for a skip-balance rope and a cage-balance rope which may be installed at some future time.

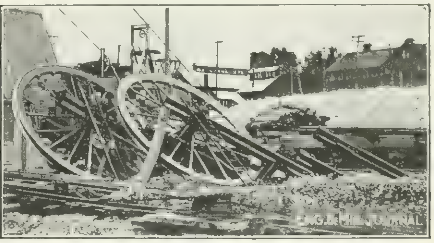


West Vulcan C Shaft Type-1 Frame

Looking northeast. Ropes shown rising to headframe, guided by pulleys on boiler-tube mast.



Guyed Boiler-Flue Mast for Idler Pulleys



West Vulcan C Shaft Frame

Looking northwest. Frame at right provided for a future 6-ft. skip-balance sheave.

In their travel to the east and north, the ropes run extremely flat, while in rising to the west toward the headsheaves they are steep. The conditions thus called for a type-2 frame for the first turn, that nearest the hoist, and a type-1 frame for the second. These new frames were to replace old decayed wooden structures and had to be built and made ready for use before disturbing the old ones. It was also necessary so to arrange that there should be no interference with the run of the ropes into the old structures and in the case of the type-2 new structure these ropes had to run through the frame—indeed, through holes cored in one of the concrete piers. These onditions fixed rather closely the positions of the intersection points, the exact positions horizontal and vertical being chosen arbitrarily.

Type-1 Angle-Sheave Frame at the West Vulcan

Type-1 structure consists of a concrete base with its top flush with the ground surface, from which emerge three steel frames. Each frame is to support a sheave, one each for the cage, the skip, and the skip balance. A separate structure will be built in case the future demands a cage balance. Each frame consists of a pair of steel members crossbraced together rigidly below the open space occupied by the sheave and provided with crosspieces at the lower end for anchorage into the concrete. The concrete base slab is about 7 ft. deep; the steel members reach nearly to the bottom and extend above the concrete to a point just above the bearings of the sheave wheel. The balance-rope sheave not yet installed will be 6 ft. in diameter while the others, which are in service, are 10 ft. The intersection points were placed at an elevation about flush with the ground level. Each member is made up of an I-beam with a channel riveted to its upper flange, giving stiffness in two planes. The bearings for the sheave rest upon the upper flange, or channel web, and are attached by bolts which reach through the bottom flange. Angle-steel braces are attached to these members near their upper ends and reaching down to auxiliary anchorage piers help to stay the main members against the bending stresses which occur by reason of the eccentricity of the position of the center of the sheave. This placing of the bearings on one flange of the members is not a thoroughly satisfactory detail and in future installations an attempt at improvement will be made. The center of the sheave and the resultant should coincide with the plane of the center lines of the members, and thus do away with practically all bending moment.

The concrete base was proportioned so that the portion contiguous to each frame should be heavy enough to resist the tendency to lift, corresponding to the vertical component of the resultant. The rope stress considered was the breaking load of a 1¼-in. "extra-strong cast-steel" rope. The steel frames are designed to withstand the stresses arising from the same load.

Of course, a set of computations was made for each sheave to determine the quantities ϕ and θ for that particular sheave. Each of the three frames was thus a problem by itself for computation and erection. In the designing of the layout it was necessary to make sure that there should be no interference between any two wheels, their frames or their ropes.

The concrete base being all below the ground level, the placing of the concrete was exceedingly simple. The mixer was set up at one edge of the excavation and after the steel members had been placed in proper position the concrete was merely poured direct from the mixer into the forms—the excavation was in an old rock fill and would not stand without form work. About 75 cu.yd. of concrete was consumed. Considerable irregular reinforcement was placed in the concrete with the idea of binding it together to act as one mass and suspend it from the steelwork. This reinforcement consisted of old steel rope $1\frac{1}{8}$ in. or $1\frac{1}{4}$ in. in size. A force of nine men spent one and one-half days at the work of actual concreting. The mixer used was a skip-loading No. 11 Cube machine, operated through gearing by an electric motor.

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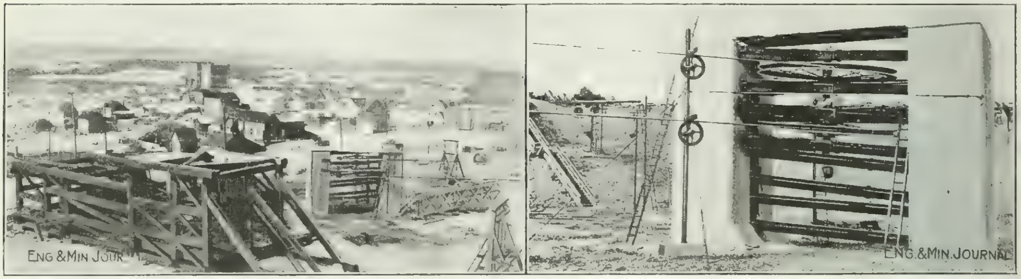
*Structural engineer, Penn Iron Mining Co., Vulcan, Mich.

The ropes approaching these sheave wheels from a lower elevation had to run under the surface of the ground for about 35 ft. from their intersection with the slope of the hill.



West Vulcan "C" Shaft Type-2 Frame

Looking southwest, showing relation between old wood frame and new concrete frame. Note wood concreting tower lying on ground; holes in concrete piers for old ropes; and old wood pulley stands.

Note idler-pulley masts in foreground; steel-stack conduits and type-1 frame in background.

The elevation of the intersection points was purposely fixed so that the ropes would enter below the surface in order to pass under the rock and ore tramway tracks. It was not practicable to build concrete tunnels or conduits for the ropes on account of their position about 15 ft. above and directly over an old tunnel through which the old ropes entered the deep pit containing the old angle sheaves. Therefore it was decided to let the ropes run each through a sleeve or conduit consisting of a length of old discarded 36-in. steel stack. These pieces of stack were suspended from stringers spanning the old tunnel and uncertain ground. After the ropes were put into operation in the new sheaves, the old pit and tunnel were filled with waste mine-rock up to and over the conduits. The extreme depth of the ropes below the surface is about 4 or 5 ft. at the edge of the bank and of course at the point of entering the sheave is nothing.

Type-2 Structure at West Vulcan

Type-2 structure consists of a concrete base 12 ft. wide, 25 ft. long, and 5 ft. deep, surmounted by two concrete piers 16 ft. high by 8 ft. wide by 5 ft. long. The top of the base is flush with the general ground surface. The piers are placed symmetrically with the center lines of the base and there is $12\frac{1}{2}$ ft. clear space between them. The long center line coincides approximately with the lines of the resultants and lies in a northwest-southeast direction. Thus there are the "northwest pier" and the "southeast pier." The sheaves, which are 10 and 6 ft. in diameter, are supported by pairs of steel members located one above another and spanning the distance between the two piers. Provision has been made for four sheaves though there are now only the two main sheaves installed. The supports for the 6-ft. sheaves are only partially installed and will be completed whenever needed.

Tension in the ropes produces compression in the steel members which push against the northwest pier, tending to bend and break it, to tear it off from the base and to tip the whole structure, base and all, over toward the northwest.

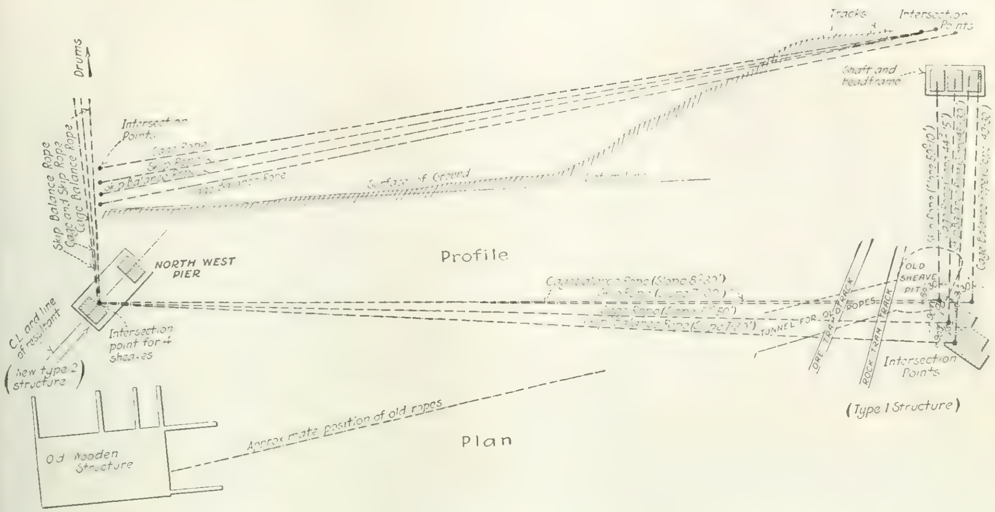
The situation of this structure bears such a relation to the mine workings below that there is a possibility of some settlement. For this reason it was considered necessary to build so that the steel members could upon occasion be removed, rearranged, and put back, in case settlement should occur so as to affect the sheaves more than could be adjusted for by blocking up their bearings. To accomplish this purpose, the steel members are not embedded into the two piers but merely butt against them. They are attached to the piers in such a way as to have their dead weight and that of the sheaves supported. A small space is allowed for the expansion of the steel so as not to put a compressive stress therein nor to put an additional overturning moment or spreading force on the piers.

The northwest pier is calculated as a cantilever from the base slab to safely resist the stressing effects of the breaking of the upper rope while the other three ropes are carrying their working load. The hoisting ropes in use are $1\frac{1}{8}$-in., but $1\frac{1}{4}$-in. ropes were assumed in the computations. The balance ropes were assumed to be $\frac{7}{8}$ in.

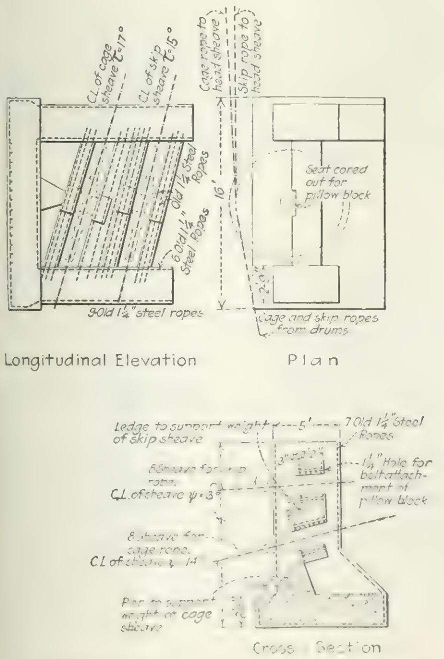
The base slab was reinforced top and bottom to insure its acting as one piece. The northwest pier was reinforced as a cantilever, the reinforcement being continuous with that in the base. This reinforcement consists of discarded $1\frac{1}{8}$-in. and $1\frac{1}{4}$-in. steel ropes. These ropes were used rather lavishly. It was found convenient to let them run up into the southeast pier much as in the northwest pier, so that it is actually reinforced, though there is no definite requirement for such reinforcement. The function of this southeast pier is to furnish weight for stability of the whole structure and to support the dead weight of the steel frames and their sheaves. It also serves to resist its share of any incidental lateral stresses.

Method of Construction

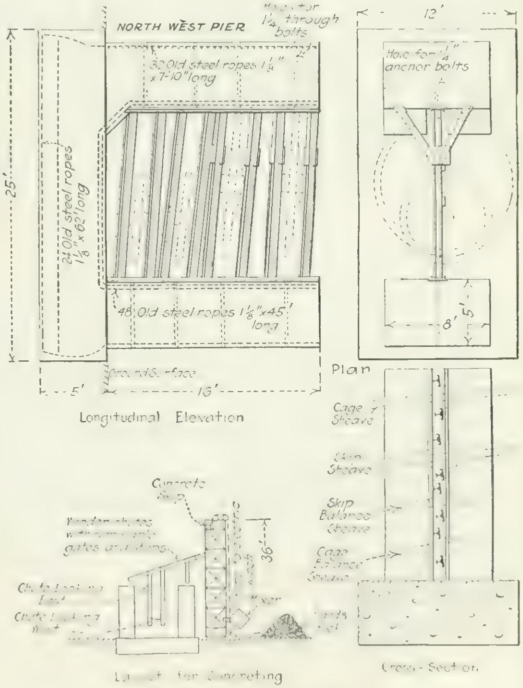
The pit for the base having been excavated and forms for the piers erected, a series of long ropes were laid



LAYOUT OF ANGLE-SHEAVES AT "C" SHAFT, WEST VULCAN MINE.



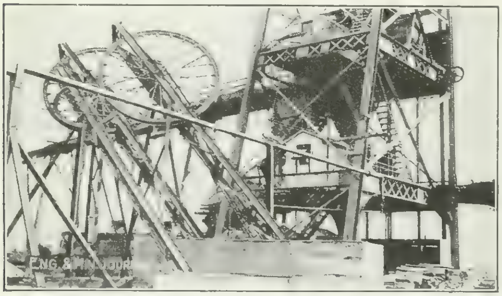
CONCRETE ANGLE-SHEAVE FRAME AT EAST VULCAN MINE.



CONCRETE AND STEEL ANGLE-SHEAVE FRAME AT WEST VULCAN MINE.

SOME OF THE PENN IRON MINING CO.'S ANGLE-SHEAVE FRAMES in a longitudinal direction in the bottom, then about 18 in. of concrete was placed embedding the ropes about 2 or 3 in. from the bottom. Also at each end, there were embedded certain anchorages made of old rails. These supported horizontal rails at the inside points of junction between the piers and the base. They were to serve a little later to take the strain arising from tightening the inside face ropes.

The ends of the long ropes, the middle portions of which were now embedded in the 18 in. of concrete, were picked up and some of them drawn up tightly into the pier forms near their outside faces. Their upper ends were wired to strong wooden beams which had been supported by bents over the forms. The rest of these ends were laid back on top of the 18 in. of the concrete, to be embedded into the bottom of the remaining 3½ ft. of base. It should be mentioned that in casting this 18 in. of base, scrap rails and rods were embedded vertically here and there to bond to it the remaining portion of the base.



THE HIGH TYPE-1 FRAME AT THE CURRY SHAFT

The other series of ropes was now put in place. These followed down the inside face of one pier form, then behind the anchorage bar mentioned above, thence horizontally across the intervening 12½ ft. to the other pier at an elevation a few inches below the top surface of the base slab, thence behind similar anchorage bars and up into the other pier form near its inner face. This latter series is of the greatest importance, since it provides the cantilever reinforcement of the northwest pier. The ends of these ropes were wired to overhead wooden beams after the ropes had been well tightened by use of the tackle. Concrete was then poured to complete the base and the piers.

The pier forms were of rough planks but were lined with tarred felt both as a nonfreezing precaution and to make the forms watertight. Concrete was mixed in proportions varying from 1:2:4 to 1:3:5.

The concreting plant consisted of a No. 11 Cube mixer with loading skip, stockpiles of sand and rock on the ground in the immediate vicinity, a 36-ft. wooden elevator tower containing a self-dumping bucket into which the mixer would discharge directly, an inclined wooden trough or chute with branches above the forms, and an electric hoist for operating the bucket elevator. This plant worked smoothly. A force of 10 men was required to mix and place the concrete. One full and two fractional days were consumed in the concreting. The concrete amounted to 104 cu.yd.

Removable steel platforms, head guards and ladders give access to the sheave bearings for oiling purposes, etc. On account of the profile of the ground, the cage and skip ropes between the two frames and to the west of them, are at an elevation of from 10 to 25 ft. above the ground. They are supported by idler-pulley frames of the guyed discarded boiler-flue mast type described in the JOURNAL of Feb. 21, 1914, as used at the Republic mine.

TYPE-1 FRAME AT THE CURRY SHAFT

Another example of a type-1 angle-sheave frame exists at the Curry shaft of the Penn mines. This consists of three steel frames, the lower ends of which are embedded into a concrete base, part of which is below the surface and part of which extends about 7 ft. above the surface. Two of these frames carry 12-ft. sheaves for cage and skip ropes, while the other frame carries a 6-ft. sheave for the skip-balance rope. The structure is situated at a point about 35 ft. north of the foot of the backstays of the steel headframe. Just north of the structure, there is the main county road over which the ropes must pass at a sufficiently high elevation to clear traffic. This latter condition fixed the elevation of the intersection points at 17 ft. above the ground, and produced a rather high structure.

The main steel members are given lateral support at points in the region of the sheave bearing by irregularly placed angle-steel braces or stays reaching down to small auxiliary piers.

The steelwork was erected during 25°-below-zero weather in February, 1912. The adjustment of the frames with such temperatures prevailing was a rather disagreeable task. The concrete was cast soon after, using steam-heated sand and rock, and was mixed as follows: Wooden platforms of large area were laid on the ground and upon these platforms was constructed a steam coil of 1¼-in. pipe and return bends. Upon this there was heaped 3 to 5 ft. of rock or sand. Over the top was put a layer of straw. Steam was taken from a large main then existing to supply the old Curry steam hoist, and in a few days after turning it on, the whole mass was hot. Mixed concrete went into the forms at a temperature of about 70° F.

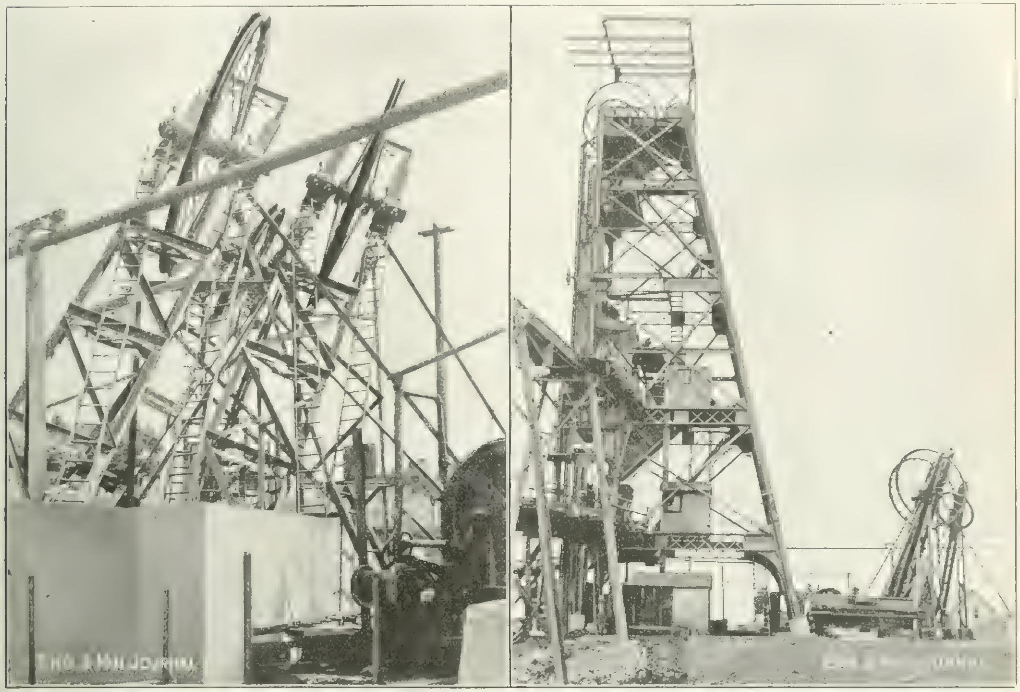
TYPE-4 STRUCTURE AT EAST VULCAN

An example of a type-4 structure is furnished by a design now in process of erection at East Vulcan No. 4 shaft. This is to carry two 8-ft. sheaves for the cage and skip ropes. The horizontal angle between the ropes lacking only 8° or 10° of 180°, the intensity of the resultant stress is comparatively slight. The structure is designed to be stable and strong to withstand the effect of breaking one 1¼-in. rope while the other rope is carrying its working load.

This frame consists of a concrete base 2 ft. 6 in. thick and 10x16 ft. horizontal dimensions, surmounted at each end by piers 2 ft. 9 in. long and 5 ft. wide. The north pier is 11 ft. 6 in. high, while the south pier is 10 ft. high.

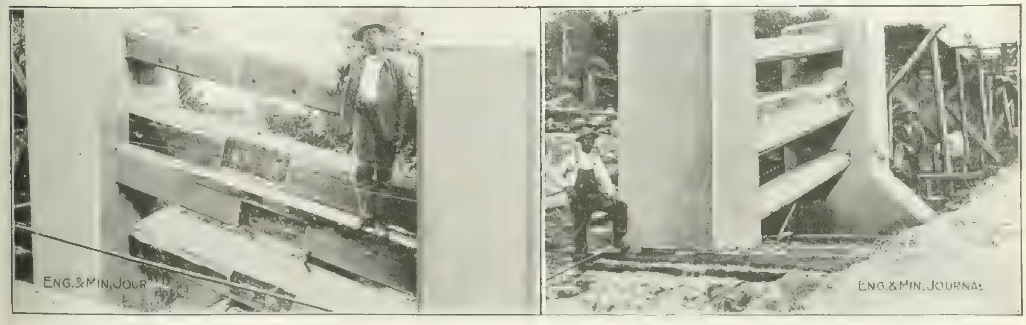
Framed between the piers and cast integrally with them are reinforced-concrete beams which are to support the weight of the sheaves (a vertical load) and resist the lateral force of the rope-stress resultant. The resultant tends to bend them toward the east and through the medium of these beams to overturn the piers and indeed the whole structure in the same direction. There is also a small end thrust exerted.

Old steel ropes are placed as reinforcement to cause the base to act as one piece and to bind the piers firmly to it. The concrete is a rubble mixture 1:3:5. About 31 cu.yd. is required.



THE CURRY FRAME—TYPE 1

Looking northeast. Showing heavy concrete base. Looking west, showing relation between headframe and angle-sheave frame.



TYPE 1. CONCRETE FRAME AT EAST VULCAN NO. 1 SHAFT

Left view looking east showing recesses for sheave bearings. Right view looking northwest. Forms just removed. Note boltholes for attachment of sheave bearings. The trestle supports a temporary runway over which concrete was wheeled in concrete carts.

Certain conditions not necessary to mention, fixed the position of the structure and limited the width of the piers.

The structure is set with its transverse center line at angles of some 5° or 10° from the lines of resultant of the cage and the skip ropes. The values of ϕ and θ were computed and used for the approximate design of the structure. For the exact setting of the beam forms, however, a mechanical scheme was used. This worked nicely for this case but would not be convenient for use in general.

The intersection points, which are on the west side of the structure, were located and marked in space by the heads of nails driven into suitable wooden falsework. It was possible to see easily from these points to points where the ropes would enter the head-sheaves and to the drums.

Other nails were sighted in along these lines at distances of 15 ft. or so from the intersection points. A suitable wire was stretched along these lines, which were, of course, the future paths of the ropes. Then on the east side of the structure, the transit was "jiggled" into line between the same points at headsheave and drum and lines were stretched to correspond. Thus for each sheave wheel we had three lines which determined the plane of the sheave, the alpha-beta plane. Now by sighting across these lines from east to west, strips were accurately located and aligned at angle ψ on the pier forms for the support of the beam forms. The longitudinal slope of the beams, angle τ, is about 17° for the cage sheave and 15° for the skip while the transverse slope, angle ψ is about 14° and 3° respectively.

It is my own opinion that the best material for beams for structures of types 2, 3 or 4 is reinforced concrete, since it can be so easily molded to any desired detail for support of sheave bearings and can be used equally as well for strut-beams as for beams subjected to bending only. It is also probably more economical than steel when used in connection with concrete piers.

⁂

Utah Copper Co.

The report of the Utah Copper Co. for the last quarter of 1914 shows a production of 20,229,012 lb.: 6,765,396 lb. in October, 6,668,049 lb. in November and 6,795,567 lb. in December. Comparison of this quarter with the preceding one is shown in the accompanying table:

	Fourth Quarter, 1914	Third Quarter, 1914
Production, lb.	20,292,012	26,686,672
Av. mo. prod., lb.	6,743,004	9,562,224
Net profit	$673,591	$1,286,323
Other income from rents, etc., Utah	27,296	26,415
Inc. from Nev. Cons. div.	375,187	....
Total net profit	$1,076,074	$1,312,738
Dividends paid	1,218,367	1,218,367
Deficit	$142,293	*$94,371

*Surplus.

Ore milled during quarter was 1,035,303 tons, as compared with 1,466,606 tons for the previous quarter. Assay of the ore was 1.5062% copper, compared with 1.4356% for previous quarter. Extraction was only 64.86%, as compared with 68.13% for the third quarter of the year. This unusually low extraction was due to the fact that the ore treated contained a considerable portion of its values in the form of carbonates of copper.

The earnings for the quarter are on the basis of 11.236c. per lb. for copper as against a basis of 12.480c. per lb. in the previous quarter and 14.857c. per lb. in the quarter ended Dec. 31, 1913. The reason for this low valuation is due to the desire on the part of the management to have all unsold copper at the end of the year carried at its then market value, and was occasioned by the fact that at the time of the curtailments in August the company was carrying a large amount of unsold copper, a considerable amount of which was sold at a substantial reduction from the price from which it was then carried. Furthermore many sales previously made for foreign delivery in August and September were canceled. The total amount of copper on hand and in transit, sold and unsold, at the end of the quarter was 10,516,627 lb., as compared with 50,118,797 lb. at the end of the third quarter. The unsold portion of the copper on hand and in transit was inventoried at 13.50c. per lb., the prevailing market price at the time, and the same price at which it was carried at the beginning of the year.

The average cost per pound of net copper produced during the quarter, after making allowance for smelter deductions, and without crediting miscellaneous income, was 7.731c., as compared with 7.760c. in the third quarter. If the miscellaneous earnings in Utah, including those of the Bingham & Garfield Ry., were credited to the cost of operations the net cost for the quarter would be 6.688c. per lb. The earnings of the railway company available for such credit were increased on account of that company not having to pay interest on nearly $2,000,000 of its bonds, which were retired near the end of the second quarter of last year. The cost shown is satisfactory, when the fact that operations were conducted on a half-capacity basis for the entire quarter is taken into consideration.

In addition to the amounts shown above, there was received from the Bingham & Garfield Ry. Co. a stock dividend amounting to $1,505,500, representing past earnings applied to capital expenditure. As the bonds of the railway company now have all been retired except $25,500, its earnings will from now on be added to the earnings of the Utah Copper.

The business of the Bingham & Garfield Ry. during the quarter was satisfactory considering the enforced curtailment in its operation. An average of 7611 tons of ore per day was transported, and an average of 2187 tons per day of other freight, making a total of 9798 tons per day.

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Nevada Consolidated Copper Co.

The report of the Nevada Consolidated Copper Co. for the last quarter of 1914 shows a production of 8,065,236 lb. of copper: 2,801,507 lb. in October, 2,612,071 lb. in November, and 2,651,658 lb. in December. The property was operated at 50% of normal capacity.

During the quarter 416,825 tons of Nevada Con. ore, containing 1.54% copper, was milled. 98% of the tonnage came from the pits and 2% from the underground workings of the Veteran mine, and 677 tons of Giroux Con. ore was milled during the quarter.

Cost of copper produced, including Steptoe plant depreciation and all charges except ore extinguishment, and after crediting all miscellaneous earnings was 8.42c. per lb. Earnings are based on copper at 11.504c. per lb. Copper on hand and in transit, sold and unsold, at the end of the quarter was 22,378,133 lb. Unsold copper was inventoried at 13.5c. per pound.

After payment of the twentieth dividend, there was a deficit of $378,949. There was set aside $76,592 for plant and equipment depreciation, and $40,460 for ore extinguishment, making a net charge to undivided profits for the quarter of $496,000.

Nevada Northern Ry. Co. purchased from the Nevada Con., for the investment of its sinking fund, $125,000 par value of the railway company's bonds held by the copper company and the investment account is correspondingly decreased.

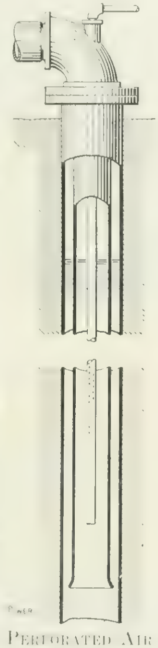
⁂

New Zealand Mineral Production in 1913 has been officially reported, the principal items being as follows: Gold, 343,595 fine oz.; silver, 975,616 fine oz.; scheelite, 221 long tons; coal, 1,888,005 long tons; kauri gum, 8780 long tons. The value of the whole mineral production in 1913 was £3,079,663.

Details of Practical Mining

Preventing Clogging in Air Lift

It is not uncommon in using an air lift, to deliver the air through radial perforations in the air pipe near its bottom. Trouble is sometimes experienced in such cases by the clogging of the perforations with precipitate or scale. E. M. Ivens, writing in *Power,* describes a method of avoiding this difficulty. A section of pipe is added to the line below the perforations, as illustrated, and the lower end left unplugged. Thus any scale or dirt is allowed to escape downward while the air follows the path of least resistance through the perforations. Should the perforations eventually become clogged, the air will still have a path open at the lower end. Its use of this path will allow the lift to operate, but will be detected on the gage. The operator can then clean the pipe when most convenient.


PERFORATED AIR PIPE WITH OPEN END

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Length of Drill Steel and Cutting Speed*

The length of the drill steel is an item generally credited as an important influence on drilling speed, and common opinion supports the idea that the cutting speed falls as the length of the steel increases, although some people, on the contrary, feel sure that the long steels drill the fastest. The tests conducted at Franklin do not lend an unqualified support to either view, for the peculiarities of different types of machines play so important a part. For example, if the air feed is strong in a stoping drill the additional counteracting weight of a long and heavy steel may so improve the working conditions as to indicate a superiority for the long steel, and if the air feed is weak the reverse may be true; if the drill steel cuts by virtue of a dancing or "jumper" action, the mass added with length may so reduce its velocity against the rock as to bring it below the amount required for efficient chipping; if the piston normally delivers too heavy a blow for the rock, the drilling speed may be improved by the added inertia of the long steel; and if the steel is always against the rock when a blow is delivered, it is doubtful whether the length of the steel plays an important part unless the permitted decrease in the gage of the drill bits aids the cutting speeds. It is, of course, to be understood that these considerations of drill-steel lengths refer to the performances with bit gages of the same diameter.

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Gunite Casing on Wood Shaft Lining

By Stephen Royce*

An experiment was recently tried at "A" shaft of the Cary mine, operated by Pickands, Mather & Co. at Hurley, Wis., on the Gogebic range. The experiment consisted of covering the steel sets and wood lath with cement mortar applied with a cement-gun. The shaft arrangement is shown in cross-section in Fig. 4. The inclination is 73° 10'. The steel sets are spaced at 4-ft. intervals and the 3-in. hemlock lathing is wedged into the flanges of the I-beams, as shown. The sets were blocked into place by wooden blocking, with bearers put in at intervals of about 50 ft. At the several level openings the shaft was completely concreted before the cement-gun work was contemplated. The total depth of the shaft is 1290 feet.

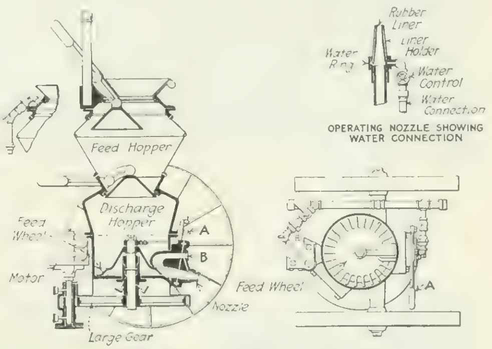

FIG. 1. THE CEMENT-GUN

The hemlock lathing showed signs of rotting out and of course it permitted free circulation of air behind the sets, which it was feared would rot the blocking and so throw the shaft out of line. In order to fireproof the wooden lining, to protect the steel work from rust, to exclude air from the spaces between the sets and the outside rock, and to keep all the wood uniformly wet so as to discourage decay, a coating of 1¼-in. "Gunite," as the material applied by the cement-gun process is called, was decided upon. This has been tried in two experimental sections of the shaft having a total length of 263 ft.

The cement gun is an apparatus designed to shoot through a nozzle a stream of mixed cement, sand and water in about 4:1 mixture. The apparatus itself (Fig. 1) consists in its principal parts of an upper, or feed hop-

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*Excerpt from an article entitled "The Testing and Application of Hammer Drills" by Benjamin F. Tillson presented before the February meeting of the American Institute of Mining Engineers.

*Mining engineer and geologist, Pickands, Mather & Co., Gogebic range, Hurley, Wis.

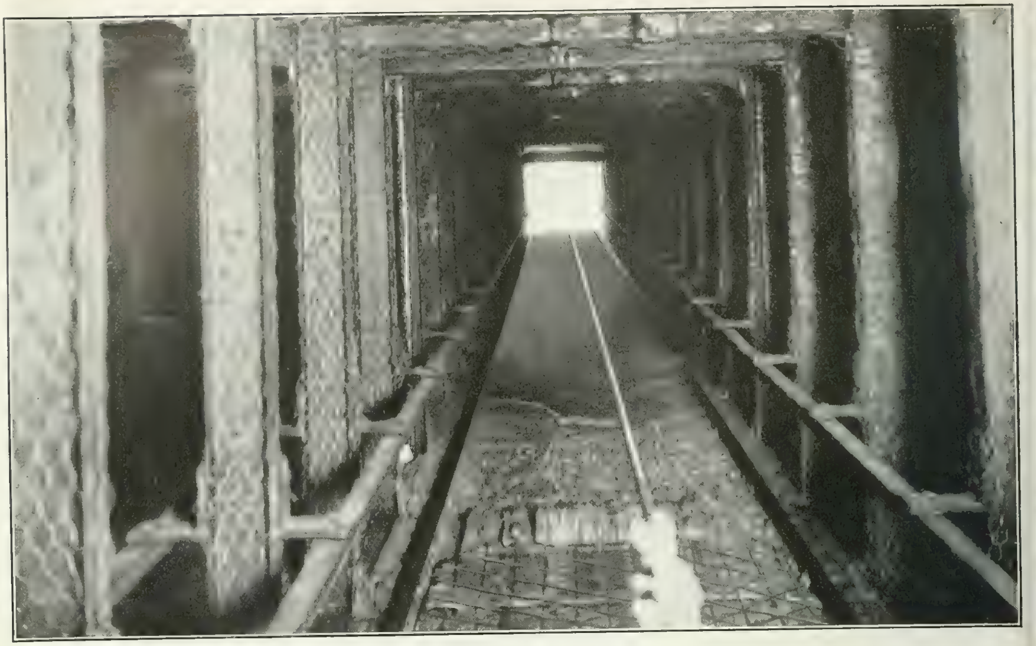

FIG. 2. SKIP COMPARTMENT, SHOWING FINISHED GUNITE, ROUGH LAYER AND UNCOVERED REINFORCEMENT

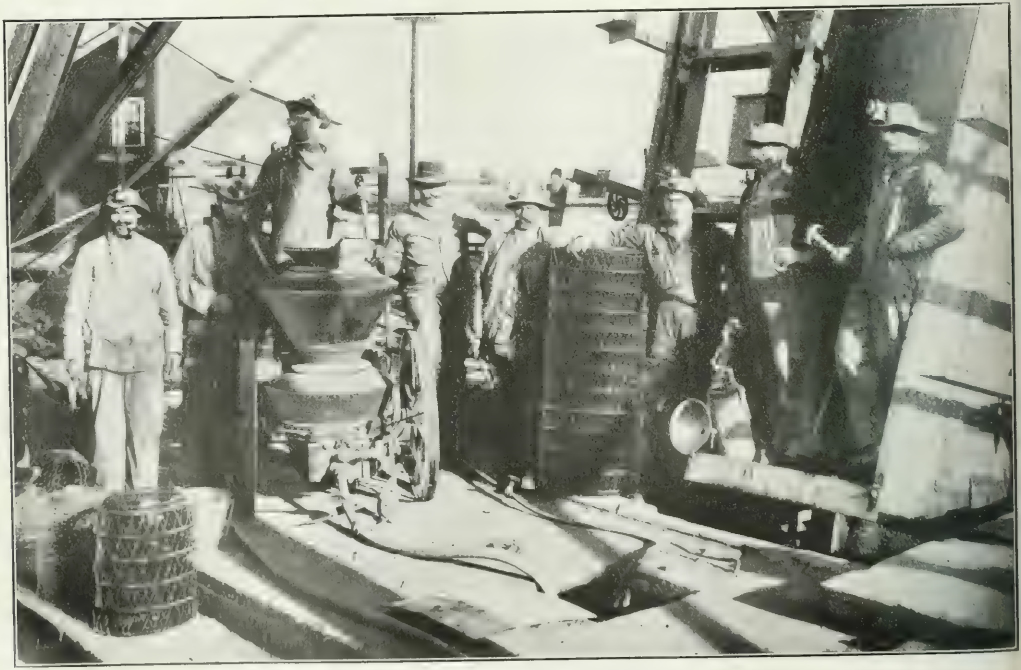

FIG. 3. THE MACHINE RIGGED AT THE COLLAR OF THE SHAFT

per, a lower, or discharge hopper and a feed wheel which is worked by a motor using compressed air at 45 to 75 lb. The discharge hopper is kept constantly under pressure after the charge has been introduced at the top, and the admission valve has been closed. The cement and sand mixed are charged into the top of the feed hopper with the upper valve open and the lower valve closed as shown. The upper valve is then closed, air pressure is admitted to the feed hopper until the pressure is equalized in the two hoppers, the weight of the cement and sand in the feed hopper presses down the valve and the material drops through into the discharge hopper, on top of the feed wheel.

When all the material in the feed hopper has gone through, the lower valve is closed by means of the lever *A*. The upper valve of the feed hopper is again opened and a new charge is put in. The feed wheel, driven by the motor through a large gear, expels the cement and sand from the lower hopper through the nozzle, which connects by means of the delivery hose with the operating nozzle.

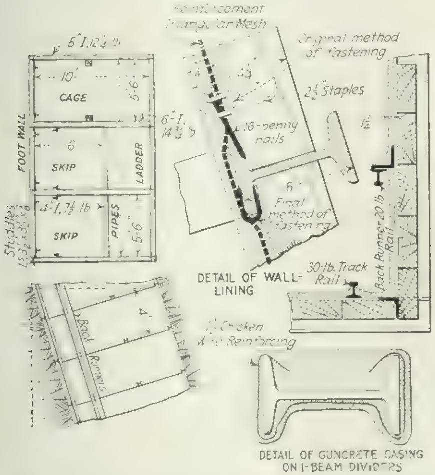

Fig. 4. Shaft Arrangement and Details of Coated Members

The feed wheel consists of a series of paddles which form pockets. As these pass the stream of compressed air entering at *B*, they take up measured quantities of compressed air which forces the material through the nozzle and into the hose. The form of the operating nozzle with water connections is also shown. The quantity of water is gaged by the operator; the proportion of cement and sand is gaged in the first mixing. The material as fed into the machine must be dry and no water must reach it before the water control at the operating nozzle. Fig. 3 shows a general view of the machine rigged at the collar of the shaft.

Composition of Mixture Varied Automatically

One of the advantages claimed for mortar shot on by this process is that the mixture is automatically enriched where most needed and is less rich where a poorer mixture is sufficient. This results from the tendency of the particles of sand to rebound as soon as they hit a hard surface, so that the first $\frac{1}{8}$ or $\frac{1}{4}$ in. will consist of almost neat cement. This material sets almost as soon as it strikes and the full benefit of the set is given to the work, there being no possibility that the cement may partially set between the time of mixing and the time of applying.

The delivery hose is made of pure soft rubber, covered with heavy canvas and may be as much as 300 ft. or more in length. The wearing out of the delivery hose is one of the chief expenses of operating; one hose may last for a period of time ranging from two to six weeks, according to the character of the sand that is fed.

Of the two sections of shaft covered in this work, one extended from the collar to the 3rd level, the other from the 8th to the 10th level. In the upper section the machine was placed on the surface and the delivery hose was carried down through the shaft to the point where work was being done. In the lower section the machine was set on the 8th level. Material and supplies were handled in a temporary cage in the center compartment, no hoisting being done in the shaft at this time.

Details of Reinforcement

Like other methods of applying concrete, this method requires reinforcing. In this case the walls were reinforced with No. 7, American Steel & Wire Co. triangular mesh and the dividers with 1½-in. chicken wire, held on with wire clamps. The reinforcement is shown in Fig. 2. Fig. 4 shows two methods of attachment of the reinforcing wire to the steel sets. The first method used nails and staples. This was discarded because it placed too much dependence upon the holding power of the staples in the hemlock plank, which might later decay. The second method depends entirely upon the strength of the staples, which hold directly on the steel, and was adopted for most of the work. The reinforcing wire was also stapled to the laths at intervals between the sets. The dividers were filled in completely on their upper faces, the result being a considerable increase in their ability to resist a downward load. This increase of strength we figure at nearly 20%.

The results seem to have been entirely favorable. There is a solid hard coating of concrete over the entire sides and all the steel work in the shaft. This coating seems to be completely waterproof, so much so in fact that we consider it necessary to set pipes in the bottom of each section coated in order to prevent the water from banking up behind the shaft covering and causing heavy hydrostatic pressure. What the effect will be upon the life of the lathing and of the blocking behind the sets we have, of course, no proof as yet, but from the uniform and apparently airtight character of the coating, we hope that it will greatly increase the life of the wood. If the lathing partially rots, the reinforcement is so solidly fastened to the steel that we believe it will take up a considerable part of the stress now borne by the laths.

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Handling Dump-Cars with Derricks in openpit coal mines is one feature of the work of the Central Coal & Coke Co.'s plant near Pittsburg, Kan., says "Engineering News." While the steam shovels are excavating or stripping on one side of the cut, which is 30 ft. deep, coal is being mined on the other side. The coal is loaded into 2-ton tram cars, which are hoisted either by a stiffleg derrick or a revolving derrick, each traveling on a short broad-gage track. The former has a 50-ft. boom and the latter a 60-ft. boom. The cars are taken from and replaced upon a track laid along the top of the cut.

Details of Milling and Smelting

A Note on the Settling of Slimes

By Allan J. Clark*

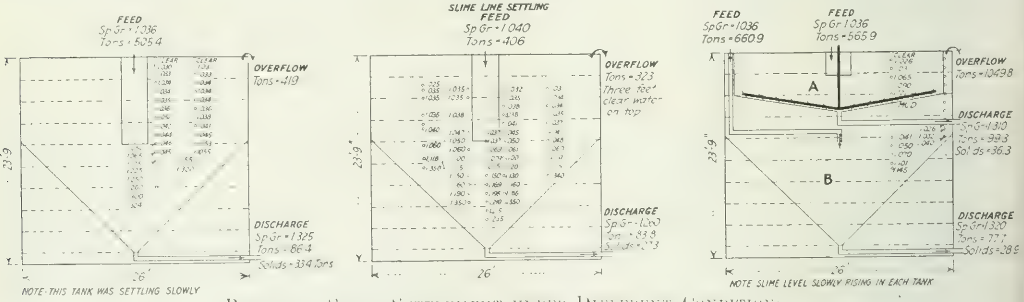
The accompanying diagrams record determinations of the specific gravity of pulp in clarifying or thickening tanks under certain definite conditions of operation. Whatever interest they may possess lies in the fact that few determinations of this nature have been recorded, rather than in any unusual or unexpected conditions developed by the determinations themselves.

Two types of tanks are illustrated: One a simple hopper-bottomed type, automatic in action and discharge; the other a double-decked arrangement of a shallow Dorr thickener, mechanically discharged, superimposed upon a tank of the first type, which is necessarily modified as to the method of introducing the feed of pulp.

The samples were taken partly through a tube, ¼ in. in diameter, the lower end attached to a rod to insure against lateral deflection, inserted over the rim of the tank and operated as a siphon; and for greater depths and particularly for determinations in the lower member of the double-decked tank, through a ¾-in. pipe, equipped with the necessary fittings and connected with a small bicycle pump. In either case flow ceased when a specific gravity of 1.35 was reached.

The slime measured was derived from the crushing of oxidized ore. It contained much iron oxide and was exceptionally slow settling. Water was the suspending liquid, and there had been no lime or other alkali added. Moreover, the work was done during the winter and the temperature of the water was low.

Too much emphasis cannot be given to the fact that conditions of testing were not necessarily parallel. Although Test 3 illustrates practically synchronous conditions in the two compartments, it should be remembered that neither compartment (and more particularly the lower one) is often operated with the upper line of solids in exact equilibrium, but rather, as illustrated in the two series of observations on the single tank, either overloaded (Test 1) or underloaded (Test 2) with the clear water line either rising or falling in consequence.



Record of Slime Settlement under Different Conditions

Feeding Reverberatory Furnaces Along the Side Walls

The effect of feeding reverberatory furnaces along the side walls is to increase greatly the surface of charge exposed to the flame. David H. Browne in commenting on this fact at the recent A. I. M. E. meeting said that formerly only the bottom, or one side out of four, had charge exposed to the heat of the flame, the other three sides being composed of refractories. The ideal condition would be to have charge exposed on all four sides, approximately as in a cylinder with the flame in the center; this is impossible in the reverberatory but he said we have progressed so that now practically only one side, the roof, has refractories directly exposed to the heat; the surface of the charge has the form of an arc of a circle and covers most of the sides and bottom of the furnace.

When the reverberatory furnaces were built at the Canadian Copper Co.'s plant at Coppercliff, Ont., the furnaces were fed[1] in accordance with the usual Western practice at that time, i.e., introducing most of the charge through hoppers near the firing end of the furnace. In the latter part of 1913 a change was made at Coppercliff and most of the charge has since been introduced along the side walls of the furnace through holes in the roof. There are large charge bins over the side walls at the firing end of the furnace; these discharge into small bottom-dump cars running on 24-in. tracks supported from overhead. Under the tracks a long trough extends down each side of the furnace just above the side walls; these troughs have openings in the bottom 2 ft. apart, communicating by slide gates with 6-in. iron pipes that pass into holes drilled in the roof brick. The furnace charge is introduced through these pipes or openings and slides down on the side walls, over which the charge forms an almost continuous blanket. The feed pipes form a nearly continuous line along each side of the furnace; over the fire wall are six similar openings. On the side opposite the slag door, the charge is fed all the way to the throat; on the skimming side, the charge is fed along as far as the slag door and no farther; cold air coming in while skimming cools the wall in that vicinity and obviates the necessity of charging beyond this point to protect the furnace walls.

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*Metallurgist, Homestake Mining Co., Lead, S. D.

[1] "Bull. of A. I. M. E.," January, 1915.

When the No. 8 reverberatory furnace at Anaconda was changed, in order to try powdered coal as a fuel, no side doors were left in this furnace, as it was thought with the new arrangement for feeding that further fettling or "claying" would not be required. The furnace as remodeled was 124 ft. long by 21 ft. wide, and charging was done from hoppers extending along both sides of the furnace for a distance of 74 ft. from the firing end. The remainder of the furnace, however, required fettling. After operating for three months, Louis V. Bender writes[1] that the bricks were eaten into along each side from the skimming door back to the point where the charge had been dropped. The depth of this cutting was 8 in., close to the skimming end, gradually tapering to zero at a distance of 50 ft. therefrom and was greatest on the side of the furnace having the larger flue connection.

After operating for a while, trouble was encountered in tapping the matte. The taphole was on the east side of the furnace, 83½ ft. from the skimming end. Charging could not be done over the taphole, and for a distance of several feet on either side of it, also owing to the method of charging, matte accumulated at the skimming end of the furnace and could not be completely drained through the side taphole. As a result of the new method of feeding the furnace, the space usually occupied in reverberatory furnaces by the matte was largely taken up by the calcines, forcing the matte to the skimming end of the furnace and preventing its being drawn out of the side taphole. The furnace thus would not hold more than 50 tons of matte, while the other furnaces at Anaconda held 175 tons. It was finally decided to put in a taphole at the side of and below the skimming door, and all matte was thereafter tapped from this opening. The matte tapped amounted to about 35 tons per shift.

The coal ratio for No. 8 furnace in September, 1914 was 7.19 excluding drying coal, and 7.08 when including drying coal. The corresponding coal ratio for a grate-fired furnace using the same coal was 3.88, and the average tonnage 251 as against 176 tons per furnace-day for the coal-dust-fired furnace. The efficiency of the coal-dust firing is increasing with further practice, approaching a fuel ratio of 7.50.

Profiting by the work done by the No. 8 reverberatory at Anaconda, Mr. Bender states that a few changes were made in the construction of the next furnace arranged for coal-dust firing. This furnace is 111 ft. long by 25 ft. wide, inside dimensions; 9 ft. 3½ in. high at the firing end and 6 ft. 6 in. at the "verb." The flue area is 48 sq.ft. The furnace has hoppers for charging calcines and fettling material on both sides for its entire length. In the No. 8 furnace the charge was dropped through 6-in. pipes spaced 19½ in. apart. The new furnace has 8-in. pipes. The tapping of matte is done from the front of the furnace, as in the case of No. 8 furnace. The skimming plate is 12 in. higher than in the old furnaces, thereby giving a larger reservoir for the accumulation of matte; the top of the skimming plate is 24 in. above the taphole. In the discussion of Mr. Bender's paper, E. P. Mathewson said that the new 25x111-ft. furnace had been completed and he had just received a telegram, dated Feb. 15, from the superintendent, who reported on the starting of the furnace as follows: "New No. 5 furnace, Feb. 5, slow wood fire; 10th, up to heat and charged 345 tons; 11th, charged 517 tons, fuel ratio 7.91; 12th, 555 tons, ratio 7.10; 13th, 605 tons, ratio 7.71; 14th, 613 tons, ratio 7.1; everything now O. K. for full tonnage soon." The laconic ending of the telegram caused considerable laughter.

The No. 5 furnace, as also the No. 8 furnace, has been arranged for continuous slag overflow. Mr. Mathewson also announced that the Anaconda company has in contemplation a still longer furnace in which it is proposed to handle converter slag. This slag is now molded in casting machines and resmelted in the blast furnaces. With the prospective discontinuance of blast-furnace smelting, the company has been experimenting and has found that the converter slag can be satisfactorily cleaned in the reverberatory furnace. It now proposes to build a furnace, 175 ft. long and 25 ft. wide, in which the molten converter slag will be poured. On the sides of this furnace will be fed high-silica concentrates that carry sufficient sulphur to help clean the converter slag; part of the charge for this furnace will probably be flotation concentrates carrying 8% copper and about 10% sulphur.

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Leaching Concentrates before Smelting

In the JOURNAL of Jan. 9, 1915, in the article on copper metallurgy by Lawrence Addicks, occurred the following passage:

"At Douglas, Phelps Dodge & Co. has installed a 75-ton test plant after conducting considerable research work, designed primarily to try out leaching on the ores of the Burro Mountain Copper Co. at Tyrone, N. M. The mineral is chiefly a finely disseminated chalcocite in a highly siliceous gangue carrying 10 to 15% alumina. The plan of operation is to give a preliminary concentration, roasting concentrates and tailings separately, leaching both products, sending the leached concentrates calcines with about half the copper extracted to the smeltery at Douglas."

Inquiry was made of Mr. Addicks as to why the concentrates should be leached and then smelted instead of smelting immediately, thereby eliciting the following reply.

"There are two reasons for leaching concentrates calcines in connection with treating the tailings: (1) The high alumina and low copper contents in the tailings give a ratio of extraction embarrassing in both accumulation of alumina in the electrolyte and acid requirements for leaching, while taking some of the copper sulphate in the rich calcines greatly assists in meeting this difficulty; (2) it is necessary to roast the concentrates at the leaching plant to get sulphur dioxide, and there is risk in losing water-soluble copper in shipping these calcines to a more or less distant smeltery by rail.

"Commercially, always assuming our large-scale experiments just starting work out as we hope, it seems clear that this copper can be leached as cathode copper directly more cheaply than by smelting. The more I study the general question of handling concentrates the further I am inclined to drive a leaching attack."

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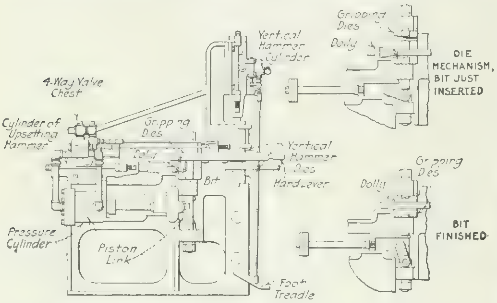
[1] "Bull. of A. I. M. E.," January, 1915

Mining & Metallurgical Machinery

Imperial Drill Sharpener

In the Imperial drill-sharpening machine brought out by T. H. Proske, of Denver, the old backing block for holding the steel while the bit is being upset is abandoned for a pair of gripping dies. These do not grip the steel so as to hold it absolutely immovable; they are designed instead to permit the steel as a whole to be moved while the metal of the heated bit is forced into its desired position.

The machine is shown in section in the accompanying illustration. The dull steel is first inserted between the dies of the vertical hammer, and the bit wings are spread out. This hammer is operated by means of the foot treadle shown. The bit is next inserted between the gripping dies, and by means of downward pressure on the hand lever the four-way valve is open so as to permit the flow of air to the pressure cylinder. This cylinder by means of a link connection brings the dies together on the bit. A further downward motion of the lever opens the throttle of the horizontal upsetting hammer, which then operates striking the shank to which the upsetting dolly is attached and driving the dolly against the base of the bit. The effect of this is to force backward the piece of steel and the center of the bit, while the metal against the dies is held there by friction; the metal is thus drawn into the outer corners of the bit where it is wanted. When the dolly seats against the dies, the bit is finished.



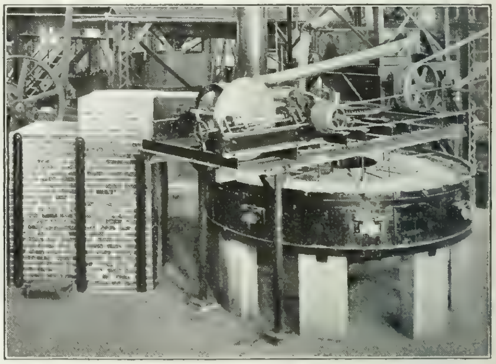
Section of Imperial Drill Sharpener with Details of Gripping Die

The main frame in this machine is a steel casting, which makes it lighter and more compact; the machine requires a space of 18x18 in. only. A speed of 1015 drills per nine-hour shift is claimed to have been obtained with the machine. It is also pointed out that the vertical hammer does not squeeze or press the heated steel into shape, but beats it out and thus improves its quality. The machine is capable of making any bits up to 3 in. in width. It is also available for upsetting bolt heads, collars on drill steel, etc., while the vertical hammer can be used for general forging.

The Wilfley Rotary-Hearth Roaster

A type of roasting furnace which applies a new principle is the invention of A. R. Wilfley. It is intended primarily to give pyrite ore a magnetic roast, and it will probably find its greatest application in plants making zinc concentrates with magnetic machines.

The Wilfley machine has a circular rotating hearth to and above which heat is supplied from an auxiliary stationary firebox. Rotation of the hearth is effected through a sliding friction-disk set of gears, permitting a close adjustment of the speed of travel over a considerable range. Ground ore is fed to the hearth at that point in its travel where the temperature is the lowest. The new principle mentioned as peculiar to this furnace is in the provision for so adjusting the quantity of feed that it is distributed in a layer or film approximately one grain deep over the surface of the hearth. This affords the hot gases opportunity to give their heat and oxygen rapidly and evenly to every particle of ore, and to bring about the degree of roast that will drive off just enough of the sulphur to render the particles subject to magnetic influence. The feed, the speed of travel and the intensity of heat may all be independently adjusted. It is found that with average ores the period of roast will not exceed one minute.



Wilfley Roaster at Colorado School of Mines

Thus far the manufacturers, the Denver branch of the Mine & Smelter Supply Co., have built this machine only in an 8-ft. diameter size suitable for laboratory purposes. These machines have been placed in the Colorado School of Mines testing plant, Golden, Colo., the Henry E. Wood ore-testing plant, Denver, and the School of Mines, at Ottawa, Can. Experiments with this size of machine have proved that approximately 7½ sq.ft. of hearth area per minute will handle one ton of ore per 24 hr. This is considerably less than the hearth area required in any type of rabbling furnace.

The furnace is maintained at proper temperature through the combustion of coal, wood, oil, gas or any other fuel. The ore being introduced at the coolest place in the furnace and the travel of the hearth being opposed to that of the gases, the particles of ore are given a rapidly but uniformly increasing temperature until they actually become hotter than the hearth itself when they are directly in front of the firebox. Immediately after passing this point, the roasted ore is withdrawn from the hearth by a suction nozzle (on the principle of the vacuum cleaner) and conveyed by pipe into an air-tight settling chamber through which air is passing to an exhaust fan. This handling of the ore provides also for the removal of its heat. Roasting action is said to terminate instantly as the ore enters the nozzle.

One feature claimed for this new type of furnace is the fact that there is no chance for the agglomeration of the ore grains so that no subsequent rolling or grinding is required before the ore is passed to the magnetic separators. Another point for which strong claim is made is that much less power is needed to drive this machine than is consumed by those machines that carry a heavier charge of ore and depend upon mechanical rabbling. The Mine & Smelter Supply Co. has complete plans prepared for and is ready to supply this type of machine in a 30-ft. diameter size, calculated to roast 30 to 40 tons of ore per 24 hours, as well as in the smaller experimental size spoken of above.

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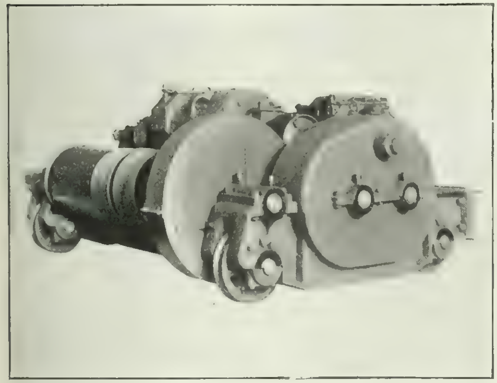
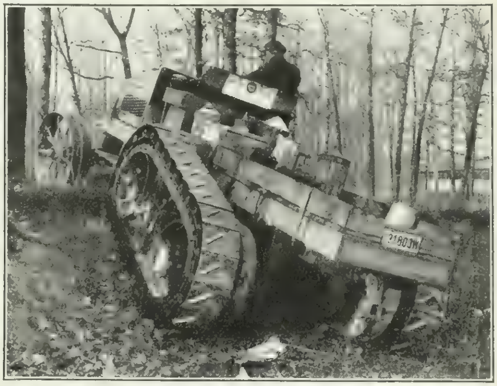
Some Useful Adjuncts to Mining



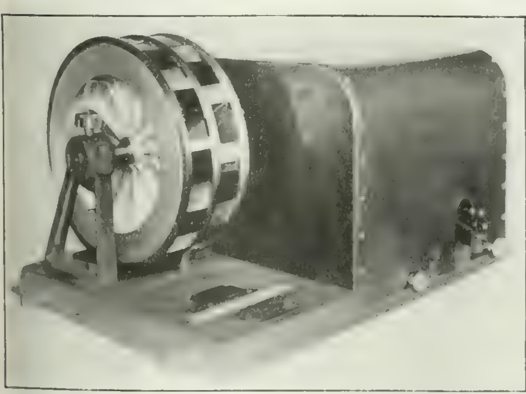
A Safe Crane Trolley

The crane trolley, made in capacities from two to 125 tons, is manufactured by the Northern Engineering Works, of Detroit, Mich., for use in mills. It is completely enclosed, giving safety to the operator and freedom from dust to the motor, but still has its parts easily accessible.



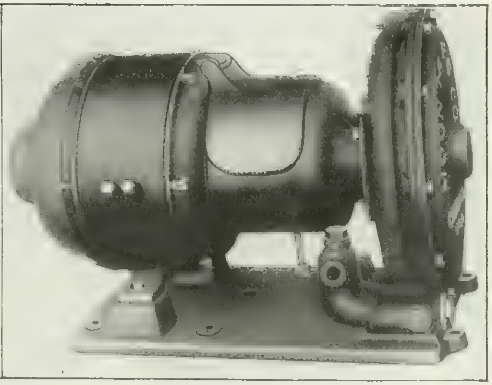
Allis-Chalmers Tractor Truck

This machine, built by the Allis-Chalmers Mfg. Co. for work in rough country, can be used as a truck of five tons capacity, or as a tractor with a drawbar pull of 9000 lb. on the first speed, 2370 on the second. The illustration says all that is necessary as to its cross-country capabilities.



The Denver Siren

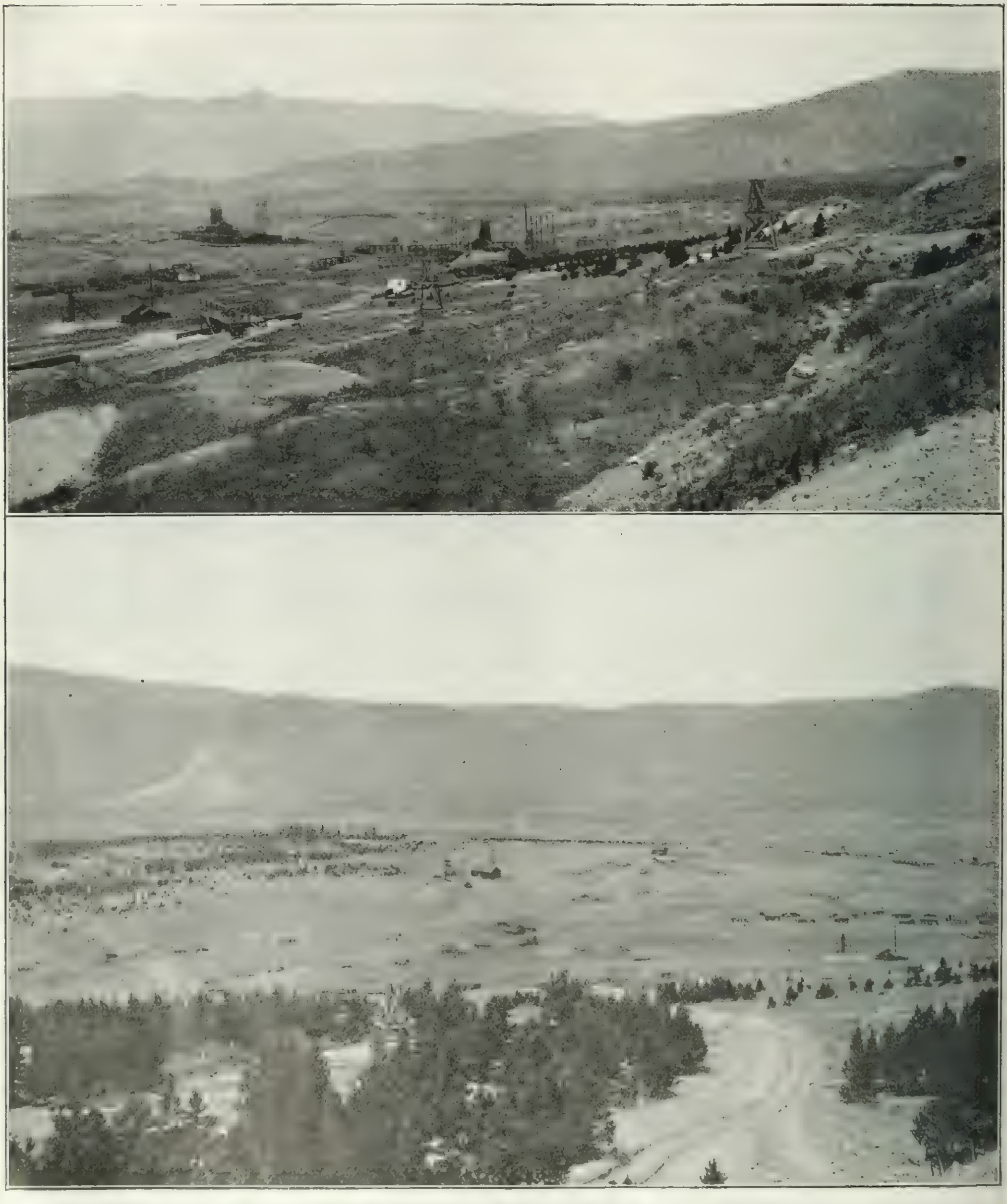
This is a motor-driven siren designed chiefly as a fire alarm for mills, cities and factories by the Hendrie & Bolthoff Engineering & Supply Co., of Denver, Colo. As the motive power is exclusively electric, the device is handy where no steam is available. It starts by pushing a button. The siren can be heard six miles away.



Compact Electric Lighting Unit

This apparatus consists of an impulse steam turbine direct connected to a small generator. It is designed by the Moon Mfg. Co., 108 N. Jefferson St., Chicago, Ill., especially for use in isolated mines and similar situations, for electric lighting or for driving a few small scattered motors where hydroelectric power is not available.

Photographs from the Field



The Leadville District, Colorado

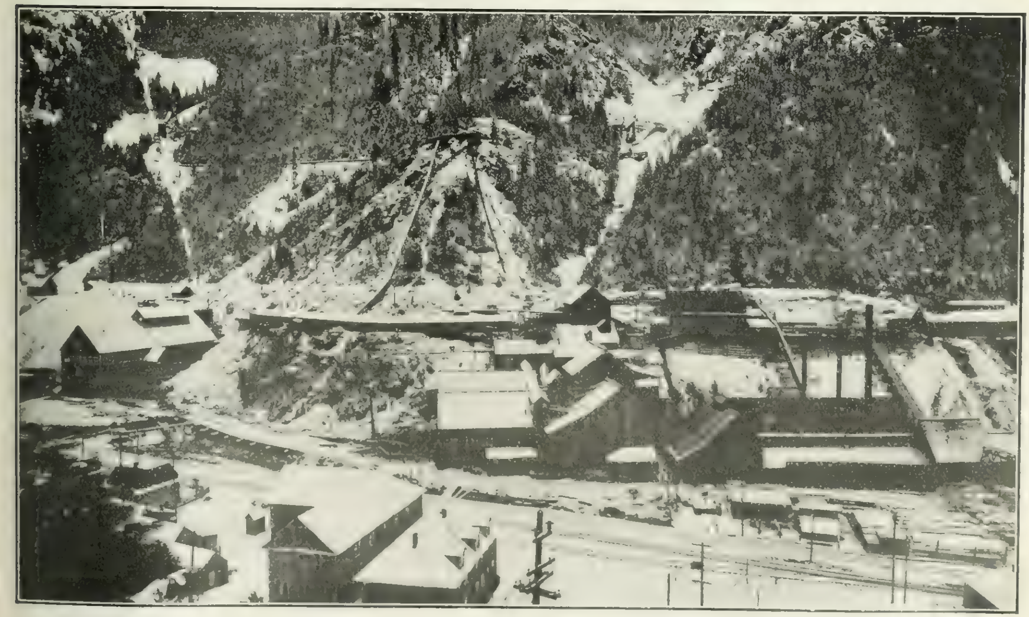
The first is a view looking northwest from Iron Hill, showing the Wolftone, Greenback, Pyrenees and R. A. M. mines. The second is a view west from Iron Hill, showing the Sawatch Range, Turquois Lake, Arkansas Valley smelter, city of Leadville, and Carbonate Hill in the middle foreground.

Beatson Copper Co.'s Property on Latouche Island, Alaska

The new mill uses gravity and flotation concentration, and began to operate about Feb. 1, 1915. Snowsheds connect the mill with concentrate bins and docks. Other buildings include power house, ore bins, offices, staff houses and boarding house.

Transportation of Mining Supplies in Alaska

Pack train crossing the Chena River, on the road from Fairbanks



Surface Plant of the Frisco Mine, Idaho

At the right is the new mill, now running experimentally, which includes Callow flotation and magnetic separation of lead and zinc

Mines and Metallurgy Exhibit at the Panama-Pacific Exposition

The exhibit of the Steel Corporation is the largest single exhibit in the exposition, several of the subsidiary companies being represented as well. The steel exhibit is installed within a facade of classic lines. In progressive order the visitor will see the iron ore mined in the vast openpit mines of the Vermilion and Mesabi ranges and the Sauntry-Alpena mines of Minnesota, carried to the ore carriers of Lake Superior, then to continue its progress through the great steel plants. The successive stages of the refining of the steel will be shown in Bessemer converters and electric and openhearth furnaces. A blooming mill will exhibit the production of blooms, billets, bars, etc. Special exhibits will show steel alloys, steel mine timbers, wire, cement made from furnace slag, bridges and many forms of steel construction, tin plate, pressed steel and so forth.

A factor in this immense exhibit is the models of mines, factories, ore docks, ore trains, steamer ore carriers. In the model of the ore docks at Duluth, for instance, there are 25,000 separate pieces or parts, each made to an exact scale. This ore dock—the original has a loading capacity of 13,000 tons per hour—will be shown in operation.

The first exhibit to attract the visitor entering the main portal of the Palace of Mines will be the comprehensive display of the U. S. Bureau of Mines. It will be in two sections, one a model mine beneath the floor of the building and the other a large rectangle devoted to metallurgy.

The demonstration mine is beneath the building and it will be a faithful replica with full-size entries, drifts and stopes reproduced from actual mines in the United States. It will be in every respect a model mine operated under modern conditions with complete representation of the most efficient machinery and the methods employed. Ventilating systems and safeguarding of workmen will be impressively demonstrated. Admission to the mine will be free and by means of a regulation mine cage.

In this underground mine the visitor will visit the Goldfield Consolidated properties of Nevada in faithful reproduction. He will see how the pay ore is taken from the Homestead mine; how lead and silver mining is practiced in the Bunker Hill & Sullivan company's plant at Kellogg, Idaho; how copper is mined in the Copper Queen Consolidated mines at Bisbee, Ariz. The bituminous coal mines of the Pocahontas Consolidated Collieries Co. of West Virginia, the Elkhorn mines of Kentucky and the South Wyoming Coal Operators' Association's properties will complete a comprehensive exhibit of coal mining.

Motion pictures are to be provided showing certain operations that it would be impossible to actually reportray. In addition to this exhibition mine there will be a practice drill twice a day, showing the latest and best apparatus for mine lifesaving.

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the last quarter of 1914 shows a production of 9,563,113 lb. of copper: 3,240,118 in October, 3,196,457 lb. in November and 3,126,538 lb. in December. In addition to the copper derived from concentrating ores, 75,473 lb. were from ores shipped directly to smelting plant.

Total ore milled for the quarter was 402,917 dry tons, averaging 1.74% copper. Average mill recovery was 68.2%. Milling cost was 54.56c. per ton, an increase due to the smaller tonnage handled. Average mining and coarse crushing cost of ores milled were 52.388c. per ton, of which 2.666c. was for coarse crushing. Underground development amounted to 3288 ft. during the quarter.

Average cost of net copper produced from milling ores, after allowing for smelter losses and applying the dividends of the Ray & Gila Valley R.R., but no other miscellaneous income, as credit to costs, was 8.748c. Combined cost of copper from all sources was 8.716c. per lb. These costs include all operating and general charges, as well as 12½c. per ton of ore milled which is applied to retirement of mine development costs.

Earnings have been computed on a basis of 10.869c. per lb. for copper.

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Improvements at the Reduction Works of the Anaconda Company*

When Mr. Ryan and Mr. Thayer were in Butte last December the important announcement was made that about $6,000,000 would be expended by the company in improvements at the reduction works at Anaconda and Great Falls. These improvements are expected to result in considerable savings in metal values and operation costs and will permit the company to work a lower grade of ore than has hitherto been possible and will thus result in a considerable prolongation of the life of the mines. This action on the part of the company will therefore prove a great benefit to the communities dependent on the company's operations.

At the present time the recovery made on the ore sent to Anaconda and Great Falls is only about 78% of the copper content. It is expected to raise this recovery to about 91% by the use of the flotation process on the concentrator tailings. This will require radical changes in the lower part of the mill. The upper portion will remain much the same as it is now excepting that a Symons disk crusher will be added in each section in order to obtain increased crusher capacity. By so doing the capacity of the concentrator will be increased from about 12,500 to 15,000 tons per day. The jigs on the roll and Huntington mill floors will be replaced by roughing tables of a special design which will make concentrates and coarse tailings. These tailings will be reground in pebble mills so that they will pass a screen with about 60 holes per linear inch. This finely ground sand will then go to the flotation machines which will be situated on the lower table floor and which will make a concentrate containing about 8% of copper and a tailing only about 0.1% copper. The slimes which are now treated on round tables will be further treated in flotation machines, making a tailing which can go to waste and concentrates which will go to the filter plant.

Under the new system there will be no first-class ore and all of the ore from the mines will go to the concentrator instead of being partly sent to the blast furnaces. No coarse concentrates will be produced and the field of the blast furnaces will be greatly restricted, if not entirely eliminated. In order to take care of all of the concentrates which have been going to the blast furnaces, as well as the concentrates which result from the concentration of first-class ore and from the increased recovery on the ore, a new roaster plant will be constructed containing 40 furnaces, 22 ft. 6 in. in diameter. These furnaces will be charged by a conveyor system instead of by cars as are the furnaces in the old roasting plant. The calcines from this plant as well as from the old roasting plant will be hauled by the present tramming system to the present reverberatory plant. The furnaces in this plant are all being enlarged and equipped with pulverized-coal burners. The new furnaces will be 25 ft. wide by almost 150 ft. long and will smelt about 650 tons per day each. The present reverberatory buildings will therefore house furnaces having an aggregate capacity almost 2½ times as great as before, and will smelt all of the concentrates coming from both roasting plants.

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*An article by Frederick Laist, metallurgical manager, in "The Anode," February, 1915.

The barrel-shaped converters in the converter plant are being replaced by large upright converters of the Great Falls type about 20 ft. in diameter. There will be seven of these converters and they will be able to produce about 22,000,000 lb. of copper per month. The slag from these converters, which is now being solidified and resmelted in the blast furnaces, will be tapped into large ladles and poured from these directly into a huge reverberatory which will be constructed in the relining department of the converter plant. This furnace will be by far the largest reverberatory in the world, and will be 25 ft. wide by 175 ft. long. It will receive about 700 tons of molten converter slag and 350 tons of fine ore per day. The furnace will clean the converter slag to such an extent that it may run to waste.

The new plant will be partially supplied with air from a turbo-blower, having a capacity of about 35,000 cu.ft. of free air per minute. This blower is directly connected to a steam turbine and runs at about 3400 r.p.m. It is now in operation and has proved highly successful. The blast furnace and the briquetting plants will, under the new system, be no longer required, but will be kept intact and in good repair, so that they may be used in emergencies, or at times when the price of copper is high, and it may be advisable to push the copper output beyond the maximum capacity of the other departments.

The improvements at Anaconda will cost about $1,000,000. At Great Falls about $1,750,000 will be spent. A new refinery is being constructed at Great Falls which will have a capacity of 10,000,000 lb. of copper per month. It will replace the old refinery which has been in operation a great many years and which is no longer economical. The new plant will, however, have twice the capacity of the old plant. The refinery will be kept in operation, partly or entirely, on copper shipped from Anaconda; depending on whether or not the Great Falls smeltery is in operation. The new smeltery at Great Falls will be completed and the pulverized coal system, which has proved so successful in Anaconda, will be applied to the Great Falls furnaces. Coal from the Lochray coal fields is to be burned. The ash content of this coal is high, but this has not proved detrimental. Both the output per furnace and the tonnage smelted per ton of coal will be greatly increased over the old system of gas firing. No concentration of ore will be done at Great Falls. All of the ore will come to Anaconda and concentrates only will be shipped from there. The blast-furnace department at Great Falls will also be closed down and all smelting will be done in reverberatories, as in Anaconda.

The new leaching plant at Anaconda, which will be operated on tailings which have accumulated during the past years to such an extent that about 15,000,000 tons are available for retreatment, is nearing completion, and will probably be started early in April. It will treat from 2000 to 2500 tons per day of tailings containing from 13 to 14 lb. of copper per ton, and will make from six to seven hundred thousand pounds of copper per month at low cost. The supply of tailings for this plant is sufficient to keep it in operation for a period of about 20 years.

The new acid plant is also nearing completion and will be able to make somewhat over 100 tons of acid per day. This acid will be used in the leaching plant and in the new flotation plants.

The company has much experimental work under way along various lines, which may in the course of a few years lead to the establishment of other important lines of industry at Anaconda and other points.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c each

DRILLING—Dust Collector for Rock Drills. Emmet F. Galligan, Idaho Springs, Colo., assignor of one-half to Henry E. Woodward, Denver, Colo., and one-fourth to William H. Galligan, Idaho Springs, Colo. (U. S. No. 1,127,225; Feb. 2, 1915.)

DRILLS—Front-Head Construction for Self-Rotating Hammer Drills. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. Nos. 1,126,941 and 1,126,942; Feb. 2, 1915.)

HOISTING—Automatic Brake-Setting Device for Mine Hoisting Engines. Alfred William Charles and Charles Edward McDonald, Butte, Mont.; said Charles assignor to said McDonald. (U. S. No. 1,127,183; Feb. 2, 1915.)

HOISTING—Safety Device or Arrestor for Colliery Winding Cages, Hoists, and the Like. Jack Yates and Charles Heyes, St. Helens, England. (U. S. No. 1,127,713; Feb. 9, 1915.)

LADLE FASTENING, Frederick H. Beebe, Elyria,-Ohio.. (U. S. No. 1,126,687; Feb. 2, 1915.)

METAL-MELTING FURNACE or Retort. Maurice Goldberger, Fort Wayne, Ind. (U. S. No. 1,125,090; Jan 19, 1915.)

METALLIC COATING and Process of Making Same Max Ulrich Schoop, Höngg, near Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S No. 1,128,058, Feb 9, 1915.)

MINE-CAR STOP John T Pero, Parsons, Penn., assignor of one-fourth to James R Fleming and one-fourth to Gary N Gray, Scranton, Penn, and one-fourth to William Harris, Parsons, Penn. (U. S. No. 1,126,562; Jan. 26, 1915.)

PULVERIZER William K Liggett, Columbus, Ohio, assignor, by mesne assignments, to The Jeffrey Manufacturing Co. (U. S. No. 1,125,137, Jan. 19, 1915.)

SEPARATOR Planetary Centrifugal Separator. Wilhelm Mauss, Johannesburg, Transvaal, South Africa. (U S. No. 1,126,547, Jan. 26, 1915.)

SINTERING PROCESS for the Recovery of Metallic Oxides from Flue Dust George F. Downs, Buffalo, N Y (U. S No. 1,127,209, Feb 2, 1915.)

SIZING Apparatus for Sizing or Volumetric Grading Materials Charles L McKesson, Colorado Springs, and Benjamin F Rice, Denver, Colo (U S. No 1,127,469, Feb 9, 1915.)

SLAG STEAM GENERATOR Charles H. Smoot, New York, N. Y., assignor to Slag Steam Generator Co., New York, N. Y. (U. S. No. 1,127,690, Feb. 9, 1915.)

SMELTING FURNACE. Edwin Vincent Lanyon and Francis Albert Curnow, Pittsburg, Kan. (U. S. No. 1,127,264; Feb. 2, 1915.)

STEEL—Improvements in and Apparatus for Carrying the Steel from the Steel Furnace to the Roller Mills and for Casting the Ingots en route. A. H. Cooper, Irlam, nr Manchester, Eng. (Brit No. 21,066 of 1913.)

TUNGSTEN Method of Treating Mill-Scale Frederick M Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Niagara Falls, N Y. (U. S. Nos. 1,127,162 and 1,127,163, Feb 2, 1915.)

Editorials

Zinc Smelters' Roasting Furnaces

The accompanying table, exhibiting the kind and number of the roasting furnaces in the zinc-smelting works of the United States and their aggregate daily capacity, is of interest. Save in the few cases noted as estimated, the data were officially communicated by the several companies, and stand as of Dec. 15, 1914.

The capacity is given in terms of tons of 2000 lb. of raw ore. The total is 2753 tons per day, or about 1,001,000 tons per annum, reckoning 360 days. However, about 201,000 tons of this was in works that did not produce spelter in 1914, leaving 800,000 for the works that were active. Of the works that did not produce spelter in 1914, two of them (Langeloth and Granby, East St. Louis) were new plants coming into operation in 1915, and their roasting capacity was 57,600 tons. The main part of the remainder of the ore-roasting capacity in 1914 was in moribund plants, the further operation of which is doubtful. An allowance must be made for the time when furnaces must be cold for repairs. Let us assume 750,000 tons as the total roasting capacity among the smelters who were active in 1914. The total amount of ore treated by those smelters was probably about 925,00 tons.

The figures for roasting capacity are not to be taken as anything but approximations, the capacity of the same furnace being variable according to the ore roasted. Thus a furnace roasts fewer pounds of flotation concentrate per square foot of hearth area than it does of Joplin blende. However, we get an idea of how things stand in the American zinc industry taken as a whole. The works operating in 1914 were about 175,000 tons short in roasting capacity. This corresponds approximately with the supply of calamine, whereof about 150,000 tons per annum is obtained from Leadville, about 16,000 tons from the Joplin district, a few thousand tons from Nevada and southeastern Missouri, besides which there is the noncompetitive output of the Franklin mine, which goes to the New Jersey Zinc Co. We may see that the smelting capacity is limited rather by the roasting capacity than by the distillation capacity (of which there is a great surplus) and why when the supply of Mexican calamine became largely cut off there arose so eager a demand for Leadville calamine that smelters were willing to take a very low grade of it and guarantee a high price for spelter as the basis of settlement.

This is a condition that is likely to change. The natural-gas smelters were eager to obtain calamine in order to keep their works going at as nearly 100% capacity as possible. They were not disposed to put any more money for additional roasting furnaces into plants that were soon to be discarded anyway. And, moreover, the consumption of gas, already scarce and costly, was reduced by smelting an ore that did not require roasting. The plants that are being built in the Eastern coal fields are, without exception, equipped for the manufacture of sulphuric acid, which implies roasting facilities. The sulphuric-acid makers at the end of 1914 had about 455,000 tons of roasting capacity, besides which there was about 40,000 tons at the Langeloth plant, just going into operation and something additional at East St. Louis. The movement of the zinc-smelting industry toward the East foreshadows a disappearance of the premium on calamine. Will the concentration of large productions of sulphuric acid between St. Louis and Chicago and between Pittsburgh and Wheeling reduce the price of that commodity and consequently the terms for blende ore?

It is interesting to examine the types of roasting furnaces in use by American zinc smelters. These are mechanical with but few and insignificant exceptions. The old hand-rabbled shelf-burners continue in use at Iola (two works) and Pittsburg, Kan.; also at the Carondelet plant of the Edgar Zinc Co., while at Peru there remain two muffled shelf-burners. With respect to the mechanical furnaces generally in use there are scarcely any novelties. The sulphuric-acid makers use the Hegeler furnace without exception. This was first introduced about 1882 and during 31 years has undergone surprisingly little change. Structurally it has been improved, but in principle and to the most extent in mechanism it is the same as in 1882. The United States Zinc Co. abandoned the Rhenania hand-raked furnaces that it had originally and uses the Hegeler for simple roasting without sulphuric-acid manufacture.

Among the furnaces used for roasting alone, the Brown (both circular and straightway) is in use at two active works and survives at another works temporarily idle. The Ropp furnace, as modified by Cappeau, is in use at three works, and the Zellweger furnace at seven works

BLENDE ROASTING FURNACES

Company	Place	No.	Kind	Daily Capacity
Altoona	Altoona	3	Zellweger	90
Amer. Z. & C. Co.	Langeloth	2	Hegeler	110
Amer. Z., L. & Sm. Co.	Caney	4	Zellweger	120
Amer. Z., L. & Sm. Co.	Dearing	3	Zellweger	90
Amer. Z., L. & Sm. Co.	Hillsboro	2	Hegeler	80
Bartlesville	Bartlesville	5	Zellweger	150
Bartlesville	Collinsville	6	Ropp-Cappeau	150
Chanute	Chanute, Kan.	3	Machine	30
Collinsville	Collinsville, Ill.	4	Brown	50
Edgar	Cherryvale	9	Brown	130
Edgar	St. Louis	5	1 Brown 4 Hand	20
Granby	E. St. Louis	1	Hegeler	50
Granby	Neodesha	2	Zellweger	60
Grasselli	Clarksburg[1]	3	Hegeler	120
Grasselli	Meadowbrook[1]	4	Hegeler	160
Hegeler	Danville	2	Hegeler	e 80
Illinois	Peru	3 2	Hegeler Hand	e 120 e 20
Laharpe	Laharpe	2	Hand	e 20
Robt. Lanyon[1]	Hillsboro	1	Hegeler	44
Lanyon-Starr	Bartlesville	2	Zellweger	60
M & H	Lasalle	4	Hegeler	155
Mineral Point	Depue	7	Hegeler	294
National	Argentine[2]	2	Hegeler	100
National	Bartlesville	4	Zellweger Rissmann & Ruebel	130
Prime Western	Gas	6	Hand	30
Prime Western	Tiltonville, O.[3]	2	Hegeler	90
Tulsa F. & M. Co.	Collinsville	2	Ropp-Cappeau	50
Tulsa Spelter Co.	Sand Springs	2	Ropp-Cappeau	70
U. S. Zinc Co.	Pueblo	2	Hegeler	e 80
			Total	2753

[1] There are no roasting furnaces at these works. The numbers entered are the furnaces at other points which supply them. [2] The roasting furnaces at Argentine supply the smeltery at Springfield. [3] This roasting plant supplies other smelteries.

e Estimated

All of these furnaces date back at least 15 years. At Bartlesville, Mr. Rissmann has a new furnace, which is about the only new thing in blende roasting in this country.

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Fireproofing Mine Shafts

The matter of fireproofing mine shafts is important. In the case of new shafts, the problem is frequently met by all-steel, or steel and concrete, or concrete construction. This does not, however, meet the case of an old timber-lined shaft. To tear out the whole system of shaft timbering and replace it with a fireproof lining would, in many cases, entail too much time and money. Even acknowledging the advantages of concrete, or steel and concrete lining, the cost is often prohibitive and the timber-lined shaft is therefore still the rule. And a timber lining offers many advantages in itself. The lining operations can follow the sinking easily and closely, the units are handled economically and can be quickly adjusted to suit local shaft conditions. If the timber could be made fireproof, therefore, it would be an excellent lining material. A system of fireproofing, permanent, safe and within the cost limit, especially one applicable at any time after sinking is completed, ought to find a large field in the mining industry.

There appears in this issue of the JOURNAL a description of a job in which a cement-gun was used to sheath the wood and steel framing of a steeply inclined shaft in the iron country. The cement-gun has been used for this purpose in other instances also and offers interesting possibilities for underground work. The machine, as is known, is one which deposits cement mortar by an air blast and is peculiar in that the material is mixed dry and no water is added until the material reaches the discharge nozzle. It is claimed that the hydration of the material really takes place in the air between the nozzle and the place of deposit, the initial set of the cement taking place on the structure and not in the mortar box. The nozzle is directed against the work as an ordinary garden hose is used. The layer of cement mortar so deposited has been given the trade name "Gunite." No forms are required for the work. In shaft jobs where timber is to be coated, the wood is first thoroughly cleaned and washed, this work being done with the machine, and then a layer of wire mesh is stretched evenly over the surface and fastened in place at the proper distance therefrom. This reinforcement is provided to take care of the temperature stresses, to give the lining homogeneity and elasticity and to increase the adhesion of the coating to the timber.

It is maintained that this coating is not only fireproof, but also dense and waterproof, thereby preventing the decay of the timber work, since the timbers become waterlogged and much less subject to decay.

This method of fireproofing was not considered for the job described until the shaft lining itself was completed. If the coating had gone hand-in-hand with the regular lining work, it is claimed by the advocates of the method that the use of the 3-in. lagging between the steel sets could have been obviated by increasing the thickness of the Gunite and placing it in the form of flat arches between the set members. Only a light lagging strong enough to afford protection during sinking, would have been necessary and this could have been placed outside the steel.

Another shaft which has been fireproofed with Gunite is the new shaft of the Old Ben Mining Co.'s No. 9 mine near West Frankfort, Ill. This is a vertical coal shaft about 600 ft. deep. It is protected by a 2-in. lining, reinforced as described above.

In considering the use of the process, the item of cost is usually the controlling factor. From the very nature of the work, however, it is obviously impossible to name any hard and fast figure which could govern all cases. The Cement Gun Construction Co. states that the price depends so much upon local conditions, material and labor cost, and other details, that it is necessary to make a special estimate for every job. Where compressed air can be furnished by the mine, and under normal conditions, the cost of the Gunite coating per square foot, it is stated, should be about 20 to 22c. for a 2-in. application and from 15 to 18c. for a 1½-in. thickness. This will include all material, labor, transportation and superintendence, except cage service, which is always furnished by the mine. Under favorable conditions this can be reduced, while in cases where large amounts of water are encountered or where material or labor is high, an increase may be necessary.

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Gold Stealing in Siberia

In reporting to the stockholders of the Lena Goldfields, Ltd., the English company which controls the Lenskoi Gold Mining Co. and through it operates rich placer ground in Siberia, the consulting engineer refers to the thefts of gold from the company's works as one of the chief sources of high cost of operation. C. W. Purington, the consulting engineer, has had much experience in the class of mining carried on at the Lenskoi, both in Russia and in other countries, and he puts the company's actual loss by theft at $500,000 yearly. This seems a large sum, but the evidence of other foreign engineers who have operated Siberian mines makes it quite probable; especially as the gold at the Lenskoi is generally free, and much of the work is done by hand. Mr. Purington philosophically accepts the fact that wherever gold or precious stones are produced there is risk of theft, but he proposes to reduce the loss by substituting machinery for hand labor wherever possible and by building change houses and requiring miners to change clothes upon leaving work.

These measures might lessen the amount of theft, but could hardly do away with it altogether. The *starateli* of Siberia are rather an independent class and much given to roving. They have been brought up generally in the old lines, are expert in concealing gold and do not seem to regard it as a crime, doubtless looking upon it as a sort of commission to which they are entitled. It can be readily disposed of, for wherever there is stolen gold, illicit buyers are ready. Foreign engineers who have been in Siberia have all commented on the thefts and some have even sought to estimate some definite percentage of the total output.

The Siberian miners are not the only gold thieves in the world; we have even heard of "high graders" in Colorado and elsewhere in our own enlightened country, to say nothing of Australia.

Outside of the stolen gold, however, there is "free gold" in Siberia, which is not stolen from the point of view of the operators, but is contraband by the government standard. Under Russian law all gold won is to be turned over to the government collectors, who pay for it by drafts on the various mining centers, after deducting the government tax or royalty. But many, especially the smaller operators, find it convenient to have a reserve which is not returned to the officials, but is carried or disposed of in various ways. This is a custom which is of old standing. Some engineers of long experience claim that the stolen gold and the free gold amount to at least 15% of the total, and it is always entirely safe to add 10% to the official returns to get at the Siberian production. The majority think 10% is too low; in some remote districts and near the Mongolian border 20% might be nearer the mark. We can only say that a gold-mining company which—like the Lena Goldfields—can lose $500,000 a year by theft and still pay dividends, is a very fortunate one.

BY THE WAY

An interesting view of the Mexican situation was that given in the speech of Chairman R. T. Bayliss of the Exploration Co., Ltd., at the ordinary annual general meeting of the company in London, Feb. 3, 1915.

> You will expect some remarks from me with regard to the Mexican situation. I approach this subject with some hesitation, for it is one on which those most competent to form and express an opinion are very reluctant to make any prediction regarding the future. The capable correspondent of "The Times," writing under date of Dec. 11, sums up the conditions prevailing last year as follows: "The conditions of the past year in Mexico have been unprecedented. The whole country has been in arms. Revolution has succeeded revolution. Various factions contending for supremacy are still at war, and the outlook, from a political, financial and economic standpoint, is clouded by many uncertainties." That statement expresses very succinctly and very accurately the conditions as I understand them today. Of the mistakes that have been made in the administration and in the interference with the administration of Mexico during the past two years one could talk by the hour; but it would not serve any good purpose. Grave mistakes have undoubtedly been made, but those who have interests in Mexico and the welfare of the country at heart can employ themselves more profitably in lending the weight of their counsel and influence toward a restoration of more settled conditions than in criticizing the errors of the past. In my opinion the great mass of the population of Mexico is neither fitted for, nor do these people want, nor are they competent to conduct, the affairs of the country under a so called constitutional government. On the other hand, they are not willing, as I understand them, to submit again to the rule of a dictator, even if another should arise so familiar with the needs of the country and so competent as the late President Diaz. Politically the country is, I believe, passing through a period of transition and cries aloud for the help and guidance of some constitutional power or powers to tide it over this period, and to do for Mexico, with the aid of some equally capable adviser, what Lord Cromer and his successors have done for Egypt. Under such guidance peace would be restored, the excuse for factional differences would be removed and Mexico would soon take a prominent place in the economic progress of the world.

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Chronology of Mining for January, 1915

Jan. 4—London Stock Exchange reopened.

Jan. 7—Federal district court at San Francisco declares Arizona's alien law to be unconstitutional.

Jan. 11—Strike started in Miami and Globe.

Jan. 12—Annual meeting of Mining and Metallurgical Society of America.

Jan. 13—Copper Producers' Association dissolved.

Jan. 24—Strike in Globe-Miami district settled; work resumed at increase in wages.

Jan. 25—Spelter price, East St. Louis, passed 7c.

Jan. 26—U. S. Steel Corporation common dividend passed.

Jan. 27—Announcement of raise in wage scale at Bisbee following higher price of copper.

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St. Joseph Lead Co.

The fiscal year of the St. Joseph Lead Co. has been changed to conform to the calendar year and its report, just issued, gives the results from its Missouri properties from Apr. 30 to Dec. 31, 1914, as well as for the calendar year. The combined net income of the St. Joseph Lead and affiliated companies for the eight months was $966,317; for the calendar year, $1,547,275. Dividends to the amount of $258,390 were paid from the income of the calendar year. The profit and loss surplus for 1914, after deducting dividends, was $1,273,580 and the total profit and loss surplus at the end of 1914 was $9,416,628. The average price received for lead at East St. Louis, Ill., in 1914 was $74 per ton, the lowest in 16 years; during the previous fiscal year the price averaged $81 per ton.

Owing to the decreased demand for lead, the company's properties were operated only at 75% capacity after October. The output for the calendar year was 77,404 tons as against 65,615 tons during the previous fiscal year. The mines of the Bonne Terre division in 1914 produced 508,649 tons of ore; there were milled 505,123 tons, of which 418,739 tons were treated in the Bonne Terre mill, 68,757 at Rivermines and 17,627 at Leadwood. Milling operations were discontinued at the Bonne Terre mill about the middle of October when mining operations were curtailed 25%. The cost of mining was $0.6337 per ton or 16c. less than last year. In the Leadwood division, there was a production of 516,878 tons from the mines at a cost of 75c. per ton. Development in the Bonne Terre division cost $8.57 per ft.; in the Leadwood division $5.12; diamond drilling cost 43c. and 61c., respectively. The milling costs in the two divisions were: In the Bonne Terre division, 34.07c. per ton of ore treated; in the Leadwood division, 28.94c. per ton.

Doe Run mined 966,273 tons and treated 967,976 tons. Diamond drilling cost 55.9c. per ft.; development, $10.53 per ft.; mining, 65.6c. per ton; milling, 27c. per ton. The mining costs were 5c. lower than in the previous year, due mainly to the introduction of automatically rotated sinkers, and an increased tonnage of about three-quarters of a ton per man-shift.

About $136,000 were spent in 1914 in completing the improvements outlined for the smelting plant at Herculaneum, Mo., and the recovery now shows a gain of 5% over what it was four years ago, while the cost of producing a ton of pig lead is now about $2.25 lower, though part of this improvement is due to higher-grade concentrates being produced in the mills.

No further new construction of an important nature is now contemplated. The grade of the ore was maintained by the mines in 1914 and costs were reduced in most departments. Labor conditions were satisfactory and wages were not reduced, despite the low price for lead. The contract with the State Board of Mediation expired on Aug. 26 and was not renewed. A system of old-age pensions was established last year.

PERSONALS

J. R. Finlay has returned to New York.

N. V. Hansell, of Hamilton & Hansell, is on his way to Russia.

Morton Webber is now in London, having sailed from New York Jan. 27 on the steamship "Baltic."

W. P. Snyder, president of the Shenango Furnace Co., Pittsburgh, has gone to Palm Beach, Fla., to remain until April.

H. C. Enos was married in Salt Lake City, Feb. 16, to Miss Caroline Nolan. Mr. Enos' present address is Hotel Paso del Norte, El Paso, Texas.

C. W. Purington, with Mrs. Purington and young child, are passengers on the "Tuscania" of the Cunard line, which sailed Feb. 20 from New York for Liverpool.

J. M. Hill is to conduct an examination of the placer deposits of the United States for the U. S. Geological Survey. The work will occupy over a year, it is expected.

Thomas T. Gray, for many years chief chemist of the Tidewater Oil Co. at Bayonne, N. J., has opened a research and consulting laboratory at 1343 North Ave., Elizabeth, N. J.

W. G. Trethewey, formerly of Toronto and largely interested in Cobalt mines, now residing in Sussex, England, has recently undergone a successful operation for appendicitis.

S. W. Cohen, general manager of the Crown Reserve Mining Co., Cobalt, Ont., will shortly leave for Nicaragua accompanied by a staff of engineers to investigate a gold property on behalf of the company.

Henry Jaxtheimer has been elected safety engineer at the plant of the Sharon Steel Hoop Co., Sharon, Penn. This is a new position the company has created as the result of recent compensation and accident legislation.

R. M. Hosea has resigned as chief engineer of the Colorado Fuel & Iron Co., the Colorado & Wyoming Refining Co., and the Crystal River R.R., effective Feb. 15. He will retain a consulting engineer engagement with the above companies and is open to any outside engagement.

Charles Janin, of San Francisco, is to conduct an investigation into gold dredging in the United States for the Bureau of Mines. The work will occupy some time and will be more or less related to the placer examination which J. M. Hill is conducting into placers for the Geological Survey.

A memorial to the late Thomas J. Grier at Lead, S. D., is proposed by the employees of the Homestake Mining Co. They have appealed to his old friends and business acquaintances to aid them by subscriptions to their fund. Richard Blackstone, Lead, S. D., is chairman of the committee.

Dr. James Douglas was made an honorary member of the American Mining Congress at a recent meeting of its Board of Directors. The presentation of the diploma to him occurred at a luncheon party at the Engineers' Club, New York, Feb. 17, at which Carl Scholz, President of the Congress, presided. About 20 prominent mining engineers were present.

Kurt Orbanowski, formerly in charge of the Putiloff shipyards in Russia, and Jacob Eton Conner, for a number of years American consul at Petrograd, Russia, are in this country looking into the purchase of tin, lead, spelter and other metals and materials for export to Russia. They are making their headquarters at the office of the Ingersoll-Rand Co., 11 Broadway, New York.

OBITUARY

William Dick, a wealthy merchant and large mine operator in southern Colorado, was killed Feb. 13, as he was driving in his automobile from Walsenburg to La Veta, Colo. It is believed that the murderers were not robbers, but that the shooting was the result of enmities arising from the mine troubles last spring. No attempt was made at robbery, though Mr. Dick had a large sum of money with him. According to local accounts his property had been threatened with destruction. He had refused to sign any agreements for working scales at his mines, running his property on an independent basis. William Dick was a stockholder in the Turner, the Solar and the Nigger Head mining companies and part owner in the Gordon Mining Co., all located near Walsenburg, besides being interested heavily in the Rugby company near Aguilar. He was president of the Pinon Supply Co. and of the Walsenburg Wholesale Mercantile Co. He leaves a widow and eight children, all living in Walsenburg. He was 50 years old.

Arthur Keen, one of the best known men in the British iron industry, died Feb. 15, aged 80 years. As a young man he was first employed as a railroad clerk, but 60 years ago he entered the firm of Watkins & Keen, which began in a small way the manufacture of bolts and nuts by newly devised machinery. By years of expansion and consolidation this small firm gradually developed into the important corporation of Guest, Keen & Nettlefolds, Ltd., owning mines, blast furnaces, steel works and rolling mills. Mr. Keen was for a number of years managing director and later chairman of the company. He was also a large stockholder and director in the great steel making house of Bolckow, Vaughan & Co. Mr. Keen was quite prominent in politics and was a close friend of Joseph Chamberlain. In 1904 he was a member of Mr. Chamberlain's tariff commission. On several occasions he acted as an arbitrator in labor disputes. Mr. Keen was a vice-president of the Iron & Steel Institute, and of the Institute of Mechanical Engineers. He leaves three sons, of whom two are directors of Guest, Keen & Nettlefolds.

SOCIETIES

Iron & Steel Institute—The secretary gives notice that the annual meeting will be held at the Institution of Civil Engineers, Great George St., London, S. W., on May 13 and 14. May 13 has been provisionally fixed for the annual dinner, and a further announcement will be made if it is found possible for the dinner to take place.

Northwest Mining Convention—At this meeting, held in Spokane, Wash., Feb. 22-27, the special mining features were in charge of the Columbia Section of the American Institute of Mining Engineers. On Feb. 24 there was an address by F. A. Ross, chairman of the section, reviewing mining in the Northwest. Papers presented were "Mine Models," by F. W. Callaway; "Economic Geology of Northeastern Washington," by F. M. Handy. Discussions followed. On Feb. 26, miners' and prospectors' day was occupied by short addresses and discussions.

International Engineering Congress, 1915—Notwithstanding the difficulties arising as a result of the present European war, the Committee on Papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some 18 different countries. The Congress will therefore be truly international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned. The papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade. The Committee of Management is now issuing to all important engineering societies, in this country and abroad, invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured. Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work.

INDUSTRIAL NEWS

The Calumet & Hecla Mining Co. has just completed the installation of 12 large Hardinge mills in its new White Pine concentrator.

The Keasbey & Mattison Co. has recently appointed Howe Brothers, 1198 San Pedro St., Los Angeles, Calif., as its agents for covering and textile goods for California south of Fresno, and also for Arizona, New Mexico and Utah.

The Hardinge Conical Mill Co. has recently entered into a contract with the Anaconda Copper Co. covering sixty 10-ft. diameter Hardinge mills, 20 of which are to be installed immediately, the others following throughout the year.

Edward M. Hagar has resigned as president of the Universal Portland Cement Co. He intends to organize a combination of portland cement producers. His successor is Benjamin F. Affleck, who has been with the company since it was organized.

Editorial Correspondence

SAN FRANCISCO—Feb. 17

Thirty-Five suits have been filed in the United States District Court at San Francisco against the Penn Mining Co. operating a copper mine and smeltery at Campo Seco in Calaveras County. These suits are brought by farmers in Amador and Calaveras Counties for alleged damage to crops and soil by fumes from the smeltery. Two of these suits were filed on Dec. 31, another followed shortly after, and 32 more were filed in the first part of February. The largest amount of damage claimed by a single farmer is $27,769 and the smallest amount $2262. The whole of the 35 suits amounts to $334,314. They followed the report of the state commission appointed by Governor Johnson for the investigation of waste and damage from the smelteries of the state. This commission examined conditions about Campo Seco and also in the region affected by the Mammoth smeltery in Shasta County. The report was unfavorable to the Mammoth, but it was not vitally unfavorable to the Penn Mining Co. The absurdity of these actions is quite apparent not only on the basis of the report of the state commission, but from the fact that the farmers did not themselves initiate the suits. A San Francisco firm of attorneys went among the farmers in the Campo Seco region and made contracts for the bringing of such actions against the Penn Mining Co., providing for a division of the money damages that may be secured through the court. And besides that, the supervisors in Amador, Calaveras and also San Joaquin Counties declined to bring such actions upon showing that had previously been made by some of the farmers. Another evidence of the absurdity of the suits is that in some cases, if not practically all, the value of the land forming the basis of demand for damages has been placed greatly in excess of actual value. For instance, in one case of former suit brought, the entire acreage of the farm was counted for the valuation placed at $125 per acre. The larger proportion of this land had absolutely no agricultural value, and the remainder had an actual value of about $40 per acre. The farmers in the Campo Seco region some time ago gave up all hope of making a damage suit lie against the Penn Mining Co. The smeltery has at times without doubt discharged some small quantities of SO_2 and a slight amount of damage has in the past been done. Recently and for the past two years every effort has been made by the company to prevent the discharge of such damaging fumes and within the past half year a comparatively small amount of smelting has been done while the main efforts of the company have been directed to the development of new orebodies. A fault was disclosed in the vein formation, and after a large amount of exploration and development the vein was again picked up. The labor devoted to the development of new orebodies has necessitated the curtailment of smelting operations, and beside that, the effect of the European war upon the copper industry further necessitated curtailment of smelting. There has been practically no damage done to any of the crops or the soil in this region. Some of the farmers who are included in these suits, in fact most of them, express no particular interest in them, having merely given the attorneys such facts as they required and signed the contract for division of the spoils, if there should be any spoils. The attorneys assume the expense of bringing the suits and it is quite likely that the chief purpose in the commencement of the actions was to impress the Penn Mining Co. with the idea of entering into a compromise and giving all the farmers a pro rata of such aggregate amount as might be agreed upon. The Penn Mining Co. of course is prepared to meet the actual trial of any or all of these suits, but it is not at all probable either one or any number of them in combination will be tried when the suits are brought fairly before the court. In the first place, there has not been sufficient expert examination to provide evidence upon which to base rational action, and it is quite certain that the report of the state commission respecting the Penn Mining Co. can not be construed as a basis of action for money damages. An interesting feature of the situation in the Campo Seco region is that no complaint has ever been made by the owner of the largest and most prosperous farm in the region, which is situated in about the center of the so called "smoke belt." This farm has an area of approximately [illegible] acres, and despite the fact that the soil is probably not above the average productivity compared with neighboring farms, the owner has found profit in its cultivation.

DENVER—Feb. 18

Workmen's Compensation is earnestly considered by the present state legislature. Bills have been framed along lines followed in Wisconsin. Whereas it was generally assumed that Colorado employers would oppose such a measure, it appears that they favor it. The metal-mine operators are perhaps among those who will suffer greatest in the enforcement of this legislation for, as they explain, casualty insurance rates are very high on lives of miners and the products of their mines are sold in markets over which operators have no control. Therefore any new expense placed upon their operations simply means a lessened profit which might, in extreme cases, amount to total eclipse. At the same time they assume a favorable attitude and openly declare their approval of the general proposition that any industry should assume its own indemnities. Among those who have appeared before the legislative committees to discuss this matter is Bulkley Wells, manager of the Smuggler Union mine at Telluride, who voiced his opinions at the same session as did John McLennan, president of the United Mine Workers and the Federation of Labor. Mr. Wells' argument was that the proposed measure will bring about better relations between companies and their employees and this, in turn, will result in increased efficiency among workmen.

At the Cresson Mine, the third chapter in the story of shipment from the great vug disclosed some time ago, relates to the re-sampling of these lots at the Globe plant of the American Smelting & Refining Co., Denver. When it became apparent that the discrepancies between the Globe's first results and those obtained at the Copeland works were too wide to permit adjustment, the smeltery officials ordered resamples. This work happened to start on a very windy day and it was quickly stopped because of fears entertained by both parties in this case that the breezes would tamper with results. Later, however, the lots were completely re-rolled and again mechanically sampled. Results were remarkable checks on those from first sampling at this plant, viz., about 206 oz. gold per ton for the first class and about 105 oz. for the second class. The deadlock was established. Arrangements were then made to dispose of this ore to the Golden Cycle company and it has undergone its third shipment, this time doubling back on its track and being now at Colorado City. Its proposed treatment in a cyanide plant causes comment and it seems there may be more to relate before this stuff is finally worn out by sampling and shipping and its content removed. Meanwhile it is reported that the Cresson management is shipping another carload lot of this ore, though its destination is uncertain at this writing. Good results are reported from development on 1300-ft. level, the level next below the scene of the rich discovery.

BUTTE—Feb. 18

enry Robinson, vice-president of the Butte Mine Workers' Union, on Feb. 12 shot Thomas Munroe, a watchman employed by the Anaconda company at the corner of Main and Park St., the busiest spot in the Butte business district, at about 6 p.m. Munroe was taken to the hospital where he died shortly afterwards. Robinson was arrested and is now awaiting trial for murder in the first degree. Reports as to the circumstances leading to the shooting are conflicting. The actual facts will probably not be known until after the trial.

The Mediation Board, appointed some time ago to bring about a reorganization of the Butte miners, submitted its report to the Silver Bow Trades and Labor Council, which was approved by this body at the regular meeting held Feb. 11. The report is as follows:

First—After extended deliberation the committee has arrived at the conclusion that the only possible way for the miners of Butte to organize is through the Western Federation of Miners. Second—After having consulted with the two factions at length and using our best efforts we conclude that neither faction has made any sincere effort in the reorganization. Third—Having reached this point we see no other way but to organize the miners of Butte regardless of either faction. Fourth—To do this we propose that ar enrollment book shall be opened for a period of 30 days, the place of enrollment to be designated later. Fifth—All miners desiring to enroll themselves under the banner of organized labor are invited to place their names upon the book and upon the payment of an initiation fee of $1 will be entitled to cast a vote for the officers of this organization. Sixth—That the mediation board supervise the initial election in the miners' union, and that thereafter the nominees for president and secretary-treasurer each name a judge and clerk to look after their interests, and that voting machines be used. Seventh—That no person now holding office in either faction of the contending organizations be eligible for office in the initial election. Eighth—That the books be audited quarterly by a firm of chartered accountants and a statement of their findings be made accessible to the membership. Ninth—That the establishment of as many locals as may be deemed necessary for the efficient transaction of the business of the organization be installed. Tenth—That a mining council be formed to be composed of delegates from the various locals and that they affiliate with the central body. Eleventh—We recommend that an appeal be made to the American Federation of Labor and the heads of international unions whose members are represented in the mining industry to send organizations to Butte and that all members of organized labor use their best endeavors to assist the miners in the work of organization.

The suggestion that a reorganization should take place through the Western Federation of Miners will probably defeat the plans of the mediation board. The great majority of Butte miners have finished with the Western Federation forever and will under no conditions submit again to the dictates of that organization. Furthermore, whether belonging to the old or the new union or to no union at all, all those now employed in the mines are content with having a job at all and are not at all anxious to bring about unavoidable trouble by reviving the animosity existing between the old and the new union and the Western Federation of Miners. Neither do they feel inclined to submit again to the excessive assessments that were the rule under that regime.

SEATTLE—Feb. 11

Ruby is Active this winter. Three big outfits are taking out winter dumps on Long Creek. Deitz, Sech & Walker, who took out profits on Mascot Creek last summer, have found equally good pay in their new shaft, some of the ground being reported to run $25 to the square foot. Graham & Johnson on the Deacon Bench claim and Buckley Bros. on Novikaket Bench are hoisting pay. Van Winkle & McKay are taking out a dump on the Buckeye claim. Al Kells is sinking a new shaft on Windy bench. Whitton & Carlson are doing well on Boston bench, as are McDonald & Warren on Warren Creek.

The Fairbanks District appears to be undergoing a revival in quartz mining, especially on the left limit of upper Fairbanks Creek. The principal mine is the Crites & Feldman, at which the main tunnel has been driven over 700 ft. into the hill on the richest of several veins. The equipment includes a 5-stamp mill, air-compressor and hammer drills for stoping. Heilig has recently moved the old Huntington mill from the Tolovana mine to Fairbanks Creek and will do custom work. This mill was entirely unsuited to the extremely hard ore at the Tolovana and was discarded when a battery of Nissen stamps was installed. It is hoped that it will do better on the softer Fairbanks Creek ores. Goyette and partners are down 30 ft. with their new shaft on the Whitehorse claim, opposite No. 11 Above, creek claim. Kleinschmidt and partners are working opposite No. 13 and G. A. Perrault opposite No. 14 Huddlestrun Bros. & McNeil are at the head of Too Much Gold Creek, a left-limit tributary of Fairbanks Creek. The vein as exposed in a 75-ft. shaft is from 2 to 3 ft. wide. There is considerable ore on the dump ready for milling and it is planned to have a run at the Heilig mill in the near future. Chris Foss and Louis Farren are driving a tunnel at the extreme head of Fairbanks Creek on the American Eagle No. 2. Rod Donaldson and partners are reported to have discovered pay on Nugget Creek, a tributary of Goldstream. Hugh Ross has also found good prospects and will put on a small plant, with the intention of taking out a winter dump.

CHICAGO—Feb. 13

In the Wisconsin and Illinois zinc districts, the high price of spelter is having a direct effect on the opening of new properties. Unusual activity is discernible, as regards both the opening of old mines and the formation of exploration companies for the drilling of new lands.

Steady Improvement in Copper Market has had good effect on actual mining operations in the Lake Superior copper country, and a better sentiment exists in that district. The announcements made not long ago that the Calumet & Hecla and its subsidiaries, commencing Feb. 6, would resume work on a full time basis, were followed shortly after by announcements that wages would be increased up to within 10% of what they were before war was declared. In addition to this, the Wolverine and Mohawk mines also announced an increase in wages. While it is a question whether the increase in consumption will continue to offset this increased production and permit the present scale of operations and pay to be continued, present plans will undoubtedly be kept in force as long as possible. In the iron country, except for the isolated cases previously noted, where the working forces have been increased somewhat, there is not such a marked improvement at the mines, although iron and steel men feel certain that such an improvement is bound to appear before long if the orders for finished products continue at the rate reported by the Steel Corporation for the past two months.

HOUGHTON—Feb. 20

Labor Agitators in Calumet found it very unhealthy last week. Finnish miners held two meetings at which they appointed committees to notify socialistic agitators that their presence was not wanted in Calumet and suggesting deportation if the reds did not leave. The men included former Western Federation agents who worked for the United Mine Workers since the abandonment of this field by Federation agents. They first attempted to cajole Finnish miners to join their union. When the miners refused they used roundabout means of suggesting to the employer that the men in question were red socialists and members of the organization. Thus the poor Finnish miner was between the devil and the deep sea. Finally the men came to the conclusion that the only way to bring peace to themselves was to rid Calumet of the agitators and trouble makers. And this they are doing in their own way.

JOPLIN—Feb. 20

Prospecting in Joplin by a new and and original method has been put in practice by a number of local operators. Throughout the district there are a large number of old drill holes which did not secure ore in paying quantities and for that reason were abandoned. It has recently been found that by shooting these holes there has been found good ore which would pay to mine. The method of doing this shooting is to fix up a charge of dynamite or nitroglycerin in a long container which will go down a drill hole which, after cleaning the hole to the desired depth, is lowered and discharged, the material thrown from the hole by the explosion of this charge is examined and is often found to carry much better ore than was shown to exist from the cuttings from the churn drill. The size of the charge ranges from one to three boxes of 40% dynamite, or approximately a quart to 1½ quarts of nitroglycerin. These charges have proven effective down to a depth of 250 to 300 ft. J. M. Short a well-known operator of the Joplin district says he has found many good prospects by shooting old holes in this manner.

The Trend of Zinc-Ore Prices is still upward. The week marked a further boost in the price of zinc ore of approximately $5 per ton, with a high base of $75 per ton of 60% metallic zinc being paid at the week end. This eclipses all former price records. It is $10.50 higher than the highest price paid in 1912 and $18 per ton stronger than in 1905, and is a raise of better than $30 per ton over the price paid not more than two months ago. This means that at the present time there is about 15 times as much profit in a ton of zinc ore in the Joplin district now as there was 60 days ago. In other words, where the mines were making about $2 per ton profit when ore was selling at $38 to $45 per ton, now they are making from $30 to $40 per ton profit with ore selling at $75 per ton base. With this unusual profit in the mining of zinc ore the Missouri-Kansas-Oklahoma zinc and lead district has never seen an era of such widespread activity. Mining land and leases are in great demand, tracts that have long been idle and allowed to fill with water are now being sought with the intention of pumping out the old workings for the production of the coveted zinc ore contained therein. With the present situation in the spelter market caused by the strong demand for spelter and the apparent lack of that metal, it is expected that the price of zinc ore will stay at high level for some time, with a possible increase over that now being paid. The only visible reason for the smashing of the high price of spelter would be a greatly increased production of zinc ore, but since it takes time to increase the production to any great extent, so it is to be expected that the zinc-mining districts are due to reap the benefit of exceedingly high prices for ore for at least four months.

The Mining News

ALASKA

GEORGE WOODMAN, a mine operator in the Chisana, will take a Keystone drill in over the ice to prospect his ground on Skookum gulch. The adjoining claim produced $30,000 to date, but Woodman has been unable to prospect his ground on account of water.

THE KOUGAROK DREDGING CO. (Cordova) — Placing dredge on Iron Creek and having machinery freighted in over the winter trails.

TREADGOLD (Dawson)—Company failed to pay employees wages due for last summer's work. Amount owing to men is reported over $100,000

NO. 3 ABOVE, CLEARY CREEK (Fairbanks)—Fairburn & Sutherland, laymen, reported to have found good pay at bottom of new shaft recently carried to bedrock. Have started drifting and will put on small crew if pay continues.

CENTRAL CREEK (White River)—Billy James, discoverer of Chisana made placer strike on Central Creek in the upper White River Valley, 25 miles below international boundary and 75 miles above Donjek according to reports, 25 claims already staked in the new territory.

PERSEVERANCE (Thane)—New system of crushing and treating ore will be installed in plant now being built. Company preparing to handle 24,000 tons of ore per day at a profit of 75c. per ton. It is claimed that the company has 50,000,000 tons of ore already blocked out.

MOTHER LODE COPPER MINES CO. (Juneau)—Just made first shipment of ore to the Tacoma smeltery. Consisted of 250 tons high-grade ore. Other shipments will be made regularly, as company plans to ship 1500 tons during the winter. Ore is all mined and sacked ready for sledding to the railroad.

AITKEN & McKINNON PROPERTY (Georgetown)—Upper part of this property suitable for opencut operations but planned to mine lower part by drifting. Patches of thawed, wet ground will interfere with drifting. Operators worked about 22 men last summer. This said to be first real paystreak discovered in Kuskokwin Valley.

GOLDEN EAGLE MINE (Golden)—Neil Robinson has completed erection of buildings and installation of 5-stamp mill at this property. Mill will be operated by water power, but will not start up for several weeks as water is too low during winter. The work of developing mine has continued for several months and company now has considerable ore blocked out.

THOMAS-CULROSS MINING CO. (La Touche Island)—Main tunnel now in 350 ft.; good ore encountered and initial shipment of 10 tons made to Tacoma. Don Thomas, one of principal stockholders, announces company will build mill at property this summer having capacity of 50 tons a day. Meeting of stockholders held in Leavenworth, Wash., recently and authority given for construction of mill.

GOLDSTREAM—Much activity in this district, from the last reports brought out by prospectors. Stampede has been on to lower Goldstream for last few days, and many people from Ester and a few from other creeks have staked property on Goldstream below Nugget Creek. General impression is that pay will be found in good quantities. Two operators recently prospecting in the vicinity of Nugget Creek struck good pay and immediately after report circulated, the stampede started. Extent of pay has not been determined. On Goldstream proper, much prospecting is going on and output this year is expected to be great

ALASKA CONSOLIDATED COPPER (Skagway) — Mines near Strelna under development for several years, about to start work on larger scale. Thought the several claims will be brought up to shipping stage soon. Large consignment of machinery will be shipped from the East. Company proposes to construct railroad to connect with Copper River & Northwestern in case Government does not start construction work on Federal line this year. Tunnel 1700 ft. long will be driven from Nugget Creek bed to tap deposit at great depth. Four levels already opened and several thousand tons of ore are on dump awaiting shipment. Immediate development work will cost about $200,000. Property near headwaters of Kuskalina River. Paul Dubois, Seattle, consulting engineer.

ARIZONA

Santa Cruz County

THREE STARS (Alto)—Shipment of ore made from this mine recently Ore lead-copper with good silver content.

WORLD'S FAIR (Patagonia) — Run of ore better than formerly; reported there is much of it, oreshoot having grown in size with depth

CONQUEST (Tubac) Another attempt will be made to get out ore from this copper vein Previous efforts vain, on account of enormous quantity of water encountered. James Cunningham in charge of work

MORNING GLORY (Patagonia) Chris Wilson, owner of this old shipper, again driving tunnel to strike vein at 100-ft. level. Work suspended when war broke out, but now attempt will be made to finish tunnel thought it will open up large body of copper ore

Yuma County

BILLY MACK (Parker)—Mine is improving. Vein cut on [illegible] ft. level

EAGLE (Parker)—W. J. Stake & Co., lessees, are taking out copper-gold ore running from $40 to $200 per ton. It is being shipped to A. S. & R. plant at Hayden.

CALIFORNIA

Amador County

AMADOR QUEEN (Jackson)—Dominic Boro and others operating lease have cut seam of rich ore, small, with indications of widening.

PLYMOUTH CONSOLIDATED (Plymouth)—Financial returns for January show 10,200 tons ore milled. Total cost, mining and milling, $2.687 per ton.

HAYWARD (Ione)—Large vein of copper-gold ore assaying from $6 to $20 per ton found in 200-ft. crosscut from 300-ft. level. Mine formerly one of the large gold producers of Amador County. Was reopened in 1913 after 50 years' inactivity.

OLD EUREKA (Sutter Creek)—Reports again circulated that mine, owned by Hetty Green, of New York, will be reopened by Scotch company, said to be ready to buy mine. History of mine 20 years ago when Alvinza Hayward and others operated it, credits it with large production. Also reported that proposed purchase includes adjoining claims.

KEYSTONE (Amador City)—Quarterly report of C. R. Downs, general manager, shows many improvements. New hoisting gear and 300-hp. motor installed and 20 idle stamps of 40-stamp mill put in order for beginning operations. Drift on 1000-ft. level heretofore used as reservoir, reopened from shaft station, water to be stored at 900-ft. station. Over 200 ft. of drifting done on 100-ft. level, developing promising orebody 60 ft. long. East vein on 1400-ft. level will be crosscut to secure sufficient additional ore to keep 40 stamps dropping. Twenty stamps have been yielding $6000 a month.

Butte County

BUTTE CREEK CONSOLIDATED (Chico)—By terms of agreement in Superior Court this dredging company acknowledges judgment of $300 in favor of the Stanford University. University trustees brought proceedings to enjoin company from dredging on Butte Creek on ground that tailings affected land of the University. Injunction will not be pressed and company will continue operations without further objections.

Calaveras County

ECONOMIC (Esmeralda)—New orebody disclosed in raise from the 500-ft. level at point where it intersects 400-ft. level. Some delay has occurred in installation of electrical plant, but development is continued and ore is being blocked out.

Kern County

TEAGLE & MILLER (Randsburg)—Recent installation of gasoline hoist resulted in increased extraction.

SANTA ANA (Randsburg)—Lovett & Christianson driving crosscut toward Merced vein expecting to work into good ore.

KING SOLOMON (Randsburg)—Last milling of Nosser & Illingworth lease showed recovery of $80 per ton. Last company cleanup of 45½ tons at Red Dog mill recovered $50 per ton. Larger force of men contemplated. Mine capable of increased production.

Nevada County

GOLDEN CENTER (Grass Valley)—An electric pump, capacity 500 gal. per min. installed at shaft. Ten-stamp mill operating on good ore. Church Hill vein being developed at depth of 250 feet.

BEN FRANKLIN (Grass Valley) — This property and Alaska mine have been pumped out and sampled with view of determining whether or not property is to be developed under the purchase option

NORTH STAR (Grass Valley)—Reported that Muller & Walling claims have been purchased by this company. This will increase the holdings and add to the importance of North Star control of the contact of the Deer Creek section. Claims lie between the Nevada City and Spanish mines and cover 2000 ft. along the contact. The latter named mines are included in Champion group taken over by North Star.

San Bernardino County

BARSTOW-SAN ANTONIO OIL CO. (Barstow)—Installation of machinery in progress for handling large deposit of fuller's earth, situated 35 miles northwest, near Dover oil well Supplies and parts of machinery to be hauled from Hinkley station on Santa Fé, by caterpillar tractor. B. V. Unwin is manager,

Shasta County

ORO WATER, LIGHT AND POWER CO. (Oroville)—Reported that this company has taken options on several ranches along Clear Creek below Redding. If ground warrants it, dredge will be installed.

IGO DEVELOPMENT CO. (Igo) Options on 4000 acres of placer land in the vicinity of Igo and 800 acres of the Menzel Ranch near Redding have been taken. Keystone drill has been installed on the Russell claims at Igo.

MOUNTAIN COPPER CO. (Keswick) -Preparations being made for the resumption of construction of new concentration plant and increased extraction of ore to meet demands of Martinez smeltery, which will resume operations on a small scale

BALAKLALA (Coram)—Shipments of high-grade ore to Tacoma smeltery to be resumed. Resumption of ore extraction on small scale has been undertaken. Only high-grade ore will be shipped. Precipitation of copper carried in solution by the mine waters is also to be resumed. Reported that high-grade zinc ore will be shipped to Eastern plants.

Sierra County

THE EMERALD QUARTZ GROUP (Jim Crow Cañon)—This mine, owned by D. W. Smith and Wm. Shipsey, and Elsie group, owned by C. Buckingham, have been bonded to Clifford Smith and associates of San Francisco, who will push development. Claims lie near head of cañon, which in past years yielded rich placer gold.

TWENTY ONE (Alleghany)—North American Exploration Co., operating this quartz mine, being financially unable to proceed, surrendered their bond and mine was taken over by G. W. Mitchell and associates of Sacramento, who almost immediately struck a pocket of high-grade ore resembling rich finds in Tightner. Extent not yet determined.

Siskiyou County

HAPPY CAMP DISTRICT making good showing for winter season. Snake Hill operations interrupted by snow slide. Repairs will be concluded and mining resumed immediately. Shearon mine, better known as Stump, has developed gravel running from 25c. to $1 per pan. Golden Sunrise being developed under bond to Eastern men with good prospect of sale. Installation of small quartz mill contemplated. Sixes Mine, operated by Salt Lake men, running full time with good gravel in sight. Siskiyou Mines Co. operating with full crew of men, with prospect of good winter run.

Tuolumne County

NEW ALBANY (Jamestown)—Rich vein reported. Extensive development in progress

BLACK OAK (Soulsbyville)—Deepening of shaft 100 ft. below 1700-ft. point contemplated.

Trinity County

GLOBE CONSOLIDATED (Dedrick)—New orebodies disclosed indicating the persistency of the veins below the main vein system. Twenty-stamp mill operating steadily on good ore.

Yuba County

SANDERS (Brownsville)—Rotary mill being installed at this property. Owned and operated by W. F. Sanders.

SOLANO WONDER (Brownsville)—This property formerly a producer is being reopened. Hoist installed and machinery for new mill being hauled in.

COLORADO

Boulder County

WOOD MOUNTAIN (Wallstreet)—Property being reopened on leasing system and the results of recent development are encouraging.

SUNRISE MINING & MILLING CO. (Sunset)—This company, recently organized in Denver, has purchased Copper Glance group of mines from W. J. Barrett. Vigorous campaign of development will begin at once. New company plans to expend $25,000 in development and placing property in operating condition. New air compressor will be installed and construction of a small concentrating mill considered.

Clear Creek County

OLD TOWN (Idaho Springs)—Roberts & Co., Lessees, while advancing 1200-ft. level west heading from a 100-ft. winze sunk from the 1100-ft. level, opened 7-ft. vein of pay ore. First-class ore averages 2.7 oz. gold and 1.6 oz. silver per ton. Milling ore assays 1 oz. gold and 1.15 oz. silver. Six sets of lessees now engaged in development of property, and more than half of new work in pay ore.

PRIZE MINING CO. (Idaho Springs)—This company, operating through the Newhouse tunnel, has cleaned up main east and west drifts on tunnel level of Prize workings, and plans to make 450-ft. raise to connect with bottom of the shaft from surface. It is estimated that company has about 700 ft. of stoping ground above present lower workings. Samples recently taken in back of stope above east heading on tunnel level indicate vein 1 ft. wide assaying up to $50 a ton. Breast of the west heading on same level shows stringers of ore assaying $70 a ton. Ore produced from recent preliminary development operations has paid for large proportion of work. O. B. Willmarth is manager.

Lake County

FANNY RAWLINGS (Leadville)—Leasing company, comprising members of Big Five Operating Co. that controls Big Four property, has secured Fanny Rawlings mine and will soon undertake development.

CHRYSOLITE (Leadville)—This famous old mine is being put into shape to produce zinc carbonate that was formerly considered country rock.

San Juan County

BROAD GAUGE MINING & MILLING CO. (Silverton)—This company, organized by Pueblo men, has been successfully developing Burns group of properties on Jones Mt. Main development tunnel is being advanced on the Broad Gauge vein. Breast of tunnel shows a 4-ft. vein of pay ore, including 3-ft. vein of galena ore on the foot wall and a 12-in. streak of gold quartz ore on the hanging wall. The company intends to install compressor plant and aërial tramway during coming season.

San Miguel County

PRIMOS CHEMICAL CO. (Vanadium)—After a shut down of several months this company has resumed operations. Under normal conditions plant employs about 75 men.

IDAHO

TERRIBLE-EDITH (Murray)—Under lease and bond to Charles Conn and son. Shipped one car zinc ore and another car almost loaded for shipment. Ore taken from raise. Property also has parallel shoot of lead ore.

COPPER KING (Mullan)—Report of directors Feb. 1 states work directed toward locating vein north and south of fault is apparently successful. Commercial ore in winze south of fault and promising showing on north side.

REINDEER-QUEEN (Mullan)—Drift being run to explore Queen ground has 12 ft. milling ore and 6 or 8 in. that runs 30% copper. Property convenient to railroad, fine mill site with unlimited room for tailings dump, and ample water for power and milling.

RAY-JEFFERSON (Wallace)—Purchased Carlisle claim, price understood to be $20,000. Has big showing of zinc ore. Is patented claim contiguous to company's ground and crossed by main vein. Company now has 31 claims, millsite and valuable water rights. Considering building mill this summer.

CASTLE ROCK (Wallace)—Shipment of 38 tons of ore to Tacoma smeltery returned 10.89% copper, 0.04 oz. gold, 10.5% silica and 35.7% iron, and netted company $603. Freight rate was $4 and treatment 15c. per ton. Meeting of stockholders authorized increasing regular assessment from 1 to 2 mills in order to crowd sinking shaft to 200 ft., work to be done by contract. Property on Placer Creek, 3 miles from Wallace.

MICHIGAN

Copper

NAUMKEAG (Houghton)—Naumkeag is sinking an exploratory winze with results which are fair. A narrow branch of the Pewabic lode, supposedly, now being opened with good results.

SOUTH LAKE (Houghton)—There is no more talk of a consolidation with Lake and it is believed that plan will be dropped. South Lake will be further financed by an issue of 10,000 shares of stock instead of an assessment as was generally contemplated. This will provide funds for further development. Work to date has been satisfactory. Shaft exploration has demonstrated core prophesy. New issue of stock probably out at $5 per share. Close to 70,000 shares issued, $6.60 paid in. Last assessment of $2 paid 1912. In 1909 20,000 were issued at $2 and in 1913 10,000 went out at $6.

ISLE ROYALE (Houghton)—Expects to have at least one stamp head of mill ready to go into operation by June 1, and two others 30 and 60 days later. Four fifth's of steel construction now up and wooden framework and roof on wash department completed. Three stamp-heads being dismantled and sent to Milwaukee for machine working. Most of the heavy stamp-head castings are salvaged but require some changes. Mine getting out largest tonnage in its history, supplying rock to two mills, the old Tamarack running two heads, and the Point Mills subsidiary, altogether averaging better than 2300 tons daily of rock running close to 18 lb. refined copper. Showing is particularly creditable since underground openings are being maintained at normal condition and are, in reality, showing just as good characteristics as ever in their history.

HANCOCK CONSOLIDATED (Hancock)—Resumption of operations will be accompanied by increased rock tonnage as soon as possible. Expects to increase daily tonnage up to 650 by June 1. At time of suspension general underground conditions showed rock as high grade as anticipated in the Pewabic lode at this point. The Franklin mill will be put into condition to run one head continuously on the Hancock rock. Hancock will be self supporting on a basis of 600 tons daily. Company now owes $200,000 which easily is covered by ore showings. Last assessment will pay this indebtedness and care for whatever further unusual expenses may be necessary to commercially profitable operation. Copper-country people attach unusual importance to resumption of Hancock because of John Ryan's association with it, indicating his faith in the stability of the metal situation.

MINNESOTA

Cuyuna Range

IRON MOUNTAIN (Manganese)—Contract placed on Feb. 18 with Imperial Iron Works, Duluth, for hoist, compressor, skips, etc. Erection of new power plant about completed.

Mesabi Range

GREAT NORTHERN ORE PROPERTIES (Chisholm)—Construction work started by contractors on two large coal trestles near Leonard Mine.

IROQUOIS (Virginia)—Subsequent to abandonment of this mine by Rogers, Brown Ore Co., fee owners decided to keep pumps going, and mine now remains unwatered pending decision as to future operations.

MISSOURI-KANSAS-OKLAHOMA

GALENA ROYALTY & MINING CO. (Galena, Kan.)—Another good zinc mine brought in on Muir land southwest of Galena, this is fourth mine company has struck on this 40-acre tract, has subleased last drill hole in which strike was made to operators who will commence sinking shaft on ground immediately. Body of ore was struck at 80-ft. point and continued down to 120-ft. level giving about 40-ft. face of good ore running about 8% zinc. Company recently secured several tracts of land adjoining Muir tract, which it expects to drill in near future.

MONTANA

Lewis and Clark County

SOUVENIR MINES (Helena)—Company has leased its group of mines, located in Grizzly Gulch, to George Woody. Lease calls for purchase price of $30,000. Seven men employed on property. Old Scharfer mill and stamps will be started up soon as possible. Seventy or 80 tons gold ore now on dump, and strong body of high-grade ore has been encountered in the shaft. Claims belong to the old Witlach Union group and in early days produced large quantities of gold

Silver Bow County

RELIANCE MINING CO. in Moose Creek country about 20 miles south of Butte active again. Operated by D. M. Adams. Work suspended in November, when water drove miners out and it became necessary to install pump along with new equipment. In interim 60-hp. boiler, No. 9 Cameron sinking pump, 35-hp. hoisting engine and remainder of surface equipment installed. Shaft now 135 ft. in depth and Mr. Adams plans to continue sinking to 200-ft. level, then crosscut and develop veins passed through above. Mr. Adams states that the country around has been pretty well located since development of his property started. Prospectors from Butte and other points have staked claims. Moose Creek district was mined for placer gold in early territorial days, but little was ever done in way of lode mining until Mr. Adams started prospecting two years ago.

NEVADA

Clark County

NEVADA DEL ORO SYNDICATE (Las Vegas)—Articles of incorporation filed; principal place of business, Las Vegas. Will take over Mahoney and Duncan claims at Railroad Pass, 20 miles east of Las Vegas in Quo Vadis mining district.

Esmeralda County

PRINCE CONSOLIDATED M. & S. CO. (Pioche)—Mill will be built. Regular shipments being made; company largest producer in Pioche district.

SIMMERONE (Goldfield)—This fraction transferred by sheriff's sale from Nevada First National Bank to Walter Trent, of Reno. Development work will begin at once.

YUBA LEASING & DEVELOPMENT CO. (Pioche)—Stated mill will be built at once as result of recent development work. Company operating Raymond & Ely property under lease.

DIAMONDFIELD BLACK BUTTE (Goldfield)—Main shaft unwatered and repaired from 150- to 300-ft. level. Work will be resumed on 300-ft. level. Winze being sunk from 100-ft. level in oreshoot assaying $2 to $40 per ton. Crosscut No. 2 on 100-ft. level opened 2-ft. shoot of $11 ore.

Humboldt County

ROCHESTER ELDA FINE (Rochester)—Articles of incorporation filed; capitalization 1,000,000 shares, $1 par value.

CROWN POINT EXTENSION (Rochester)—Lease on 350 ft. of Crown Point claim, adjoining Big Four lease, taken by Lovelock men. Work will be done through Big Four ground.

Nye County

HALIFAX (Tonopah)—Retimbering finished and production will begin at once; ore to be treated at West End mill.

TONOPAH EXTENSION (Tonopah) — Filter capacity of mill being increased 40%; new water system for fire protection being installed. Usual production.

MIZPAH EXTENSION (Tonopah)—Extensive development work including sinking of working shaft will be done. Property recently acquired by Tonopah Mining Co. and work will be done under direction of J. E. Spurr.

Ormsby County

NEW MINING BILL to permit stockholders of mining properties to inspect physical conditions as well as books being drawn; will be presented to the Legislature this session. Similar measure, but more radical, defeated four years ago.

Washoe County

GOLDEN GATE MINE (Greenhorn Dist.)—Reported stamps are dropping at new mill recently constructed on this property. Mill bins full of ore carrying free gold, and large bodies of ore blocked out in mine. Snow at mine, 4 ft. deep, caused delay in getting mill ready to run. Mill constructed by B. L. McLainas.

OREGON

ARRANGEMENTS ARE BEING MADE by a syndicate of mining men of Baker and Salt Lake, headed by L. G. Burton and James O'Toole, of Salt Lake, to develop several groups of mining claims on Cañon Mountain. This district has yielded large returns to early placer miners.

THE REDMOND COMMERCIAL CLUB hired an expert to examine black sand deposits recently found in Jefferson County. A number of assays have been made by the Club and the average of the samples run $2.60 per ton. Mining men who have lately seen and investigated the deposits say that gold can be extracted from the ore or sand at a cost of about $1 per ton, and the Club is now taking steps to verify these statements. If true the ore can be milled at a profit. Many locations of claims are being made daily.

GLEESON DEVELOPMENT CO. (Granite)—W. G. Gleeson of this company reports a breakdown of the machinery that was started up on the first of the year, so mine is shut down a few days for repairs.

LA BELLEVUE MINE (Granite)—T. S. Kennereley has completed arrangements to reopen this mine, which has been idle since 1896 through disagreement of owners. Has 7000 ft. of workings; most of it has to be retimbered.

UTAH

Salt Lake County

TAR BABY (Salt Lake)—Teams are hauling supplies to this property in Big Cottonwood, and work is to be resumed soon.

UTAH COPPER (Bingham)—A small addition has been made to working forces on account of snow. One steam shovel has been added.

MICHIGAN-UTAH (Alta)—This company is to be reorganized, and it is probable that authorization for sale of property will be asked.

SOUTH HECLA (Alta)—This company has been holding down its output throughout the winter and concentrating on development; there is a good tonnage available for shipment as soon as roads are in condition.

COLUMBUS EXTENSION (Alta)—A new strike of copper-silver ore has been made. Work on this will begin, with the completion of the new airline, which is being put in for better ventilation.

UTAH APEX (Bingham)—Sinking of Parvenue shaft 150 ft. has started. This will open Parvenue orebody, add materially to reserves of crude or smelting ores. Much development has been done in upper workings, exposing additional reserves of mill ore. There remains a large area to be developed.

UTAH POWER & LIGHT CO. (Salt Lake)—Judge Marshall, of United States District Court, ordered decree holding that Utah Power and Light Co. and Beaver River Power Co. are illegally occupying Government land and enjoining such further occupancy. Property involved is said to be worth about $15,000,000 and consists of power plants, transmission lines, reservoirs and machinery in the Cache, Filmore and Wasatch national forests of Utah. Cases have been pending about three years. Attorneys for the defendants announced they would appeal to the United States Supreme Court.

CANADA

New Brunswick

GROUP OF PLACER CLAIMS (Vernon) has been taken over by local capitalists headed by Thomas A. Russel and Samuel W. Hoag. Properties cost $55,000, and company plans immediate development and improvement. Hydraulic equipment will be installed.

SALMON-BEAR RIVER GROUP (Portland Canal)—Bonded by O. B. Bush to H. R. Plate, of New York who is putting force of 14 men on development. Diamond drill being installed. Property situated in Salmon River district, near Alaskan boundary line, about 13 miles from tidewater.

Ontario

REA (Porcupine) will pay a dividend of 6% on the $200,000 issued capital. The mine is operated by a leasing company on a 25% royalty basis, and has a 10-stamp mill, using amalgamation only.

DOMINION REDUCTION MILL (Cobalt)—Operations have been resumed after a three-weeks stoppage.

ALEXO NICKEL MINE (Porquis)—Twenty-five cars of ore have been shipped to the Mond smelter at Coniston.

NORTHERN CUSTOMS (Cobalt)—This mill, which was closed for a time owing to power shortage, is again in operation.

NIPISSING (Cobalt) has stopped work on 64 shaft on account of shortage of power. Shaft has reached depth of 1000 ft. and is deepest in the camp.

MINING CORPORATION OF CANADA (Cobalt)—Cobalt reduction mill of this company has closed down for two weeks owing to power shortage.

TRETHEWEY (Cobalt)—Staff has been officially notified that operations at mine and mill will be suspended indefinitely, 100 men will be thrown out of employment.

TOUGH OAKES (Kirkland Lake)—Mill of this company is expected to be running in March. During the past few months much treasury stock has been sold at $2.50 per share.

WETTLAUFER (Kirkland Lake)—Mine is under option to Teck Hughes Company which has adjoining property. Teck Hughes is under option to Nipissing, and recent development on bottom level shows good values, but extent of the ore shoot still in doubt.

PORCUPINE CROWN (Schumacher) — Main vein which faulted between 300- and 400-ft. level, has come in again and has been proved to a depth of 1000 ft. Mill is treating from 125 to 140 tons per day. Company negotiating for purchase of North Thompson property adjoining.

CARTWRIGHT GOLD FIELDS (Beatty Township)—A 10-stamp mill will be erected on this property, situated on Painkiller Lake, and is expected to be in operation by May. The vein shows free gold in places and is stated to assay high. A shaft is being put down to the 100-ft. level.

CROWN RESERVE (Cobalt)—This company has taken an option on large low-grade gold mine in Nicaragua and sent engineers to make examination. Deal will involve much money for development and equipment. It is understood that the Lewisohns will participate in undertaking if examination proves satisfactory.

MEXICO

Sonora

CALUMET & SONORA MINING CO.—Bondholders of company, through J. L. Lyder, Jr. and J. L. Washburn, trustees, began foreclosure proceedings in District Court, Duluth, Minn., on Feb. 11, 1915, claiming nonpayment of interest on $100,000 bonds since Mar. 6, 1914. On Feb. 1, 1911, Calumet & Sonora Mining Co. executed a trust deed to the trustees, at same time turning over 2500 shares of its stock. Pursuant to the terms of the trust deed, $100,000 in bonds were issued. Later the company suffered another reorganization. Attorneys for the company have filed their answer, admitting the company's failure to redeem the bonds or pay the interest.

AFRICA

Transvaal

GOLD PRODUCTION OF TRANSVAAL in January was 714,984 oz., being 19,847 oz. more than in December and 63,231 oz. more than in January, 1913, when the industry was recovering from the miners' strike. Number of negro laborers in the gold mines in January 172,331, or 7681 more than in December. Number in the coal mines, 8675 in January.

The Market Report

Metal Markets

NEW YORK—Feb. 24

All of the markets have been extraordinarily confused, although in different ways. Copper turned a shade weaker during the week. On the other hand, tin and lead were stronger. The extravagant rise in spelter continued.

Copper, Tin, Lead and Zinc

Copper—A fair business was done with domestic consumers at 14½@14¾c., regular terms. This was chiefly with the brass makers whose business is supposed largely to reflect European orders for the finished product. Demand from wire drawers has not exhibited any signs of material improvement. Export business has been confused more than ever by the military, shipping and financial situations. It is impossible for a seller to Europe to figure out what he is going to realize until his returns are all in.

Copper sheets base price is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15@15¼c., carload lots at mill.

Exports of copper from the United States for the week ended Feb. 13 are reported by the Bureau of Commerce at 7,142,000 lb. The larger items were 5,525,000 lb. to Great Britain, 672,000 lb. to Italy, 448,000 lb. to Sweden and 251,000 lb. to Norway. Imports for the week were 2,612,000 lb. metal and 1,978,000 lb. in ore and matte: 4,590,000 lb. in all. Imports were chiefly from Cuba, Canada, Chile and Peru.

Visible stocks of copper in Europe Feb. 15 are reported as follows: Great Britain, 17,000; Rotterdam, 1150; afloat from Chile, 3200; afloat from Australia, 4700; total, 26,050 long tons, an increase of 435 tons over the Jan. 31 report.

Tin—This market has been a much mixed affair on account of the topsy-turvy conditions abroad. The advance recorded here simply reflects the advance in London. The volume of business done here was very small.

Exports of tin from the South China fields for the year 1914 are reported by U. S. Consul George E. Anderson at Hongkong at 51,235 slabs, against 77,412 slabs in 1913. The 1914 exports were equal to 2562 long tons; the destinations were: Great Britain, 282 long tons; other Europe, 1045 tons; United States, 1235 tons; total, 2562 long tons.

Tin production of the Federated Malay States in January is reported at 4983 long tons in 1914, and 3995 in 1915; a decrease of 988 tons.

Lead—There continued to be conflicting reports about this market. In sifting them all, the conclusion is unescapable that business is poor among domestic consumers, but that a strong demand from Europe continues right along which is the backbone of the market and supports the latter very well so long as the production remains curtailed. Lead has been going from St. Louis to Europe via Southern ports, and the filling of foreign orders from St. Louis is supposed to be the explanation of the rise in the St. Louis price above the normal differential.

Spelter—There is no longer any wholesale market in spelter for spot and prompt deliveries for the reason that all supplies, except occasional odd lots, have been exhausted. Any belated consumer who must have immediate delivery is obliged to pay a fancy premium. The wholesale business is now being done for April and later deliveries. Domestic consumers have heretofore been reluctant to consider such purchases, but during the last week they began to take a new view of the situation and bought some rather large tonnages. The prices paid varied according to the delivery, the bulk of the business, being apparently done at about 8¼@8½c. The high prices here tempted European buyers who resold contracts previously made, accepting from 8⅛c. for March-April, up to 9c. for prompt, St. Louis basis. On the other hand, England was unwilling to buy futures at anything over an 8c. basis. American producers are practically cleared out for March delivery. On the other hand, domestic consumers who have previously been uncovered are now believed to have arranged for what they need, and demand from them is no longer urgent. Demand for brass special is reported as having abated.

It has been rumored that some Australian ore is coming into this country for smelting here.

It is reported that the smelting works at Caney, Kan., are to be put into operation immediately. Resumption of smelting at Altoona, Kan., is also contemplated. Smelters in many quarters report firing of additional furnaces.

During the week ending Feb. 6, Germany put an embargo on spelter and exportation is now permitted only in small quantities, to neutral countries, and under governmental supervision.

Zinc sheets are a little higher and are quoted today at $12.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Feb.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
18	4.8175	48⅞	14.40 @14.55	37	3.85	3.72½ @3.77½	8.30 @9.05	8.12½ @8.87½
19	4.8175	48⅞	14.40 @14.55	39¼	3.85	3.75 @3.80	8.30 @9.17½	8.12½ @9.00
20	4.8100	48¾	14.40 @14.55	39¼	3.85	3.75 @3.80	8.30 @9.30	8.12½ @9.12½
22			....			....		
23	4.8000	48¾	14.35 @14.55	39	3.85	3.77½ @3.82½	8.42½ @9.42½	8.25 @9.25
24	4.7913	48½	14.35 @14.55	38	3.85	3.77½ @3.82½	8.42½ @9.42½	8.25 @9.25

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
18	22 13/16	63½	13.79	63⅞		178	156½	19 7/16	4.22	40	8.60
19	22¾	63¾	13.85	64¼		184	161	19 7/16	4.22	41½	9.02
20	22¾										
22	22⅞	64⅜	13.99	64⅝		186	161	19 7/16	4.22	42⅛	9.15
23	22 15/16	64¾	14.07	65		180	159	19 7/16	4.22	41⅞	9.10
24	22⅞	64¾	14.07	65¼		177		20	4.35	42⅛	9.15

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—There has been no especial incident in this market and conditions are about the same, with moderate sales. Quotations are 19@19.50c. per lb. for No. 1 ingots, New York—**Antimony** remains strong. Business has not been heavy for the week, but there is some concern about supplies. Ordinary brands sell at 18@19c. per lb.; while 21@22c. per lb. is asked for Cookson's—**Nickel** is unchanged, ordinary forms being 40@45c. per lb. according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** continues strong and prices are again advancing. Bids of $58 in the early part of the week were not closed. The large dealers ask $62 per flask of 75 lb., New York. San Francisco, $60 for domestic orders. London price is £12 10s. per flask.

Minor Metals—Current sales of **Bismuth** have been at $2.75 per lb., New York. **Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.

Gold, Silver and Platinum

Gold—Foreign exchange continues low, and there is talk of more gold imports. None have been actually made yet.

Gold production in the Transvaal in January was $14,778,719, against $14,368,482 in December and $13,471,735 in January, 1913. Production of the Kolar gold field, Mysore, India, was $978,807. The Kolar returns for January are made for the first time in fine gold; heretofore they have been made in ounces of bullion.

Gold imports in Great Britain in January were £1,358,776; exports, £726,733; excess of imports, £632,043, against £3,722,055 for January of last year.

Platinum—Nothing new has developed and the market is quiet and unchanged. Dealers ask $40@42 per oz. for refined platinum, but sales have been made as low as $38, so that we must still give $38@42 as the range of prices. Hard metal is $44@49 per oz., according to the iridium content.

Iridium—This metal is still scarce and high in price. It is difficult to give any general price, as each sale seems to stand by itself.

Silver—The market continues quiet with moderate orders at current prices. So far this year the shipments to India have exceeded those of 1914. In 1914 they amounted under date of Feb. 4 to £567,000, while in the current year they have been £678,000 in all.

Exports of silver from London to the East Jan. 1 to Feb. 11, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes	
India	£568,500	£881,500	I.	£313,000
China	10,000		D	10,000
Total	£578,500	£881,500	I	£303,000

Silver imports in Great Britain in January were valued at £1,069,485; exports, £656,307; excess of imports, £413,178, which compares with an excess of exports amounting to £200,079 in January of last year.

Other Ores

The Carnegie Steel Co.'s new schedule, dated Aug. 5, gives prices per ton of 2240 lb. for domestic manganese ore delivered at Pittsburgh or Etna, Penn., or at South Chicago, Ill., as follows: 49% metallic manganese, 26c. per unit; 46 to 49%, 25c.; 43 to 46%, 24c.; 40 to 43% manganese, 23c. per unit. This is an advance of 1c. per unit over the old list.

Prices are based on ores containing not more than 8% silica or 0.20% phosphorus and are subject to deductions as follows: For each 1% in excess of 8% silica there shall be a deduction of 15c per ton; fractions in proportion. For each 0.02%, or fraction thereof, in excess of 0.20% phosphorus there shall be a deduction of 2c. per unit of manganese per ton.

Ores containing less than 40% manganese or more than 12% silica or 0.225% phosphorus are subject to acceptance or refusal at the buyer's option.

Settlements are based on analysis of sample dried at 212° F., the percentage of moisture in the sample as taken being deducted from the weight

Fuel production of Austria, year ended Dec 31, in metric tons:

	1913	1914	Changes	
Coal mined	16,466,972	15,073,132	D.	1,393,840
Brown coal	27,276,259	23,772,069	D.	3,504,190
Coke made	2,584,281	2,189,913	D.	395,368
Briquettes made	138,099	124,863	D	13,236

Of the briquettes reported in 1914 a total of 230,642 tons were made from brown coal or lignite. The decreases shown were all in the second half of the year

Exports and imports of secondary metallic products in the United States year ended Dec. 31, in pounds:

	Exports		Imports	
	1913	1914	1913	1914
Copper sulphate	4,168,675	7,387,236		
White lead	15,062,384	17,645,538		
Zinc oxide	28,932,953	31,183,369		
Zinc dust	186,138	356,262	4,382,470	4,604,107
Zinc dross	56,696	5,051,067		

Exports include reëxports of foreign material.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 20

Blende, high price, $78; assay base 60% zinc $65@75; metal base 60% zinc $65@70; calamine base 40% zinc $42@46; average, all grades of zinc, $68 per ton. Lead, high price $49; base $47 per ton of 80% metal content; average, all grades of lead, $47.60.

Blende low in lead was in strong demand and practically all containing less than 0.05% lead was purchased. The demand for other grades was strong, but at offerings of $65@70 and sellers declined to accept. It is evident from recent purchases that the present call at high prices is for low lead content, with a reduction of $1 per ton for each 0.01% of lead over 0.05%. This is drawing a line very sharply, and producers who realize the situation are improving concentration methods to meet the new demand.

SHIPMENTS, WEEK ENDED FEB. 20

	Blende	Calamine	Lead	Values
Totals this week	11,400,020	1,096,000	1,333,270	$456,590
Totals this year	82,281,780	7,660,990	11,991,450	2,786,840

Blende value, the week, $400,740; 8 weeks, $2,374,610.

Calamine value, the week, $24,120; 8 weeks, $130,930.

Lead value, the week, $31,730; 8 weeks, $281,300.

PLATTEVILLE, WIS.—Feb. 20

The base price paid this week for 60% zinc ore was $70@72 per ton. The base price paid for 80% lead ore was $48 per ton. This week's shipment is increased one-fourth by including the tonnage curtailed and unreported on account of the snow blockade of two weeks ago.

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,647,220	79,000	330,000
Year to date	30,103,860	305,000	2,876,300

Shipped during week to separating plants, 4,381,320 lb. zinc ore.

Iron Trade Review

NEW YORK—Feb. 24

There is no break in the slow improvement in business and the trade is becoming more and more hopeful of the future as times goes on.

Structural steel is about the slowest side of the market, and not much improvement can be reported there. In other lines the change is all for the better, though the movement is not rapid. The railroads are coming into the market rather slowly for rails and cars. Some more export orders have been quietly placed.

The Algoma Steel Co. at Sault Ste. Marie, Ont., has taken several more orders for rails for the United States, the lower prices offered proving attractive.

The pig-iron market shows some improvement, and February will probably show an increase in production. Some Alabama pig is reported taken for export.

PITTSBURGH—Feb. 23

The steel market is holding its own, and no more. Orders have not been increasing in the past week or two, but they are as heavy as 30 days ago. Mill operations have increased slightly but now, with an average operation of 55 or 60% of capacity, they are at the summit unless orders increase further Any decrease in buying would be reflected promptly in decreased operations, as the mills have no large tonnage ahead. There is extremely little railroad material being made, and very little structural material is going to the mills. Export business is about the same as for several months past The most active buying has been by jobbers and ordinary manufacturing consumers, with a very good volume of line pipe and tank work

Bars, plates and shapes have lately been quoted at 1.10c. for February specification, 1.15c. for March and 1.20c. for second quarter. It is believed that the 1.10c. quotation will disappear at the end of the month, putting the market squarely at a minimum of 1.15c. next week. Large buyers are well covered by contracts already made at 1.10c. for first quarter and 1.15c. for second quarter

Most mills have advanced galvanized sheets to 2.40c. and are quoting this price only for immediate specification and early shipment. The scarcity of spelter has forced the galvanized sheet market up by about $15 a ton, but there is of course practically no buying.

Pig Iron—The market is still regarded as being between seasons, with little activity but prices well maintained at $13.60 for bessemer, $12.50 for basic, $12.75@13.25 for foundry, $12.75 for malleable and $12.50@12.75 for forge, at valley furnaces, 95c. higher delivered Pittsburgh. A detached merchant stack in western Pennsylvania is considering the question of going into blast, to take care of its regular trade.

Ferromanganese—Steel mills still have nothing like any promise as to when shipments of ferromanganese from England will be resumed. Stocks are variously estimated at from three to six months' supply at the present rate of consumption. Small prompt lots are dearer, being usually quoted at about $100, Baltimore.

Steel—There is no activity in billets or sheet bars, consumers being covered by contracts. There are one or two low sellers at Youngstown, where about $18.25 for billets and $18.50@19 for sheet bars could be done, the Pittsburgh market being $1 higher, representing the freight. Rods are $25, Pittsburgh.

Exports and Imports of Iron and Steel, including machinery, in the United States for the year ended Dec. 31 are valued as below by the Department of Commerce.

	1913	1914	Changes
Exports	$293,134,160	$199,861,684	D. $93,272,476
Imports	33,601,985	28,615,344	D. 4,986,641
Excess, exports	$259,532,175	$171,246,340	D. $88,285,835

The decrease in exports was 31.8%, which was accompanied by a decrease of 14.8% in imports.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 250,855 short tons; shipments, 249,543 tons. Production of Greensburg and upper Connellsville districts, 34,345 tons.

Connellsville Coke—The market is absolutely stagnant and prices are more or less nominal, at about $1.50@1.55 for prompt furnace, $1.65 for contracts to July 1, $1.75 for contracts to the end of the year, $2@2.20 for prompt foundry and $2.20@2.30 for contract foundry, per net ton at ovens.

Exports and imports of fuel in the United States year ended Dec. 31, in long tons.

	Exports		Imports	
	1913	1914	1913	1914
Anthracite	4,154,386	3,830,244	921	19,347
Bituminous	17,986,757	13,801,850	1,413,857	1,375,316
Coke	881,603	592,487	93,507	120,777
Bunker coal	7,700,520	7,266,002	.	. . . .
Total	30,723,266	25,490,583	1,508,285	1,515,440

The bunker coal, or coal furnished to steamships in foreign trade, is almost wholly bituminous. The coal export trade has lost the heavy increase made in 1913 and has fallen off almost to the level of 1912. The chief trade, both exports and imports, is with Canada; other large items of bituminous exports were 1,075,824 tons to Cuba, 552,000 to the West Indies, 359,802 to Mexico, 278,026 to Brazil, 267,598 to Panama and 241,248 to Argentina

Lake Coal Tonnages for the full season are given below for three years past in short tons, showing the origin of the shipments:

From	1912	1913	1914
Pittsburgh District	11,300,000	13,415,473	11,195,000
Ohio	4,676,000	6,176,624	1,363,000
West Virginia and Virginia	7,360,000	8,736,586	9,106,000
Other districts			1,332,000
Total bituminous	23,336,000	28,328,683	22,996,000
Anthracite	4,204,741	5,033,696	4,285,228
Total	27,540,741	33,362,379	27,281,228

The tonnage of 1914 was about the same as that of 1912, but was less than that of 1913 by 6,081,151 tons, or 18.2%. The coal from other districts included 436,000 tons from western Pennsylvania outside of the Pittsburgh District, and 896,000 tons from Kentucky. The small shipments from Ohio in 1914 were due to the long strike in that state.

IRON ORE

Imports of iron ore into Great Britain month of January 528,325 long tons in 1914, and 365,812 in 1915; decrease, 162,513 tons. Imports of manganese ore 60,683 tons in 1914, and 39,413 tons in 1915; decrease 21,270 tons

Imports and exports of iron ore in the United States, year ended Dec. 31, in long tons:

	1913	1914	Changes
Imports	2,594,770	1,351,368	D. 1,243,402
Exports	1,042,051	551,618	D. 490,433

The large imports of iron ore in 1914 were 815,017 tons from Cuba, 280,887 tons from Sweden, 66,982 tons from Spain, 52,514 tons from Canada, 38,515 tons from Newfoundland. Exports were chiefly to Canada.

FOREIGN IRON

The Number of Furnaces in Blast in Great Britain Dec. 31, 1914, was 294, or six more than on Sept. 31. The average number active during the December quarter was 293, being 12 more than in the September quarter.

The German Iron & Steel Union reports the total make of pig iron in Germany in December, 1914, at 853,881 metric tons, which compares with 788,956 tons in November and 1,611,250 tons in December, 1913. For the year ended Dec. 31 the output compares with the previous year as follows, in metric tons.

	1913	1914	Changes
Foundry iron	3,657,326	2,494,527	D. 1,162,799
Forge iron	489,783	370,257	D. 119,526
Steel pig	2,599,887	1,996,786	D 603,101
Bessemer pig	368,840	237,988	D. 130,852
Thomas (basic) pig	12,193,336	9,289,989	D. 2,903,347
Total	19,309,172	14,389,547	D. 4,919,625

Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys. The total decrease is 25.5%, which is less than might have been expected.

Chemicals

NEW YORK—Feb. 24

The stockholders of the General Chemical Co. have voted to authorize increases of $5,000,000 in the preferred and $7,500,000 in the common stock, making the total amount of each class $20,000,000. All of the new stock to be issued now is $260,000 preferred in exchange for stock of the General Chemical Co. of California.

Arsenic—The market remains quiet with no material change and fair supplies. Quotations are steady, at $3.75@ per 100 lb., for both spot and futures

Copper Sulphate—Business is fair with little change from recent reports. The quotations have been again advanced 25c. and are now $5.25 per 100 lb. for carload lots, and $5.50 for smaller orders.

Nitrate of Soda—Business is still a little irregular, with more or less activity. The current quotations are 2.12½c. per lb. for spot and March-June; 2.07½c. for June-December, and 2.05c. for 1916 deliveries.

Messrs. W. Montgomery & Co., London, give the following statement of the position of nitrate for the year ended June 30, in long tons:

	1911-12	1912-13	1913-14
Shipment from S. America	2,456,000	2,647,000	2,660,000
Consumption, United Kingdom	132,000	125,000	122,000
Consumption, other Europe	1,711,000	1,689,000	1,868,000
Consumption, United States	503,000	583,000	553,000
Consumption, other countries	114,000	86,000	90,000
Total	2,460,000	2,483,000	2,633,000
Visible supply June 30	318,000	420,000	418,000

Visible supplies include stocks in the United Kingdom and on the Continent of Europe and quantities afloat from South American ports on June 30, the end of the fiscal year.

Pyrites—Imports at Baltimore for the week included 1049 tons of pyrites from Huelva, Spain

Sulphur—Late advices from Japan report increased production of sulphur in Hokkaido. The total for 10 months of 1914 was 85,148,000 lb., an increase of 27,000,000 lb. over 1913. There was an increase in the exports to the Pacific Coast of the United States.

Imports and Exports of Fertilizing Chemicals in the United States, year ended Dec. 31, in long tons.

	Imports		Exports	
	1913	1914	1913	1914
Kainit	465,850	329,611	140	300
Manure salts	223,292	168,126		
Other potash salts	253,300	204,773	3,419	3,914
Nitrate of soda	625,862	543,715	5,560	9,220
Sulphate of ammonia	58,281	74,121		263
Phosphates			1,364,508	964,114

Exports include reëxports of foreign material. Some phosphates are imported, but are not given separately in the returns.

Assessments

Company	Delinq.	Sale	Amt.
Belcher Silver, Nev	Feb. 8	Mar. 1	$0.10
Booth, Nev	Jan. 25	Mar 1	0.02
Brunswick Con., Nev	Feb. 16	Mar. 9	0.01
Caledonia, Nev	Mar. 8	Mar 31	0 05
Cedar-Talisman, Utah	Feb. 8	Mar 1	0 005
Clear Grit, Ida (post.)	Feb. 9	Mar. 3	0 0015
Confidence, Nev	Mar. 11	Mar. 31	0.10
Con. Virginia, Nev	Feb. 24	Mar 18	0 10
Copper King, Ida..........	Mar. 1	Apr 1	0 005
East Hercules, Ida, (post.)..	..	Mar 3	0.001
Emerald, Utah (three instal.)	.	June 9	0 01
Gethin Le Roy, Utah (post.)	Feb. 16	Mar 7	0.02
Idaho-Nevada, Ida.	Mar 10	Apr 2	0 002
Index, Ida	Feb 27	Mar 27	0.005
Indiana, Mich	Feb. 4	.	1.00
Iron King, Ida	Feb. 18	Mar. 19	0 001
Jack Waite, Ida	Mar 1	Mar. 24	0 01
Kentuck, Nev	Mar 18	Apr 7	0 02
Keystone, Utah. (post)	Feb. 23	Mar. 23	0.02
King Pine Crk., Ida	Feb. 12	Mar. 13	0.002
Laclede, Ida........	Mar. 20	Apr 6	0 003
Majestic-Idol, Nev.	Dec. 15	Jul 20	0 005
Manhattan Con., Nev	Feb. 30	Mar 1	0 01
Nor. Bnkr. Hill, Ida	Jan. 30	Mar 6	0 002
Ophir, Nev.	Feb. 11	Mar. 5	0 10
Oreano, Ida	Mar. 25	Apr 26	0 0015
Overman, Nev	Mar 8	Mar. 26	0.05
Pioche Coalition, Nev......	Feb. 10	Mar 1	0 025
Reindeer-Queen, Ida.......	Feb. 15	Mar. 8	0.003
Rescue-Eula, Nev	Feb. 11	Mar 22	0.01
Saltese, Ida	Mar. 1	Apr. 1	0 002
Selma, Utah	Mar. 20	Apr. 6	0 0025
Sierra Nevada, Nev..	Feb. 8	Mar. 2	0 05
Snowstorm Ex., Ida .	Feb. 19	Mar. 22	0 003
Sonora, Ida.......	Mar. 15	Apr 15	0 002
Syndicate, Ida. (post.)	.	Jan. 28	0.001
Tarbox, Ida (post.)	Jan. 28	Mar. 25	0 0025
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0 01
Torino, Ida	Feb. 20	Mar 20	0.001
Utah-United, Utah	Feb. 20	Mar. 15	0.01
Verde May, Ida	Feb 1	Mar 1	0 001
Wolf Mountain, Utah....	Mar. 15	Apr. 14	0.0015

Stock Quotations

The past week has been characterized by weakness in the stock market, bringing many standard stocks nearly down to the Exchange's "minimum" prices.

COLO. SPRINGS Feb. 23 Name of Comp.	Bid.
Acacia	.05
Cripple Cr'k Con.	‡ 01
C. K. & N	06½
Doctor Jack Pot	.08
Elkton Con	.47¼
El Paso.	1 70
Findlay	.02¾
Gold Dollar	.04
Gold Sovereign	04¾
Isabella	.16½
Jack Pot	.06½
Jennie Sample	.02
Jerry Johnson......	.03¼
Lexington	‡ 009
Old Gold	‡ 01
Mary McKinney.	31½
Pharmacist	.01¼
Portland	1.10
Raven B. H	.02⅝
Vindicator	1 25

SALT LAKE Feb. 23 Name of Comp.	Bid.
Beck Tunnel	.06
Black Jack	08½
Colorado Mining	10
Crown Point	.01¾
Daly-Judge	5 25
Gold Chain	08¾
Grand Central	.62
Iron Blossom	.98
Little Bell	.10
Lower Mammoth	.05¾
Mason Valley	1.10
May Day	.12½
Opohongo	.01¾
Prince Con	.44
Seven Troughs	.02½
Silver King Coal'n	3 00
Silver King Con	1 92½
Sioux Con	.03¾
Uncle Sam	.05¾
Yankee	.07

TORONTO Feb. 23

Bailey	02	Dome Exten	07
Coniagas	4.75	Foley O'Brien	15
Peterson Lake	22	Hollinger	22 00
Right of Way	02	Imperial	01
Seneca Superior	1.25	Jupiter	09
Silver Queen	.02	McIntyre	33
T & Hudson Bay	20 00	Pearl Lake	02
Timiskaming	16	Porcu Gold	25
Wettlaufer-Lor	05	Preston E. D.	01
Big Dome	5 60	Rea	12

SAN FRANCISCO Feb 23

Comstock Stocks		Misc. Nev. & Cal	
Alta	19	Belmont	3 75
Belcher	23	Jim Butler	67
Best & Belcher	06	Lone Star	08
Caledonia	20	MacNamara	03
Challenge Con	‡ 05	Midway	12
Confidence	12	Mont.-Tonopah	48
Con. Virginia	14	North Star	14
Crown Point (Nev.)	‡ 19	Rescue Eula	10
Gould & Curry	02	West End Con	53
Hale & Norcross	04	Atlanta	26
Julia	01	Booth	32
Mexican	11	C. O. D. Con	05
Occidental	80	Comb. Frac	07
Ophir	13	Jumbo Extension	76
Overman	07	Pitts.-Silver Peak	10
Potosi	01	Round Mountain	39
Savage	04	Sandstorm Kendall	08½
Sierra Nevada	12	Silver Pick	06
Union Con	21	Central Eureka	‡ 25
Yellow Jacket	30	So. Eureka	‡12 25

N. Y. EXCH. Feb. 23 Name of Comp.	Clg.
Amalgamated.	51¼
Am.Sm.&Ref.,com .	61
Am. Sm. & Ref., pf	99
Am. Sm. Sec., pf. B	‡78
Anaconda	25¼
Batopilas Min	.50
Bethlehem Steel, pf.	103¼
Chino.	34
Colo. Fuel & Iron.	23¼
Federal M. & S., pf.	‡26
Great Nor., ore., ctf.	29
Guggen. Exp	48¼
Homestake.........	115½
Inspiration Con....	18
Mex. Petroleum	63½
Miami Copper	18¼
Nat'l Lead, com.	48
National Lead, pf...	106
Nev. Consol.	12
Ontario Min.	2
Phelps Dodge.....	175
Quicksilver, pf	1⅛
Ray Con...	16
Republic I&S, com..	19⅝
Republic I&S, pf..	72½
SlossSheff'd, com.	24
Sloss Sheffield, pf...	‡82
Tennessee Copper. .	26¼
Utah Copper.	50
U. S. Steel, com	41
U. S. Steel, pf......	103⅜

BOSTON EXCH Feb. 23 Name of Comp.	Clg.
Adventure	1
Ahmeek.	250
Alaska Gold M	27¾
Algomah	.50
Allouez	39½
Am. Zinc ..	22
Ariz. Com., ctfs...	4
Bonanza	31
Butte-Ballaklava	2¾
Butte & Superior	45¼
Calumet & Ariz	52
Calumet & Hecla	380
Centennial	16½
Copper Range	33
Daly West	2⅛
East Butte	9
Franklin	4½
Granby..........	65
Hancock	11¼
Hedley	29
Helvetia	.25
Indiana	3½
Island Cr'k, com.	44
Island Cr'k, pfd...	87
Isle Royale.......	20
Keweenaw	2½
Lake.	5¾
La Salle	3¼
Mass	4⅛
Mayflower	4⅝
Michigan	.60
Mohawk	53
New Arcadian.....	4¾
New Idria Quick	‡3½
North Butte	23
North Lake......	1⅛
Ojibway	‡.70
Old Colony.	3¾
Old Dominion...	41½
Osceola.........	66
Quincy.	55
Santa Fe........	1⅛
Shannon	5½
Shattuck-Ariz....	20¾
Superior	26½
Superior & Bost..	1¼
Tamarack.	29¼
Trinity.	2⅝
Tuolumne.........	.25
U. S. Smelting	21
U. S. Smelt'g, pf...	41
Utah Apex......	2
Utah Con	9¾
Victoria	1¼
Winona	1⅛
Wolverine.	49⅛
Wyandot	.50

N. Y. CURB Feb. 23 Name of Comp	Clg.
Beaver Con	26
Big Four.	07
Blue Bell.........	04
Braden Copper....	6⅝
Buffalo Mines	.75
Can. Cop. Corpn	1 5/16
Can G & S	03
Caribou	.50
Chambers Ferland	12
Con. Ariz Sm	.25
Coppermines Cons	‡1¼
Davis-Daly.	.90
Diam'field-Daisy.	08
Dia. Black B	04
Ely Con.......	‡ 01
Florence	60
Goldfield Con	1 9/16
Goldfield Merger.	24
Greene Cananea	24½
Kerr Lake.	4⅜
La Rose	11/16
McKinley-Dar-Sa	42
Mines of Am.....	2¼
Mutual Min., pf	‡2½
Nevada Hills	28
New Utah Bingham	‡ 7/16
Nipissing Mines	5⅜
Ohio Copper	09
Oro.............	10'
Pacific Smelt	1/32
South Utah.......	10
Stand'd Oil of N J	387
Standard S. L.	1¼
Stewart	2 1/16
Tonopah	6⅝
Tonopah Ex.	2¾
Tonopah Merger	.39
Tularosa........	3/16
West End Ex...	03
Yukon Gold	2½

BOSTON CURB Feb. 23 Name of Comp.	Bid.
Alvarado	.60
Bingham Mines...	‡3⅜
Boston Ely........	.14
Butte & Lon'n Dev.	.19
Calaveras........	1 1/16
Calumet-Corbin...	.12
Chief Con	.70
Corbin	‡1
Cortez.....	.25
Crown Reserve....	.73
Eagle & Blue Bell.	.75
First Nat Cop	1
Houghton Copper.	1½
Iron Cap Cop., pf	‡5
Majestic	10
Mexican Metals.	13
Nevada-Douglas	30
New Baltic.	1¼
Oneco...........	‡ 60
Raven Copper....	09
Smokey Dev......	10
So. Lake.........	4⅛
Tonopah Victor	‡.17
Trethewey	.08
United Verde Ext	2 9/16

‡Last Quotations

LONDON Feb. 11	
Alaska Tre'dwell	£7 12s 6d
Camp Bird	0 7 6
El Oro.......	0 9 9
Esperanza....	0 9 6
Mexico Mines	4 2 6
Oroville	0 12 6
Philippine Dr	1 0 0
Santa Gert'dis	0 11 3
Tomboy	1 3 9
Tough Oakes	0 13 9

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48.855	28 983	26 553	22.731
February	61.642	57 506		28 357	26 573	
March	57.870	58.067		26.669	26 788	
April	59 490	58 519		27 416	26 958	
May	60 361	58 175		27.825	26 704	
June	58 990	56.471		27 199	25 948	
July	58.721	54 678		27 074	25.219	
August	59.293	54 344		27.335	25.979	
September	60 640	53.290		27 986	24 260	
October	60.793	50.654		28 083	23 199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26 720	22 900	
Year	59 791	54 811	...	27.576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January...	14.223	13.641	64.304	60.756	69 488	65.719
February..	14.491		65.259		70 188	
March	14.131		64.276		69 170	
April.	14.211		64.747		69.313	
May......	13.996		63.182		67 786	
June	13.603		61.836		66 274	
July..	13.223		60 540		64 955	
August....	*		‡		‡	
September	*		‡		‡	
October...	*		‡		‡	
November	11.739		53.227		*	
December .	12.801		56.841		*	
Year	13.602		61.524		68 168	

TIN

Month	New York		London	
	1914	1915	1914	1915
January..	37.779	34.260	171.905	156.550
February	39 830		181.556	
March.	38.038		173 619	
April.	36.154		163 963	
May	33 360		150 702	
June	30 577		138.321	
July...............	31.707		142 517	
August...	*		‡	
September..........	32.675		‡	
October..	30.284		‡	
November	33.304		139.391	
December.	33.601		147.102	
Av. year..	34 301		156.564	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048		3.937		19 606	
March. ..	3 970		3.850		19.651	
April.	3.810		3 688		18.225	
May.	3.900		3.808		18.503	
June.	3.900		3.810		19.411	
July....	3.891		3 738		19 051	
August....	3.875		3.715		‡	
September	3.828		3.658		‡	
October ...	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19 097	
Year..	3 862		3.737	..	19.079	..

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	5.262	6 386	5.112	6.211	21 533	30.84
February.	5 377		5 228		21.413	
March..	5 250		5 100		21.460	
April...	5.113		4.963		21.569	
May.	5 074		4 924		21.393	
June.	5 000		4.850		21.345	
July....	4.920		4.770		21 568	
August.	5 568		5 418		‡	
September	5 380		5.230		‡	
October..	4 909		4 750		‡	
November	5.112		4 962		25.016	
December .	5.592		5 430		27.369	
Year...	5 213		5.061		22.544	

New York and St Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.
February	15 06		14.12		14 08	
March	15 07		13 94		14.10	..
April	14.90		13 90		14 13	
May	4.90		13.90		14 27	
June	14.90		13.90		13 96	
July...	14 90		13 90		13 90	
August	14.90		13.90		14 08	
September	14 90		13 90		14 03	
October...	14.84		13 75		13.97	
November	14.59		13.43		13.83	
December .	14.70		13.45		13 83	
Year..	$14.88		$13.78		$14 01	.

The Engineering and Mining Journal

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West Coast Business

By Mark R. Lamb*

SYNOPSIS—The manufacturer who is looking for easy money will not find it on the West Coast of South America. The buying power per thousand of population is much below that in the States, even in normal times, and now it is crippled by the war. Interest rates are high, but industrial earning power of capital is often low.

Much has been written lately of the business opportunities in South America for the American manufacturer. At first the statements were wild and conditions much exaggerated, but lately the newspaper and magazine articles which we see here in Chile are much more reasonable and truthful pictures of conditions. If the first rosy pictures were allowed to stand, many manufacturers would send for some of the easy business and would be much disappointed. To be sure this would clear the field of American competition for those of us who are here to stay, but there is another point of view. If only those who are warranted in having their own representative in the field will make a start on the West Coast, it will be better for all of us. And if by any chance American capital should begin to enter this field, then there would really be business. There are many opportunities not only in mining but in other lines, and as the banks pay 7% on six-month deposits and the return on the gilt-edged bonds of the country is around 9% at the market price of the bonds, it is easy to see that there is opportunity for investment.

Breakfast Stop at Pazña, Antofagasta Ry.

Snowbound at Ollague, Bolivia, June 1-3

In choosing a representative for the West Coast or for anywhere else in the world, the main thing is that he should know his goods. Speaking Spanish, or French, or Portuguese is merely a detail, and given a year of contact with a new language, the average man will pick it up rapidly. While he is learning it is advisable and not too expensive to use a translator. The world is full of waiters who speak several languages. Nevertheless, the salesman should have all his Spanish letters written by some one skilled in Spanish composition, however long he has been in Spanish-speaking countries. Nothing makes quite so bad an impression as a badly written letter. Badly spoken Spanish is overlooked because of the ideas expressed—and also because most foreigners speak that way. There is no other way to speak Spanish except to speak it as best you can. But it is easy to send out well written letters, especially by using a dictaphone. With this machine, it is possible to dictate in the worst kind of Spanish, and the typist, without knowing any English, can put your thoughts into intelligible language. So much stress is laid upon the importance of knowing Spanish that the above explanation seems necessary. The big houses are continually bringing out new men from England and the States who are useful even as clerks while they are learning the language. The specialist who is brought out to sell electrical machinery, machine tools, air drills or locomotives quickly learns to express himself, whereas if he knew Spanish and nothing of locomotives he would have a very bad time of it and his contract would not be extended.

Although railway fares seem low, traveling is rather more expensive here or on the East Coast than in the States. If one makes the trip through Peru, Bolivia and Chile for the first time, his expenses will figure close to $12 per day. This includes an occasional horse, guide and pack mule to reach some distant mining camp, or it may include a special coach to avoid waiting for the weekly train. The ship usually supplies you with dirty water and ice, and bottled water is cheaper than a delay with typhoid. The stewards expect their tips just as much as if your representative was traveling with his own money and until he is thoroughly familiar with the various robber bands that take him ashore at the various ports, he is likely to pay excessively for going ashore and aboard.

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*Manager, Allis-Chalmers Mfg. Co., Santiago, Chile.

For no service whatever, comparatively speaking, the hotels along the coast charge more than in New York, and in Bolivia a hot bath is not to be had unless some friend takes pity and lends you his. This is no joke.

The manufacturer who cannot afford a representative of his own, must choose a representative among the dealers here and my advice is brief and clear. Find a representative who knows *your* line, who is in business *already* and who does not represent several of your competitors.

It may seem curious that it is necessary to advise that the representative be in the same line of business. But the main point made in asking for representations is the fact that the applicant is a successful banker, or steamship owner, or he is a nephew of the president, or he speaks Spanish—none of which qualifications have anything to do with his value as a representative. Would the National City Bank be a good representative for retailing 21-lb. shovels in New York? Is it likely that the White Star Line would make a success of selling vacuum filters in Colorado? Or would Kermit's being son of our next President make it easier for him to sell a municipal pumping engine on a duty basis?

As regards being in business already, we are being flooded with enthusiastic and well meaning hopefuls who *are* going to *start* a business all right—but who only *think* they are going to make a success of it.

JOINT REPRESENTATION INADVISABLE

As to representing competitors, that is all right in the automobile business in the States, where there are so many different types of autos and such a varied line of prices, but *no* representative is better than one who also is exclusive agent for your competitor—because he does not work for you, sells what is demanded, and takes commissions from both.

I have seen one such agent with catalogs, price books, samples, superseding price sheets and circular letters all piled on a shelf together, who represented six manufacturers of cutlery, tools, etc. No one in the place could quote a price or knew the difference between a stope wrench and a left-handed saw. The branch-office manager of another such agent asked the newly arrived man from the factory what kind of machinery they made! Another agent on the nitrate fields, representing a large manufacturer of crushers said frankly that he would buy nothing but English crushers for a plant his owners were building! There is nothing here to take the place of Dun and Bradstreet, so information on prospective agents must be got from whatever friends you have along the coast.

There are but few American manufacturers that have a large enough line of products which are in demand here to afford to have their own branch either in Chile, Peru or Bolivia. It does not follow that because it is profitable to have a branch in San Francisco it will pay to have one in Peru, Bolivia, Chile, the Argentine or Brazil. For example, Chile has a population of about three millions but their purchasing power is not equivalent to an equal number in the States. This difference is due to a variety of causes such as lower wages, fewer necessities and simpler habits. Another important reason is that there is lacking the extraordinary system of advertising and service that we have in the States that practically prepares a market for any good thing before it appears—and maintains the market afterward. In Chile, the only way to sell is to make a canvass from plant to plant, ready to prove such elementary propositions as that patent flour is better than roasted wheat ground between burr stones, or that classification is a good thing to provide preceding concentration, or that the cyanide process is really a success. The sanitary-fixture salesman finds just as curious conditions as any other. For example, in renting an apartment, you will find that your predecessor took his electric lights and wiring, his bath tub, sink, gas piping and water closet with him to the next house and you are expected to install whatever you require of these luxuries. This is not exceptional and even houses built by foreigners are rented this way. The point is that the plumber, while perhaps making more installations than he would under the American system, finds it difficult to convince his patrons that really fine installations are good investments.

Most of the road transportation in Chile and Peru is done by oxen with high, two-wheeled carts. Three and four mules abreast are also used with a lighter two-wheeled cart, and I have yet to see a real four-wheeled horse-drawn farmer's wagon. Whether such a wagon is better than the two-wheeled carts is a question here, naturally, and it is a point which must be proven before the salesman can begin to sell wagons. This is a handicap of which he does not dream when he leaves the States.

HAND-SCREENING OF HAND-CRUSHED TIN ORE AT HUANUNI

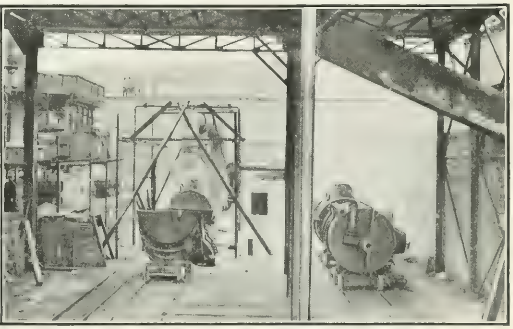
There are several flour mills in Chile and a few in Peru. The largest in Peru is at Callao with a daily capacity of 180 bbl. in 24 hr., 200-lb. barrels. These mills make good grades of flour—as good as flour made elsewhere—and in Peru an import duty of $1 per 100 lb. helps the miller. But many, many country people grind their own flour in simple burr mills. This condition is a hurdle which must be faced both by the flour salesman and the milling-machinery salesman.

PUBLIC UTILITIES ON THE WEST COAST

The industry of selling electric lighting and power on the West Coast is pretty well absorbed by the present interests. There is ample power available from Panama to Magellan on the west of the Andes, but the difficulty is to find a use for it. The Chilean Electric Tramway & Light Co., Ltd., provides light, power and street-car service at figures that positively would not be attractive to American capital. For example, the usual fare for a ride to any part of Santiago (except to the most distant suburbs) is equivalent to three cents for first-class and half of that for second class. As the second class is merely the top deck of a double-decked car, the cost to the company of carrying a second-class passenger is the same as for a first-class passenger. The company has many difficulties to contend with that are not encountered in the States and Europe which it is not necessary to enumerate, so that it is giving more service for the return than does the American traction company. The streets are narrow and big cars are entirely out of the question. All the above applies to the system in Valparaiso and Concepción, though as these are much smaller than the Santiago system they are not so important as investments.

There is a good modern system of street cars at Lima, very small ones at Arequipa and La Paz. When nitrate is again a marketable commodity perhaps Iquique and Antofagasta may afford very small lines of street cars, but outside of these the electric-railway engineer can see nothing here. There are a few small towns like Chillan which could support two or three cars and which are near cheap power, and there is a really good opportunity for an interurban line between Coquimbo and La Serena, but neither is hardly large enough to be of interest to American capital. The money to provide the power and equipment will come from Germany, France or England—and so will the equipment.

Copper-Leaching at Guayacan, Chile



Hand-Operated Converters at Chañeral, Chile

For a long time to come there will be no important new railway work in Chile, Peru or Bolivia. A line may be extended to Cochabamba in Bolivia, and a short cut-off may be built between Santiago and Valparaiso, though these projects are both a long distance in the future. The Longitudinal Ry. in Chile is completed as far as Iquique and is very useful to the interior districts. However, as Chile is so narrow, it is all near the coast, and the steamers will always do the majority of the carrying and passenger business. The Longitudinal is almost completely equipped and the equipment is largely French and English. Occasionally American locomotives and cars are sold here and when Americans contract for the construction of the railways this also leads to sales of locomotives and cars, but the cases are few. It is rumored here now that the Chilean government will buy a few locomotives from the Canal Commission, but new material is not likely to be purchased, even if times get good quickly, and this latter will not happen until a market is found for nitrate and copper. Peru needs a market for her cotton and rubber, and Bolivia for tin and rubber, the railway program for the latter country having been entirely upset by the drop in price of tin.

Lumbering a Minor Industry

Lumbering in Chile is only a minor industry due to the scattered condition of the timber, the lack of transportation facilities and also to the cheapness with which Oregon and California lumber can be brought in and sold. Lately the railway rates, both freight and passenger, have been raised about 50% and the lumbermen complain that this is killing their business. What lumber is cut is made with the simplest of circular saws and I think it is safe to say that there is not a band mill in Peru, Bolivia, Chile or the Argentine and there may not be a place for one. The waste in cutting lumber in Chile is great as the trees are small and the circular saws make a lot of sawdust. Besides this, the lumber is shipped as fast as cut and therefore reaches the market wet and at a disadvantage as compared with American lumber. The lumber business is only large from a South American point of view, since one county in Oregon will produce more lumber than is cut in all of South America together.

Perhaps this is a good place to again call attention to the relative size of the South American market. Based on population and purchasing power, Peru, Bolivia and Chile taken together will not equal San Francisco as a field for selling modern machinery, even after discounting for the competition in the home market, which is somewhat keener, perhaps, than here.

Although concrete construction is becoming increasingly popular, there is but one cement plant, and that a small one, on the West Coast. Though it makes a good quality of cement at a much lower price than cement can be imported it is not a successful venture from an American point of view. The selling of cement should be a good small business if the manufacturer would send his own salesman and carry a stock, but as it is usually sold—one dealer being agent for as many brands as possible in order to keep out competition—the manufacturer does not get the profit to which he is entitled.

Lately a desirable concession for the exclusive right to make cement in Peru for a long term of years was granted and that is a bright and shining example of an opportunity which has been open to American capital and yet will probably be taken in hand by someone else. The selling price of the cement is fixed in the concession, but it is so high that the profit will be more than the average selling price of cement in the States. A similar concession could be obtained in Bolivia and would be a benefit to the country and a source of profit to the owners.

With the exception of the plants at the port works at Talcahuano, Valparaiso and Cruz Grande there is not a proper stone-crushing plant on the coast. Santiago is using about 600 cu.m. of sand, gravel and stone daily. Most of it is dug out of the river by hand. The crushing is done in the simplest possible plants, consisting of a motor and a crusher, the material being fed to the crusher and taken away by hand. There is one No. 4 gyratory with elevator, trommel and bins, but I believe it is the only one in Chile, Bolivia and Peru. Ballast for the railway is crushed in the same simple way, the power usually being a portable boiler and engine on wheels, and the crusher being a 10x20 in. at the most.

Power Goes Begging in Chile

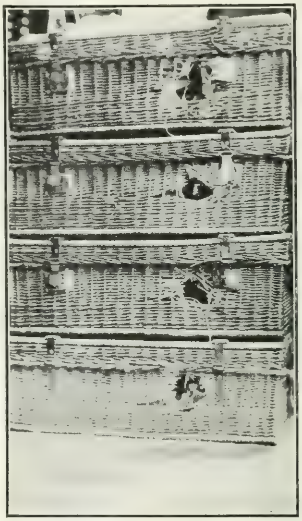
Power opportunities, as stated above, are frequent along the coast except through the nitrate districts, but no one can find a use for the power. A short time ago a power proposition near Santiago was offered to an American company which sent its engineer to examine the field. The power proposition was feasible, but the engineer could find no sale for his power. The present company has an excess of power over that required for the street cars and lights and furnishes power at a reasonable figure. There are few industries requiring power which are established here, probably because there is no protective duty, the funds for the government coming largely from the nitrate industry. A glance over the city shows only here and there a cracker factory, a laundry or a shoe factory. All around the city are irrigation canals which provide power at low prices. There is one turbine in the center of the city which will supply 70 hp. and which goes begging for a user. The city will give the power and turbine and a reasonable site to whoever will supply a reasonable amount of lighting current during the evening. The trouble is to find a use for the power. If the power available in Chile is ever used, it will be in some important industry in no way connected with the ordinary life of the people.

Throughout the nitrate districts, steam has been the main source of power and will continue to be for a long time, though here and there the Diesel engine is being installed. Lately the California fuel oils have been replacing European and Australian coals, and for the Diesel engines a light Peruvian crude oil is used which sells in tank cars for around 75s. per long ton—about double the price of the California residues.

Each nitrate plant has a big boiler equipment, Boquete, for example, having eight 8x30-ft. Lancashire boilers, and Boquete only makes 35 tons of nitrate daily. The power requirements in a nitrate plant are relatively small and as the steam pressure required for the process is around 40 lb., it is easily possible to use the steam for the power at a higher pressure, using the exhaust at the desired 40 lb. back pressure, thus obtaining power even cheaper than by the use of the Diesel engine. There are disadvantages, however, to this system, which have left an opening for the Diesel.

The whole prosperity of Chile and therefore its purchasing power is bound up in the nitrate industry, and as a barometer of conditions in this country nothing could be better than the market quotations of price and shipments of nitrate. The barometer for Bolivia is tin. Also, nothing would help get business in Chile and Bolivia like finding markets for these products. The cables have advised us at times that we could expect to see American ships sail along the coast with merchandise for here with a good capacity for tin and nitrate for the States, but we are still waiting for the ships. Meanwhile the first of a fleet of Norwegian oil ships reached Valparaiso today and advises that there will be a 15-day service through the Straits and back through Panama, the ships having first-class passenger accommodations and planning to take nitrate home.

Lately the Chilean government has chartered two navy transports to the Antofagasta Nitrate Co. and to Gibbs & Co., so that nitrate can be shipped in neutral ships, and as the manager of the Antofagasta company will reach the States this week with the idea of selling a cargo of nitrate there, it is to be hoped that he will be given every assistance by those who wish to sell machinery in Chile. So that the importance of this business will be realized it may be stated that the production of the plants under Mr. Alibaud amounts to the very respectable figure of $12,000,000 American currency on a price basis of $40 per ton. There are 170 nitrate plants, of which the Antofagasta company owns six or eight.



The Advantage of Wicker Cases

Mining on the West Coast

Mining along the West Coast should be divided for commercial purposes into groups, as follows: One consists of the big American concerns like Braden, Cerro de Pasco and Chuquicamata, who do all their buying in the States through New York buyers. Then there are the European companies which buy almost exclusively in Europe. The third group comprises the local and small concerns which buy locally, or of whoever can make the best showing. It is to these latter that the salesman of machinery or other merchandise must look for his orders. This group can be further divided for convenience into a group comprising the comparatively large tin-mining companies which operate in Bolivia but which are owned in Chile, and another group which includes small copper, lead, silver and gold mines.

The tin companies can be counted on the fingers of one hand and the others—even counting the smallest operating mines—can be counted on both hands so far as the interests of the salesman are concerned. There are of course many small prospects and many small mines that are worked by contractors who sort and ship substantial quantities of ore, but as they buy no machinery they are of no interest to the American manufacturer.

Even the tin miners are not ordinarily important buyers, as their equipments are now more or less complete and no new mines have been discovered for several years. Within the last two years the Bolivian operators have become interested in air drilling and this has led to a number of satisfactory sales of compressors and drills by the manufacturers of this type of machinery, in spite of the high altitude and consequent loss of volumetric efficiency of the outfits.

Lately the price of tin has been low and when this obtains the purchases are cut off entirely. The price quoted by cable from London today was £140 per ton so that the tin miner is again hopeful. At this price, the Bolivian mine can make a profit so there are again hopes of selling mining and concentration machinery occasionally. At the present moment the mines that are operating at all are working with a minimum force under a low wage, since due to the closing down of some of the mines, the labor market is over-crowded and many of the laborers are working for their food only. Many of the thousands of nitrate laborers who have been let out are returning to Bolivia, with the result that there are 10 men for each job and there is much privation. There are districts in Peru and Chile also where laborers are working for their board. I passed an irrigation-ditch digging gang near San Rafael where 50 men were working for these terms, and men are offering to work near Coquimbo for the same terms. This is no discredit to the country or the men. On the contrary, I think it is a striking proof of the reasonableness of the Chilean *roto*.

My personal expectation had been that the European mix-up would result in orders for me for spares which would be urgently required and which could not be got out from Europe. This would have been the case had conditions remained normal, but with no prices for silver, copper, nitrate, rubber, cotton or any other of the West Coast products, no one has money even to buy urgently needed spare parts and most of them have no need for the parts. In a few cases such parts as were required were for special European machines and could be made only with the shop drawings at hand.

No Credit Trade at Present

The big houses in local trade, which always have out a long line of credits, are much worried. There is no such thing as credit now, and it is so bad that positively the largest houses will not trust each other, not knowing how heavily the other may be involved with German credits which may or may not be good after the war is over. Where the houses are German, the explanation is reversed, as bills payable in England are in some cases dishonored. This means that every bit of business is strictly for cash. One paint salesman who has made this territory several times before, has heretofore made his sales through importers with New York connections. He is here now and has received nearly $20,000 in orders under the usual terms, but can find no local house that will assume the credits. As paint is a material that is kept in stock for months it is not possible to sell much of an order for cash, so that this salesman has decided that he can do no business here—though he can get orders.

There is rarely any question of the quality of American goods. Montero, the big hardware man, will show you three wrenches, let us say, and will explain that one is German, the next English and the third American. He will explain that the American costs more and is best, the German is cheapest, and the English is in between. Mrs. Lamb bought an alarm clock at a jeweler's and was shown several kinds. The jeweler explained that he would guarantee any of them, but that it was not necessary to guarantee the American—it guaranteed itself.

The question of packing has so often been lectured upon that nothing further should be required—but it is. The four basket trunks shown in the illustration (p. 436) were shipped packed with shoes and only crated instead of boxed. An oar handle served the launchman to open them, after which the contents were removed. The baskets were then sent on to Bolivia in this condition. The moral is to box heavily.

While ordinary business is the same here as elsewhere, there are some things that are decidedly novel. To begin with, the telephone is so far behind American service that it is difficult to express a comparison. The series of operations required for getting a connection requires special prayer and preparation and a great exercise of patience. For this reason people who really should have a telephone often do not. It is not fair to blame the company with the bad service, since the user is quite as much to blame. It is a frequent thing to hear the phone ring and no one attend it. Often the ring is due to a crossed line or an error in the exchange, so about half the time it would be right to ignore the ring, but it is a bad practice to get into. Again, it is considered quite the thing to discuss the matter with the operator in case the connection is slow, or wrong, or indistinct or a failure in any other way. If it were a crime to sass the operator, half of Santiago would be in jail. I look back with considerable amusement to my first trials of the system several weeks ago, when I would actually lose my temper. Now I only seem to.

Afternoon Tea Adopted by Chile

The Chilean has taken kindly to the English custom of afternoon tea and it is universal custom to take 15 minutes to half an hour off about 4:30 and enjoy a cup of tea and a cracker. The favored enjoy their tea in the quiet corners of the Club Union—the club which to my mind is the most intensely interesting and live of all clubs. This impression is not due to the building, which is old, nor to the equipment, which is only good, but to the fact that it is the popular, personal club of the brightest and chosen men of Chile. In a country the size of this all of the upper crust of the upper class are personally acquainted with each other and a large percentage are related by marriage. It is this feature of universal acquaintance and cordiality which strikes the stranger and which makes it the club ideal we have all hoped our own clubs would be.

Sulphuric-Acid Manufacture in Great Britain

According to the 50th annual report of the British Alkali Inspector (abstr. in *Journ. Soc. Chem. Ind.*), further advance was made during 1913 in the prevention of the escape of metallic fume and in the reduction of acid escaping with chimney gases, but the acidity of gases from lead- and copper-smelting works presents a problem which still awaits solution, and the amount of sulphur escaping into the air from the blende calciners in the immediate neighborhood of Swansea (within an area of 4 sq. miles) is equivalent to approximately 80 tons sulphuric acid of 150° Tw. (sp.gr. 1.75) per 24 hours. At one large spelter works chambers are being erected for the manufacture of sulphuric acid from the gases, and it is suggested that by calcination in muffle-type furnaces, at a central works, or by arrangement with vitriol makers, the whole of these waste gases might become a source of profit instead of polluting the air.

More attention is now given to providing wider space between sulphuric-acid chambers, thus affording greater cooling space and condensing power, longer life to the chambers, greater ease in effecting repairs, and opportunity for keeping the outside of the chambers clean; the practice of limewashing chambers and woodwork is commended as tending to preserve the latter and as making evident the slightest leak. Incasing flues from burners to denitrating columns in cast iron has been found successful in preventing local escapes due to weakening of the brickwork by heat.

Appreciative reference is made to an apparatus called "Nitrophor," devised to control automatically the supply of niter to the system by responding to alterations of temperature of the chamber gases, but it is pointed out that influence may be exerted by factors other than the chemical actions taking place in the chambers.

Glass-packed absorbing towers are being used in increasing numbers, and water sprays in lieu of steam for supplying moisture to the chambers are on the increase, although in Scotland there is said to be some tendency to return to the older system. The injection of sodium-nitrate solution into the first chamber instead of "potting" nitrate in the burner flue is also becoming popular. In Scotland, fans for controlling draft and additional Gay-Lussac towers are in more general use, and a strong solution of soda ash has been employed at several works to reduce obstruction of towers by chemical deposits, with good effect. The undue escapes previously reported during the concentration of acid in over-heat pans were greatly lessened. Kessler plant came into more extended use during the year; the substitution of mechanical means for obtaining the necessary draft further replaced the high-pressure steam-jet aspirator originally used in all installations of this form, with advantage as regards steam consumption, and strength of recovered weak acids. The cascade system was also further adopted, silica ware, "tantiron," and, to a small extent, "ironac" being in use for making the evaporating vessels.

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Cementation at the Wallaroo & Moonta Mines[*]

The Wallaroo and Moonta mines are situated in the northern part of Yorke's Peninsula, in South Australia. The deposits were discovered by accident in 1860, and were separately operated until 1889, when they were combined under the name of the Wallaroo & Moonta Mining & Smelting Co., Ltd. The total production of ore has been about 10,200,000 tons averaging 3% copper, and the output of fine copper about 283,682 tons. Treatment is by direct smelting, or concentration, cementation and smelting.

Jig tailings are treated for the recovery of the copper which they contain. The large accumulations of old tailings are in five heaps, varying in height from 30 to 60 ft., and covering an area of about 60 acres. The top is divided by little ridges into 12-ft. squares, so that the distribution of water may be promptly controlled. Only a part of the heap is subjected to leaching at any one time.

Plowing Slimes to Promote Oxidation

Loading Cars with Wheel Scrapers

Exposure to the atmosphere oxidizes the sulphides in these tailings and by slow degrees they become decomposed. Saturation by water containing iron salts may greatly expedite this decomposition and encourages the gradual conversion of the sulphides into soluble salts. In addition to other salts, the water circulated contains about 100 grains of sulphate of iron per gallon, and a fractional percentage of free sulphuric acid. It is pumped onto the top of the heap by Worthington compound, duplex, acid-resisting pumps (made of special alloy), which force 20,000 to 40,000 gal. per hr., as required, through 2¼ miles of cast-iron wood-lined pipes. A pumping station at Moonta Bay provides sea water to supplement the mine water and make up for losses through evaporation and a certain amount of seepage.

The liquors are pumped onto the surface of the heaps, and, in percolating, collect the soluble copper sulphate in their passage. The solutions then drain through earthenware pipes to six wood-lined masonry tanks, 60x30x3½ ft. The first two are for clarifying the liquors and the remaining four are charged with scrap iron, the liquors depositing by precipitation a portion of the copper they carry. From these tanks the copper solutions gravitate through about 3000 ft. of wood-lined canals, 2 ft. 8 in. wide by 9 ft. deep, also containing scrap iron. By the time the liquors reach the end of these passages practically all of the copper has been precipitated. The water charged with the sulphate of iron resulting from these reactions is returned to the circulating pump, and again lifted to the heap to recommence its work. The tailings heaps contain about 1,500,000 tons, estimated originally at 0.9% copper, in addition to which slimes deposits amount to some 323,000 tons.

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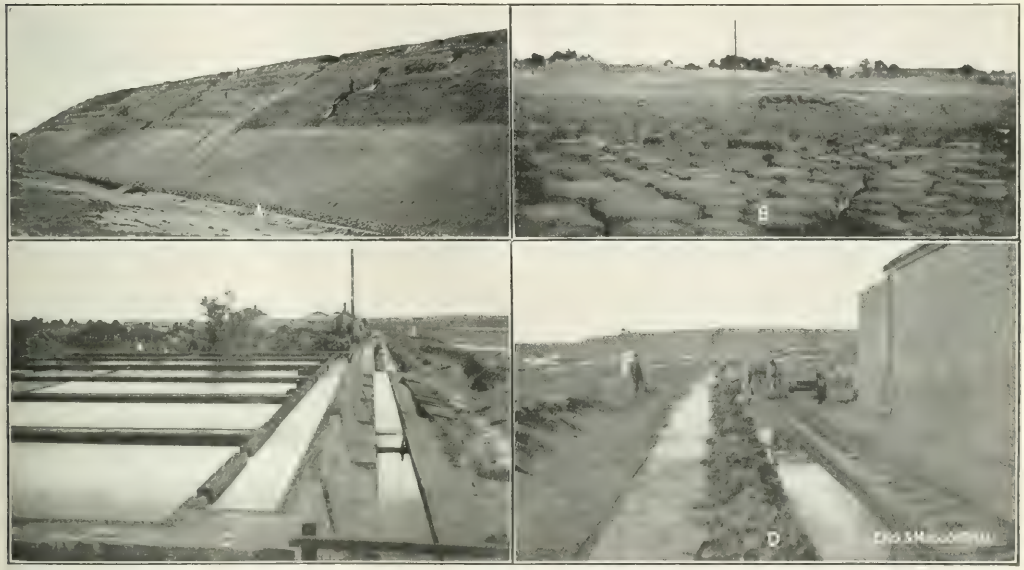
[*] Abstracted from "Min. and Eng. Rev.," Melbourne, Australia, June 5, 1914.

The old slimes from the concentrating process, not being amenable to treatment by percolation, are exposed in shallow heaps for oxidation, the process being greatly accelerated by a well arranged system of plowing, so that different portions of the slime are exposed to air at different times. The slimes are run out into flat places in the ground, where they are dried. After drying, they receive the plowing treatment, and are then loaded into cars and taken to the treatment plant. At this plant, the material is passed through agitators with the liquors containing iron and other salts, to which sulphuric acid is added to the extent of from 10 to 20 lb. per ton of slimes, according to the character of the material. The quantity of water used is sufficiently large, 1200 to 1400 gal. per ton of slime, to convert the product into a thin pulp. This is conveyed by long launders to settling dams, where the slimes are deposited, while the liquors pass through clarifying reservoirs and thence through earthenware pipes to join the solutions coming from a tailings heap in the precipitating tanks and canals.



CEMENTATION PROCESS AT WALLAROO & MOONTA MINES, SOUTH AUSTRALIA

A—Tailings heap under leaching treatment. B—Drying out the slimes. C—Precipitation tanks and canals and pumping station. D—Cleaning precipitate from the canals.

The precipitate from these operations is removed from the tanks and canals at frequent intervals. It is washed, cleaned, freed from metallic iron, dried and sent to the smelting works. The total amount of precipitate recovered up to the end of 1912 was about 9400 tons, having an average of about 76% copper. An annual quantity of about 700 tons of copper is being obtained from this source.

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Observations on the Appraisal of the Iron Mines of Michigan*

As the present system of appraisal of the mining properties of Michigan for the purpose of taxation has been in force for several years and promises to be permanent, it will be of value to review what has been done, for the benefit of those who have been too busy with other matters to follow it.

Prior to 1911, all property in the state, except that of railroad, union-station and depot, express, telegraph and telephone, sleeping-car and car-loaning companies, which was assessed by a state board of assessors, was assessed by local officers, and their assessments were passed upon by local boards of review. That this resulted in gross inequalities, both local and state-wide, was inevitable. It was also inevitable that such assessments should be at a low ratio to cash value. The assessors had neither the time nor the ability to assess the property of their districts properly and inequalities in ratio were much less evident than inequalities in actual cash value. Moreover, as the counties were equalized by the State Board of Equalization, as to the proportion of the state tax each should bear, and as the townships and cities in each county were equalized by the county board as to the amount of state and county taxes each should pay, the whole tendency throughout the state was toward an artificial value at a low ratio to the actual cash value.

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*Abstract of an article by C. H. Baxter, superintendent, Loretto Iron Co., Loretto, Mich., in the Michigan College of Mines "Alumnus," July, 1914.

Taxes throughout the state were rapidly increasing as greater demands were being made upon the state, counties and municipalities. Under these conditions some of the powers of the state began looking around for some one to pay the state tax, which was about 15% of the total. The taxes received from the railroad, telegraph and telephone and other similar companies were returned to the municipalities as the primary-school fund and were proportioned according to the school census. This fund was jealously guarded, most of the settled farm districts receiving more primary-school money than they paid out in state taxes. In more sparsely settled districts, of course, the reverse was true. The wealthy mines of Upper Michigan, "whose non-resident owners were robbing the state of its resources and who, through the control of local assessing officers, were paying but a pittance into the state coffers," seemed the most likely source. The state grange advocated a tonnage tax in lieu only of state taxes, and in the 1911 session of the state legislature came near getting a bill passed that would have crippled the mining industry of the state. It was argued that it was impossible to value a mine, and that the only way to make the mines pay their share of the taxes was the tonnage-tax method, which in this bill consisted of a flat-rate royalty of 15c. per ton.

In this session of 1911, the power to review and correct the assessments of local assessors was restored to the State Board of Tax Commissioners—this board had been created in 1899, but its power had been later materially restricted—and under the pressure of public opinion, the board began on the mines. It engaged James R. Finlay to appraise the mines of Michigan, and he in turn engaged Dr. C. K. Leith as assistant on the iron mines, William Hague for the copper mines, and Dr. H. M. Chance for the coal mines. Mr. Finlay's method of valuing the mines has been generally accepted as correct in principle. He computed the value of a mine as the present worth of a diminishing asset and capitalized the estimated future annual dividends left after a certain sinking fund was deducted from the earnings, an amount that would, if set aside each year and invested at compound interest, replace the valuation at the expiration of the life of the mine. If Mr. Finlay did an injustice to the mining companies in his appraisal, it was in the rates of interest used, the estimated future value of ore, and in the estimated tonnage below bottom level. The last item was corrected by Doctor Leith before the valuations were put on the rolls. It must be taken into consideration that the amount of work done was enormous and the time allowed less than three months.

For the following two reasons, for which Mr. Finlay was not responsible, the mines paid more than their just share of the tax: (1) It will be evident that a valuation thus computed is a full valuation of the mine based on the ore and the profit that can be derived therefrom. Climatic conditions necessitated the stockpiling of ore during the winter months, or else stopping the mine, which would reduce the value of the mine by lowering the output, and be a hardship on the community dependent on the mine. The tax laws demanded a separate assessment of the stockpiles as personal property and they were assessed in addition to the appraisal on the mine. (2) In 1911, while the mines were raised to full valuation, the other property of the counties in which they were situated was not. This resulted in the mines paying much more than their proportion of the taxes for the year 1911.

Since 1911, the State Board of Tax Commissioners has revalued the mines each year, in 1912 employing Doctor Leith and in 1913 and 1914 Dr. R. C. Allen, director of the Michigan Geological and Biological Survey. In 1912, the board assessed all of the property in the four iron counties at full valuation and thus relieved the mines of the heavy overburden they had borne the year before. In 1913, the board changed the interest rates to 6% on both the investment and the sinking fund, on the ground that the sinking fund is not set aside as a separate investment at a low rate of interest, but is either paid out in dividends or reinvested in the mining business. This reduced values slightly. In 1914, they corrected the double taxation caused by the extra assessment of the ore on stockpile, and also made an allowance for hazards that were not considered in the cost of mining.

The board has only been assessing other counties of Michigan at full valuation, and I understand that it is its intention to continue until all the property of the state is assessed as nearly as possible at full cash value. When it comes to assessing the farms of Lower Michigan on this basis, will the board have the power to "put it over"? Or, will public sentiment change and the work be discontinued on the ground that those counties have already placed themselves at full cash value and that the expense is therefore unwarranted?

There have been many hearings on mine valuations held both in Upper Michigan and in Lansing before the state board, and I think the members of the board have come to the conclusion that the mine operators are no more naturally taxdodgers than any other class of people in the state, and that the operators are convinced that the State Board of Tax Commissioners is not actuated by prejudice, but is willing to give the mines a square deal. This spirit carried out cannot but bring good results and be beneficial to all concerned.

The only effect that I can see that the present method of valuation will have on the mining industry is that it may delay the development of ore reserves. There is, of course, enough ore developed to supply the demand for years to come. A mining company is penalized for opening up its reserves, that is, showing its full value. The extra taxes will have to be added to the interest on the cost of developing reserves, as balanced against the value of the knowledge of such reserves. Will not this cause the development of reserves only as needed in the course of mining?

The Strontia Trade

The opportunity for development of the American strontia deposits is pointed out in the December issue of the *Journal of Industrial and Engineering Chemistry*:

> Prior to Aug. 1, the refined nitrate was offered in commercial lots at 8c. per lb., but since the above date, the price of the salt has advanced 200%. The commercial demands for strontium nitrate are not so diversified as for certain other chemical products, but the total annual consumption in the United States seems to warrant the American manufacturer entering upon this new field with the confidence that once his market is established, he need no longer fear ruinous competition from the foreign producer.
>
> The principal salts of strontium that appear on the commercial market are, in the order of their importance: Stron-

tium hydroxide, strontium nitrate and strontium chloride. Of the above salts, however, the nitrate is the only one that has been imported in large quantities, but the world consumption of this salt is very small in comparison to that of the hydroxide, which is used in the refining of beet-sugar molasses. So far as is known, the major portion of the nitrate imported annually is consumed in the manufacture of railway signals or Coston lights, and the manufacture of so-called red fire used extensively by the pyrotechnists.

For reasons best known to the continental sugar refiners, the price of the hydrate has never been within the reach of our domestic consumers, but inquiries made among large beet-sugar refiners in this country indicate that there would be a very large consumption of the compound, provided a stable source of supply could be secured.

The conversion of celestite, or strontium sulphate, into soluble strontium compounds, is effected through the reduction of this salt by heating with carbon in rotary furnaces, thus producing the soluble strontium sulphide, from which the hydroxide or nitrate can be readily prepared with suitable reagents.

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Generalizations Concerning Economic Geology of the Belgian Congo*

The Belgian Congo, with the exception of the coastal plain, is an ancient plateau which has suffered successive erosional periods, not only in pre-Cambrian and Paleozoic times, but also a particularly important one continuing from late Triassic to Recent time. The thickness of rocks removed must have been very great. Because of this and the fact that no intrusions of post-middle-Carboniferous age (according to Studt's correlation, mid-Devonian) are known to have been important metallic mineralizing agents, it is natural that those metals which, according to present knowledge, are deposited near the surface (mercury, for example), do not occur in important amounts.

The ore deposits of the Katanga Paleozoic rocks, however, are not of deep-seated nature, as these rocks, though in places closely folded, have not been particularly deeply buried. In the pre-Cambrian rocks, however, which form large areas in the Katanga, and greatly predominate among the pre-Permian rocks in other portions of the rim regions, the majority of the ore deposits are of types deposited at great depths, and those later to be found as mining progresses will probably be mineralized quartz lenses, magmatic segregations, sulphide and oxide segregations, and contact metamorphic deposits.

From the rather striking likeness of the pre-Cambrian rocks of the various portions of the colony, it is not surprising that their ore deposits throughout the colony have many points of similarity. The limited bulk of limestone in part accounts probably for the absence of important lead and zinc deposits, although the absence may be more apparent than real, as outcrops of lead and zinc ore are much more apt to be passed over in prospecting than the brilliantly hued surface showings of certain types of copper deposits. The almost complete absence of Tertiary intrusives and the depth of the erosion explain the nonpresence of certain types of silver deposits, and if argentiferous orebodies are later to be found, they will presumably be of intermediate or deep types.

In the northeastern part of the colony the gold mineralization appears to be of pre-Cambrian age, and many of the lesser, commercially unimportant copper deposits, and most of the iron-ore deposits throughout the colony are of similar age; indeed, metallic mineralization, with the exception of the Katanga Paleozoic tin and copper, the Ruwe gold deposits and the recent iron ores, is presumably largely pre-Cambrian. The diamond deposits, at least those of the Katanga, are of post-Permian and perhaps of Cretaceous age.

The flat-lying sandstones and shales of the central basin are without important epigenetic deposits. They may possibly later be proved to contain, locally, lignite and petroleum. Stray colors of gold occur therein, and the placer diamonds of the Kasai region were probably weathered out of certain of their conglomerate beds. The original source of the precious stones, however, must be looked for elsewhere. The Tertiary and Mesozoic sedimentary rocks of the coast are known to contain sandstone with a high bitumen content, but otherwise appear to be barren. The Recent gravels of the rim highlands contain in places concentration of the more resistant minerals, gold, diamonds, monazite, etc.

Although the greater portion of the central Congo basin is of little interest from a mining standpoint, the rest of the country may be considered rather well mineralized. Of particular interest to economic geologists are the Aruwimi-Uelle region in the northeastern part of the colony, the Katanga in the southeastern corner adjoining Rhodesia, and the Kasai-Lovua region in the southwestern portion of the colony.

The analogy between the geology of the Central Africa plateau and of Brazil is close, as pointed out by Cornet, and to an equal extent the mineral resources of the two countries resemble one another. Not only are alluvial diamonds widely distributed over these two regions, but the mineral associations in instances resemble one another. In each country gold deposits are closely associated with hematitic quartzites. Further, there are similarities between iron-ore deposits of the two countries and on the coasts of each occur bituminous sedimentary rocks of more or less importance.

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*Excerpt from "Economic Geology of the Belgian Congo, Central Africa," by Sydney H. Ball and Millard K. Shaler, "Econ. Geol." October, 1914.

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Proposed Legal Definition of Vitrification

As clay products which are visibly glassy are practically certain to be overburned and worthless, and as all clay products, whether much or little vitrified, show some portions of glassy maxtrix under magnification, E. Orton (*Trans. Am. Ceram. Soc.*, 1914, p. 497; abstr. *Journ. Soc. Chem. Ind.*) proposes a quantitative absorption test in order to ascertain "vitrification." The definition he suggests for a legal standard is as follows: "Where the word vitrified is used in a contract or agreement as an adjective in describing the properties of a clay product, without further definition in such contract, it shall mean that the product shall have attained in the firing process such a degree of structural density that its mean absorption of pure water will not exceed 3% of its own initial weight, when subjected to absorption tests of 18 hr. complete immersion in cold water or 3 hr. immersion in boiling water. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0.5%. Neither the possession of the visual properties or appearance of a glass, nor any definite degree of physical strength, hardness, color, or specific gravity, shall be implied as an attribute of vitrification."

Foreign Mineral Trade of Great Britain

The heavy mineral trade of Great Britain, both imports and exports, was naturally much interrupted and broken up by the disturbed conditions in Europe in the second half of 1914. Comparisons made with 1913 show some marked changes.

Gold imports into Great Britain in 1914 showed a considerable decrease towards the close of the year, the December total being £579,634, or not much over 11% of those of December, 1914. For year ended Dec. 31 the totals were as follows:

	1913	1914	Changes
Imports	£59,533,549	£50,646,642	D. £8,886,907
Exports	46,087,359	30,599,050	D. 15,488,309
Excess, imports	£13,446,190	£20,047,592	I. £6,601,402

Exports to South America, Egypt and India, and of course those to Germany, showed large decreases. Imports from the Transvaal decreased heavily, probably owing to the deposit system adopted by the Bank of England there.

Exports and imports of silver both showed large decreases. The total values for year ended Dec. 31 were:

	1913	1914	Changes
Imports	£14,495,049	£11,950,090	D £2,544,959
Exports	16,054,679	10,889,075	D. 5,165,604
	Exports	Imports	
Excess	£1,559,630	£1,061,015	....

The decrease in imports was mainly from the United States and Canada, while that in exports was to India and China.

Silver coinage in the British Mint in 1914 showed a large increase. The total number of silver pieces struck in 1914 was 92,455,843, against 32,296,527 in 1913. The face value of the coins increased from £1,934,354 in 1913 to £6,250,524 in 1914. The increase in face value was proportionately greater than that in number of coins.

METALS AND ORES

Imports and exports of metals other than iron and steel in Great Britain for the full year ended Dec. 31 are reported as follows in long tons:

	Imports		Exports	
	1913	1914	1913	1914
Copper	155,485	200,166	72,510	50,774
Tin	45,682	49,961	41,749	44,209
Lead	204,136	224,194	61,993	50,984
Zinc	163,772	128,213	11,076	7,456
Quicksilver	1,518	1,258	898	769
Minor metals	9,805	6,809	26,829	23,931

Exports include reëxports of foreign material. Copper totals include metallic contents of ore and matte imported.

Imports of ores, other than those of iron in Great Britain year ended Dec. 31, in long tons:

	1913	1914	Changes
Copper ore	94,265	71,573	D. 22,692
Tin ore	34,592	32,398	D. 2,194
Manganese ore	601,177	479,435	D. 121,742
Pyrites	781,711	803,065	I. 21,354

Exports of these ores are insignificant, and can be safely disregarded. Of the tin ore in 1914, there were 22,542 tons from South America.

The foreign trade of Great Britain in iron and steel and manufactures thereof for the year ended Dec. 31 is valued by the Board of Trade returns as follows:

	Exports		Imports	
	1913	1914	1913	1914
Iron and steel	£54,291,768	£41,719,422	£15,231,633	£10,865,140
Hardware, etc.	13,358,653	[illegible]	8,965,651	6,439,301
Machinery	37,012,635	[illegible]	7,282,971	6,704,389
New ships	11,026,530	[illegible]	....	....
Totals	£115,689,586	[illegible]	£31,480,258	£24,008,830

The quantities of iron and steel exported are given at 4,933,704 long tons in 1913, and 3,888,907 tons in 1914; decrease, 1,044,797 tons. Imports were 2,220,366 tons in 1913, and 1,616,693 tons in 1914; decrease, 603,673 tons. The heavy losses shown were all in the second half of the year and were, of course, due to the war.

Imports of iron ore for the year ended Dec. 31 were 7,442,249 long tons in 1913, and 5,704,837 tons in 1914; decrease, 1,737,412 tons.

COAL

Exports of coal showed a marked decrease month by month from the beginning of the war. In December the exports of fuel—not including bunker coal—were 3,879,393 long tons, against 6,526,307 in December, 1913. For the year the total exports were, in long tons:

	1913	1914	Changes
Coal	73,400,118	59,039,880	D. 14,360,238
Coke	1,235,141	1,182,848	D. 52,293
Briquettes	2,053,187	1,607,757	D. 445,430
Bunker coal	21,031,550	18,535,579	D. 2,495,971
Total	97,719,996	80,366,064	D. 17,353,932

The total decrease was 17.8%. The imports are insignificant, only 24,029 tons in 1913, and 44,572 tons in 1914, an increase of 20,043 tons in the latter year.

* * *

On the Composition of Bat Guano

Owing to the many inquiries received at the JOURNAL office as to bat guano, the following analyses reported by C. F. Miller, of the Bureau of Soils (*Journ. Ind. Eng. Chem.*, August, 1914), seem of interest:

BAT GUANO ANALYSES

Results in Percentages, based on Air-Dry Sample

Source of Sample	N	P_2O_5	K_2O	Volatile
Near Carlsbad, N. M.	4.24	2.33	1.28	
Guadalupe Mts., N. M.	1.77	2.68	0.41	40.00
Torreon, N. M.	10.82	4.08	1.01	
Oregon County, Mo.	8.10	2.16	0.58	
San Juan, P. R.	1.00	3.40	0.21	
San Juan, P. R.	0.50	2.10	0.29	
El Fondo, Santo Domingo	11.84	4.80	1.61	....

The large variations are attributable either to foreign matter, such as rock débris and the like, or to removal of the more available constituents by leaching. In the more recent deposits, nitrogen is the most valuable constituent, phosphoric acid and potash following in the order given, but on aging, the nitrogen content decreases rapidly. The sample from Santo Domingo represents practically uncontaminated and undecomposed guano.

* * *

The Hanyehping Iron & Coal Co., Ltd., commonly known from its chief plant as the Hanyang Iron Works, has coal mines at Pinghsiang, Kiangsi Province, and iron mines at Tayeh, Hupeh Province. The Hanyehping company, the Japanese Iron Works and the Yokohama Specie Bank entered into joint agreements in the spring of 1914, according to a recent consular report, by which the bank was to lend the Chinese company about $7,500,000, to be redeemed within 40 years through the sale of iron ore and pig iron to the Japanese Iron Works. In March, 1914, the Hanyehping shareholders agreed to the proposed joint control of the company by the management and the Chinese Government. Practically all the pig iron exported in 1913 went to Japan. The Hanyang Iron Works are now in full operation; but owing to the contracts with the Japanese, the prospects for increased shipments of iron ore to the United States are not promising. The blast furnaces, which were partially destroyed during the revolution of 1911, have been repaired and a new furnace is being installed. The output of the Hanyang Iron & Steel Works during 1913 was as follows: Pig iron, 97,633 tons; steel, 41,961 tons; steel rails, 16,743 tons. The production of coal at the Pinghsiang mines amounted to 579,633 tons in 1913, compared with 232,373 tons in 1912; that of coke to 171,665 tons in 1913. The output of iron ore at the Tayeh mines was 192,980 tons in 1912 and 485,865 tons in 1913. The projected railway construction in the district is creating such a demand for rails that the entire output of pig iron of this company, after satisfying the Japanese pig-iron contract, must be used in producing rails for the Hukuang Railways.

Finding the Judson Orebody

By L. E. Ives*

SYNOPSIS—Discovery of iron orebody near Crystal Falls, Mich., on which Judson and Balkan mines have been opened. Geological conditions, preliminary investigations. First drilling exploratory. This followed by systematic outlining of the ore.

One of the most important events in the recent history of Michigan iron mining was the discovery by the E. J. Longyear Co. of the Judson orebody near Crystal Falls. Five years ago the property was a swamp containing some long abandoned exploration pits, trenches, etc., and so far as anyone knew, or cared, apparently, nothing else. The district had received a black eye, having been turned down by one of the large companies operating on the Lake Superior ranges, which had drilled it to some extent, but had found nothing. Today, as the result of scientific exploration, the Balkan and Judson mines are stockpiling from a deposit known to be extremely large.

Geology

The Menominee region comprises the Iron River, Crystal Falls and Florence districts, and the old Menominee range proper. The region was at one time the scene of volcanic activity. The lava flowing in great rivers into the adjacent sea, formed deltas of volcanic muds and sands. In time volcanic action ceased and the muds were solidified, some under water and some above water.

Accompanying the laying down of these muds and sands, a chemical deposition of iron-bearing cherts occurred, forming lenses at several different horizons in the mud mass. Later the muds and sands were consolidated into slates and graywackes and the iron formations were hardened. In subsequent geologic periods, intense folding took place and the whole was brought up as a land mass. From then on, circulating waters concentrated portions of the iron-bearing lenses, producing local orebodies of iron ore. In recent geologic times, the ice sheet covered the country and on its retreat left a mantle of moraine of varying thickness, a light veneer in some portions, but heavy in others.

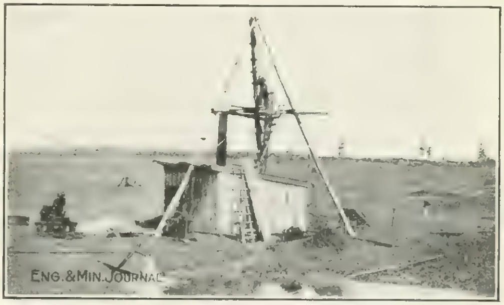
Previous mining and exploration work on the Menominee range had proved conclusively that the lenses of iron-bearing formation are contained in the Upper Huronian slates. However, all the slate does not necessarily contain the iron-bearing formation, nor is all iron-bearing formation merchantable ore. The problem is: Given the slates, to find first the iron-bearing formation, and then that concentrated portion of it which constitutes merchantable ore.

Preliminary Investigation

In 1909, certain interests controlling the fee of over 00,000 acres of cut-over lands in Iron, Dickinson, Baraga and Marquette Counties in Michigan, conferred with a well known geologist, thoroughly conversant with Lake Superior geology regarding the advisability and methods of exploring these lands for iron ore, and arrangements were subsequently completed whereby a thorough geological examination of the lands was made.

The geological field work consisted of examining each 40-acre tract for geological data and making a magnetic survey. Any old trenches, test pits, shafts, adits or other abandoned mining operations were carefully mapped, sampled and recorded, and information was obtained from all possible sources that had any bearing on the lands in question. Old drill-hole data were examined, and this whole mass of information was arranged, classified and embodied in the maps that were made of the various parcels. Whenever warranted, the magnetic work was extended, and the scale of the map increased to show as close readings as seemed desirable.

The area now containing the Balkan and Judson mines was finally selected for drilling because of the proximity of three old abandoned mines. The evidence procured from these, the Alpha, Delphic and Mastodon, while meager, was conclusive on these points: Some ore had been found in them, though of questionable grade; the area was in the Upper Huronian slates. The early explorations at the Alpha had consisted of two drill holes and two shafts, 50 and 110 ft. deep. Here ore of various grades up to 60% iron had been found. It was difficult to mine because it occurred in small seams, but it showed conclusively the presence of iron formation. The Delphic had been opened in 1880 and closed in 1887, not a long life as Michigan iron mines go these days. From it had been shipped 30,730 tons of nonbessemer ore, running from 55 to 60% iron, on which a royalty of 50c. per ton had been paid. The orebody, however, was reported to have pinched out at a rather shallow depth. The last drilling had been done by other interests in 1907 and no continuation of the orebody was found.



Drilling for the Judson Orebody

Preliminary Drilling

Having selected the land to be drilled, the next thing was to spot the first hole. In work of this sort, the selection of a site for the first hole is largely a matter of judgment; in most cases it is scarcely more than a feeler. A glance at the map will show the lands in question and their position relative to the three old mines. Hole No. 101 was finally selected as the first hole, because its site was on a strike through the old Alpha pit, and the intention was to continue drilling toward the southeast until the appropriation was exhausted, unless definitely positive or negative results were obtained sooner.

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*Chicago editor, "Engineering and Mining Journal."

Ore was first found in hole No. 126, and 25 holes had been drilled between this and the first one. No attention should be paid to the series of holes numbered 600, as these were drilled later in connection with the mining operation and had no connection with the exploratory work. By the time hole No. 126 had been reached, the drilling had cost about $40,000.

A Fortunate Discovery

The crucial point of the campaign occurred just before hole No. 126 was started. The first appropriation had been almost exhausted and up to this point no merchantable ore had been found, although iron formation over 600 ft. wide and running up to 40% iron had been encountered. Here a discovery was made that turned into success what would probably otherwise have been failure. The supposition had always been that the direction of bedding was approximately northwest and southeast. This fact, supposedly determined by the early mining operators, apparently had been passed along by successive geologists. This theory had been followed in the new drilling, in the expectation of connecting the Alpha and Mastodon workings. It was finally proved that previous explorers had confused bedding and jointing and by following the bedding around a fold, the correct direction of the bedding was found to be northeast and southwest. Based on this new theory, hole No. 126 was spotted and the result was the finding of the ore.

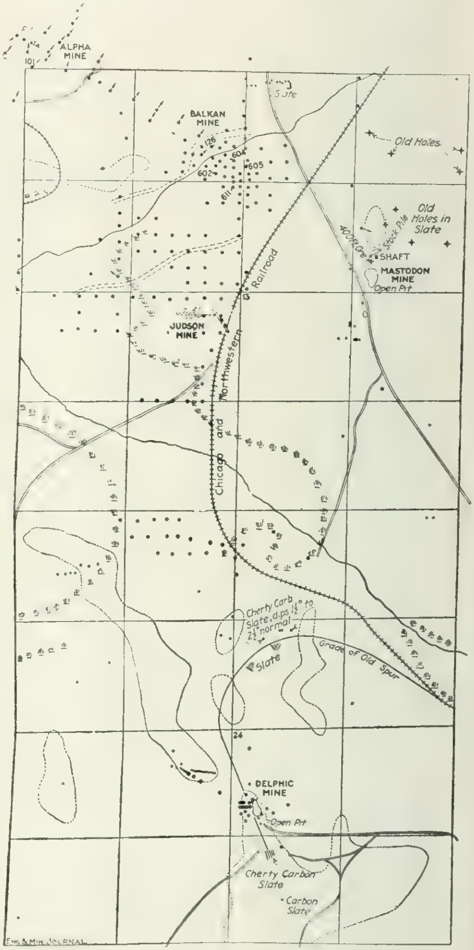
Delimiting Orebody with Vertical Holes

After ore had first been found in hole No. 126, the problem changed to that of delimiting the orebody and estimating its contents. In this work, as in that of actually finding the ore, although perhaps to a less extent, the position of the various holes depends greatly upon results found in preceding holes. And in this connection, it should be remembered that the general procedure on the Mesabi range is to drill all holes more or less according to a predetermined plan, usually consisting of staking out a 40-acre tract in squares and drilling vertical holes at the corners of these squares. This procedure is satisfactory on the Mesabi, because of the vast amount of such work that has been done there, the general proximity of opened properties from which valuable data may be secured, and the fact that the orebodies usually extend over a 40-acre tract in a flat bed of varying thickness, below an overburden that may be anywhere from 1 to 100 ft. thick. Most of the exploratory work on the Mesabi also can be done with churn drills.

The Michigan orebodies are different. The ore itself is harder, the deposits assume the form of lenses and tabular bodies dipping at various angles; and they are generally surrounded by harder rocks. These conditions necessitate the extensive use of the diamond drill. In the case of the Judson orebody, however, the first few holes and the surface topography indicated an orebody of such dimensions that, in proportion to the tract under exploration, it was thought Mesabi conditions would be approximated. At this point, furthermore, the commercial aspect of the work assumed great importance. And since, from a business standpoint, the prime object was to outline an orebody, vertical holes were decided on; these were placed at the corners of 200-ft. squares. Eventually the ore was outlined and the necessary information obtained for estimating its size.

Estimating the Ore

In estimating orebodies on the Lake Superior ranges, practice has developed two methods: (1) Using cross-sections through the holes; and (2) using surface area and average depth. Both methods are in general use on the Mesabi, but the second method is somewhat new practice for the Michigan ranges, due probably to the dissimilarity of the orebodies. In this case both methods were used.



Map of the Judson Find and Vicinity

It should be remembered that there is a sharp distinction between estimating the tonnage of merchantable ore in a given tract, and computing the valuation of a property based on the tonnages of the various grades of ore it contains. The former is a rather simple arithmetical problem, while into the latter there enter many factors, such as mining cost, royalties, taxes, prevailing ore prices, etc. The valuation of such an orebody is too large a subject to attempt consideration here.

SUMMARY OF WORK DONE

The total amount of drilling on the Judson Mining Co.'s property was 52,338 ft. in 117 holes. It was done with Longyear Nos. 1 and 2 hydraulic diamond drills, which bore what the company calls an "E" hole, $1\frac{9}{16}$ in. in diameter, and which produce a $\frac{15}{16}$-in. core. The No. 1 drill has a capacity of 1000 ft. and No. 2 drill, 2000 ft. In carrying on this work, which extended over three years, the drills in use varied in number from 2 to 10; the maximum number of men employed was 50 to 60.

A sludge box was also developed in connection with this drilling, which was described in the JOURNAL, Mar. 28, 1914, p. 660. On this particular work, the holes were surveyed only by the hydrofluoric-acid method. The magnetic-needle method was not used because the local zones of attraction, due to the magnetic slate in the vicinity, would have rendered the results useless. The majority of holes, furthermore, were vertical and not over 1000 ft. deep.

SCIENTIFIC EXPLORATION

The casual operator will say this was luck. So it was—to the extent that luck in varying degree enters into all exploratory and mining operations. But there was much more to it than luck. The entire undertaking was based on scientific principles, and the campaign was carried out carefully along that line. And scientific exploration may be described as the bringing to the work in hand all available information on the geology of the land involved and on previous mining operations or explorations in the vicinity, together with the expenditure of well directed thought by trained men and of some money for carefully conducted drilling, before actual opening work is performed, in the effort to avoid the expenditure of larger sums in wasteful and useless ground-breaking. It is an effort to make trained intelligence do what it would cost more to do with a drill, and to make the drill do what it would cost more to do with shafts, drifts and crosscuts. Repeated successes are bringing it increased popularity.

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Income-Tax Ruling: Gross Value at the Mine

The following ruling has been handed down by Commissioner Osborne in regard to mining-company income, according to the *Commercial and Financial Chronicle*:

> "Gross value at the mine," as contemplated in that provision of the Federal income tax law which authorizes mining companies to deduct from gross income an amount to take care of depletion of natural deposits, is held to mean the gross price at which the product could be sold at the mine; that is, its actual bona fide market value.
>
> The term "gross" as applied to "value" contemplates the aggregate value of the product at the mine determined upon the basis of the market conditions at the time and place, and is best defined as the price at which the product sells or would sell when delivered at the mouth of the mine in a marketable condition. Five per cent. of the value thus determined will constitute the maximum amount which a mining corporation may deduct under the Federal income tax law from gross income on account of depletion of natural deposits. This does not contemplate that the full 5% of the gross value will be allowed if the aggregate amount calculated at a less rate will equal the cost in place of such deposits or secure to the corporation the return of its capital when the deposits have been exhausted.

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Influence of the European War on the Mining Industry of Dutch Guiana

By F. B. PERCIVAL*

The European war is having a disastrous effect on the mining industry of Dutch Guiana, especially among the classes which depend entirely on the gold they mine to keep themselves and their families together. The influence of the conflict is so strongly felt in the colony that misery and starvation are the order of the day.

The mining industry kept about 7000 people employed, and through them quite a respectable sum of money was always in circulation. It is hard to say how long the cessation of business will last, but the government of the colony has adopted measures whereby the suffering may be alleviated, at least for a time.

The majority of miners operate on their own account. They work at what is locally called "pork knocking." The proprietors of concessions lease to these people, for three months, a piece of land for mining purposes. They are obliged to sign a contract of agreement before the chief of police, agreeing to pay to the concessionaire 15% of all gold mined on the concession, and to deliver all gold to the owner of the land, who only has the legal right to sell it, deduct the 15% and return the remainder.

To obtain a contract is easy work, but the miner must have money or credit to enable him to purchase his outfit. In only about one out of a hundred cases the man has capital. The rest are therefore obliged to seek credit from a merchant who will supply the outfit and wait for three or more months before the miner returns to town and pays the bill. However, the "pork knocker" is an honest sort, works hard, and in the majority of cases not only pays his bills, but clears a respectable sum upon his return to town. Since the war broke out, however, the United States exporters demand cash on delivery of all foodstuffs coming to the merchants of Dutch Guiana. Formerly the merchants had time to pay their obligations, and therefore could very well extend the same consideration to their miner customers. Now there is nothing doing and the miner, not having any savings to fall back upon, is beggared.

At the present time there are only four mining companies operating in the colony. Of these, two are run by United States capital, the others by English. They have their own permanent employees and have no openings for the unemployed "pork knockers." Work along other lines is scarce. The balata industry is also a victim of the war, and the plantations for the greater part have closed down.

Last year promised to be a record one for the gold industry. At the outbreak of hostilities the production up to July 31 stood at 2,744,664 grams, and most of the ground gave promise of rich returns, weather conditions being normal. The new mining regulations, which are ideal, passed their final reading in the local parliament in July and are now law. The mining industry promised well and but for the war would have become the principal industry of the colony.

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*Paramaribo, Dutch Guiana

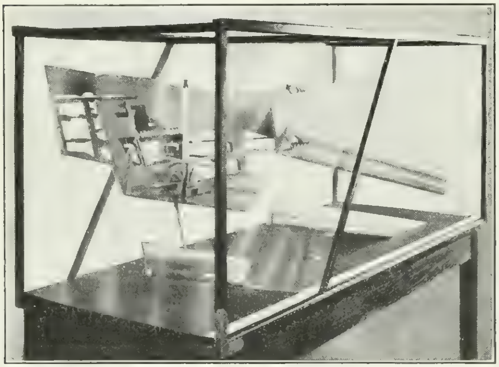
Details of Practical Mining

The Mt. Hope Mine Model

By J. C. Stockland*

At Mount Hope, N. J., the Empire Steel & Iron Co., of Catasauqua, Penn., is operating a magnetite iron mine. The longitudinal shrinkage method of stoping has been adopted and the entire plant modernized by the installation of electrical equipment.

The formation at the Mt. Hope mine consists of a series of parallel, steeply dipping oreshoots cut by a fault having approximately 400 ft. of vertical throw. The mine workings lie on both sides of the fault; the oreshoots are fairly regular, continuous, and opened up to such an extent as to permit of the construction of a model believed to have features of clearness, simplicity and ease of manipulation not ordinarily realized in the conventional construction of mine models.



Model of Mt. Hope Mine

The dimensions of the ground to be included in the model having been determined from the mine plans and sections, allowance was made for future probable advance and a scale of 50 ft. to the inch adopted as the most convenient. The longitudinal limits of the model were represented by two rectangular plates of selected double-thick glass mounted vertically at the extremities of a table. The fault plane was represented by a similar plate of glass cut to the average inclination and strike of the fault. A light wooden framework was then built around the whole and well reinforced by heavy brass plates to make the structure self-supporting and at the same time leave the spaces between the glass plates free for the work to follow.

The cross-section of any given oreshoot is approximately constant throughout its known length, so that for the purposes of the model an average section was taken and the shoot assumed to be uniform. As a matter of fact, slight variations in thickness are common, but they would be difficult to represent. These average cross-sections plotted to scale were then transferred to the ends of soft, white-pine boards built up of strips 1½ in. wide by 6 in. long, glued together edge to edge with the grain of the wood reversed in adjoining strips to minimize warping. The whole length of the board was then dressed down to the uniform section of the shoot, when it was ready to be mounted between the glass plates. This was done by taking sections across the whole formation at the two extremities of the model and at the fault plane, transferring these sections to the respective glass plates, and fitting the boards in position between the corresponding sections, using bits of glass and transparent adhesive cement to secure them in place. Care was taken to so arrange the bits of glass as to admit of the ready removal of the boards for subsequent addition or alteration.

The various workings in the ore were then outlined on the boards, the mined-out portions cut out with a scroll saw and the remainder painted a color as near to the natural shade of the ore as possible. Where the shoots intersect the surface they were cut away to conform to the contour of the land, and the outcrop lines painted white, while the walls of all drifts and raises in the ore were painted a bright yellow. Crosscuts, shafts and other workings in rock were fashioned to scale out of wood and fixed in place with dowels and painted yellow to correspond to the passages in the ore. Finally, typewritten labels giving the name and code numbers of the workings were pasted on in their proper places and fine copper wires fixed in position to represent the more important diamond-drill holes.

As will be seen in the photograph, only the actual orebodies are represented in the model, the intervening country rock being left to the imagination. This facilitates the work of keeping the model up to date from month to month, and by coloring in the portions representing the monthly advance or extraction, estimates and comparisons can be quickly and easily made. A model of this kind is also useful in that it enables those not familiar with mining to readily form an idea of the location of the mine and workings and the geologic relation of the orebodies to one another.

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Concrete-Block Mine Houses*

The Witherbee-Sherman Co. at Mineville, N. Y., houses its employees in company dwellings. During the past eight years no wooden houses have been built. Instead, concrete blocks made from the tailings of the concentrating plants have been used. The interior floors and partitions are wood and the roofs of slate. The concrete blocks are 8x10x20 in.; each occupies 0.92 cu.ft. of wall space. It costs 15c. to make a block, of one part cement and six parts tailings, this cost including sprinkling and piling for seasoning; 10c. additional covers the expense of hauling, handling and laying in the wall.

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*Mining engineer, Empire Steel & Iron Co., Catasauqua, Penn.

*Excerpt from an article by S. LeFevre, "Bulletin of the American Institute of Mining Engineers," February, 1915.

making the blocks cost 25c. each in the wall. No charge is made for the tailings, and the blocks are made at the foot of the tailings pile. They are mixed and tamped by hand and made in a Century block machine. The 10-in. blocks have a 4-in. air space in the middle. On one of the first houses the experiment was tried of plastering the inside wall directly on the concrete blocks, but this was a failure, as water ran down the walls in streams; not due to moisture coming through the concrete-block wall, but to the condensation of moisture from the heated air inside coming into contact with the cold surface of the block wall. To remedy this trouble 1-in. strips were nailed to the blocks, to which wooden laths were nailed and the wall was replastered.

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Reinforced-Concrete Shaft Sets

By L. D. Davenport*

The Oliver Iron Mining Co. has erected a concrete plant at Hibbing, Minn., for the purpose of making building blocks, shaft sets, slabs and similar products for use at its new mines on the Mesabi range.

The plant is near the company's office and adjacent to the carpenter, blacksmith and machine shops. The structure is a frame building covered with corrugated sheet iron. It is 115 ft. long over all and consists of a main plant, 24x57 ft., four stories high, and a one-story shed 16x91 ft., divided into drying and steam rooms.

The sand and rock for the concrete was brought in stripping cars from one of the openpit mines and dumped close to the plant. This material as needed is trammed in a small car over a low trestle to the crusher.

From the crusher a belt conveyor carries the crushed material to a trommel at the top of the plant, where it is sized and deposited in three bins as shown in the flow sheet. A 30-hp., 200-volt, Westinghouse motor runs the crusher, the trommel and the conveyor belt.

The cement is brought to the plant in railroad cars over a trestle at the elevation of the charging floor and is unloaded and stored under the bins conveniently near the charging car. Below the bins is a track carrying a wedge-shaped charging car which is divided into compartments for sand, rock and cement. The charging car dumps directly into a No. 1 Smith mixer, water being added from a tap close by. This charging car is also used to tram the oversize from the screens to a chute leading back to the crusher.

From the mixer the concrete is taken to one of three chutes by a transfer car of the same pattern as the charging car except that it is not divided into compartments. One of the chutes feeds the Denver block machine and the other two supply the various forms placed below them. All blocks are cured in the steam room and the shaft sets are either sent to the steam room or are dried in the main shed, which is steam heated. The finished product is taken from the trucks and piled or loaded on freight cars by means of an air lift of about five tons' capacity, running on an overhead crane.

A 1 : 4 mixture of cement and sand is used in the blocks and a 1 : 2 : 4 or a 1 : 2 : 3 in the shaft sets.

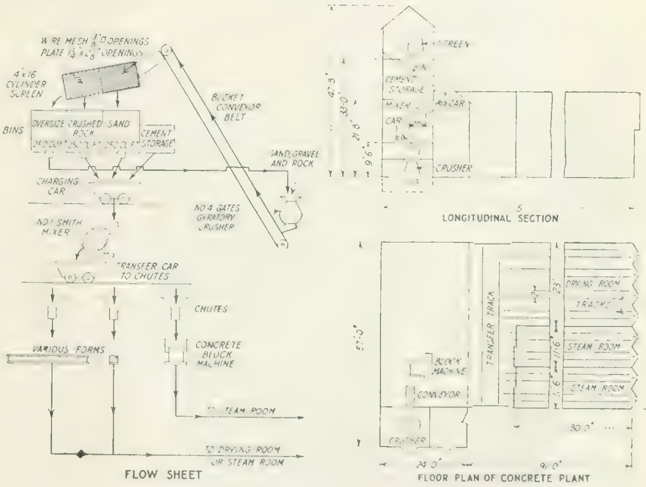
Three complete shaft sets, i.e., six wall plates, six end plates, six dividers, 24 studdles and 156 slabs for lagging, and from five hundred to seven hundred 9x24-in. building blocks constitute an average day's output under favorable conditions.

Shaft Sets Cast in Forms

The concrete shaft sets are cast in forms built up of steel plates and angles with all holes cored tapering about ⅛ in. larger than the bolts to be used. A 1 : 2 : 4 mixture was used at first, but this was changed to a 1 : 2 : 3 in order to obtain a smoother product. The concrete is made wet and puddled in the forms rather than rammed.

The wall plates and end plates are 12x12 in., and the dividers are 10x12 in. The corner studdles are 10x10 in. and the center studdles are 8x10 in. The studdles being 4 ft. long, the sets are spaced on 5-ft. centers.

The general style of framing is the same as for the standard wood-lined shaft 6x18 ft. inside, with the exception of a few details as follows: A 2x2-in. cleat spiked in the center of the outside of the wooden sets makes a bearing for the lagging, while the upper and lower outside edges of the concrete sets are rabbeted 1½x3 in. to hold the concrete lining slabs.



Method of Handling Material at Manufacturing Plant

The shaft is hung from four steel crossbearers which in turn rest on two reinforced-concrete longitudinal bearers about 2x3 ft. in cross-section and 31 ft. long. These were cast in place just below the surface of the ground from the outside of the shaft. The crossbearers at each end of the shaft are each made up of two 15-in., 33-lb. channels 19 ft. long. Those at the dividers are single 15 in., 12-lb. I-beams of the same length. The shaft collar including all the shaft above the first bearers was cast in one piece with 12-in. outside walls and 10-in. dividers.

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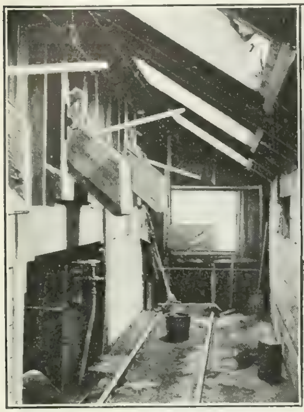
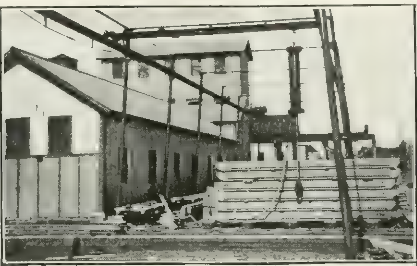
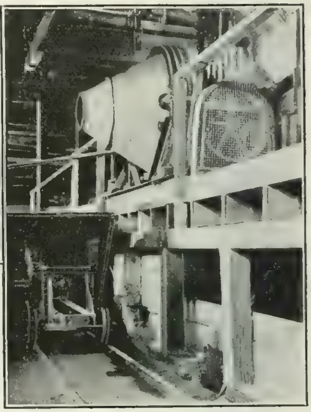
*Assistant chief engineer, Oliver Iron Mining Co., Hibbing district, Minn.

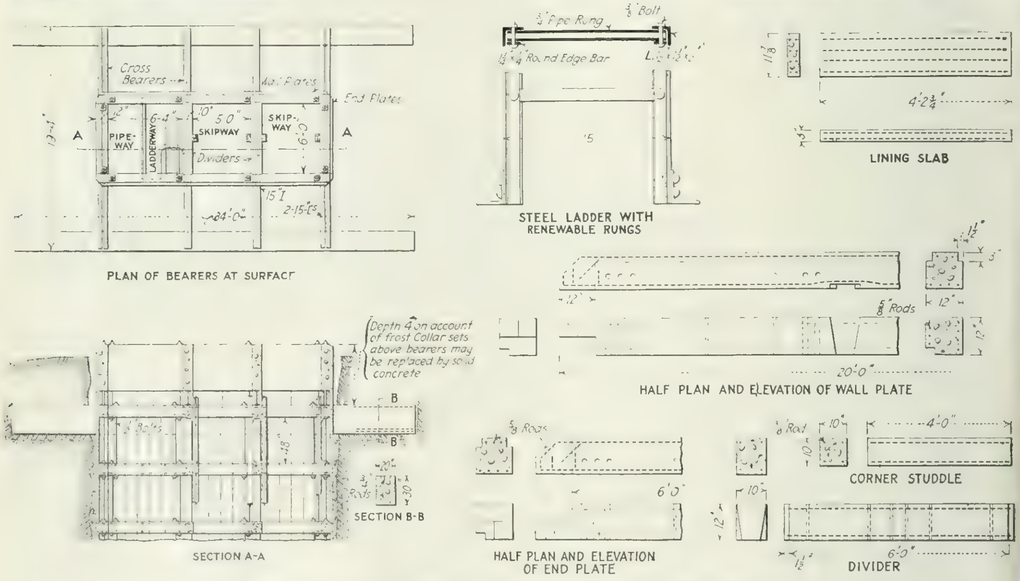






The Manufacturing Plant

On left, the charging floor. Above, outside of plant showing crane, air lift and wall plates ready for shipment. On right, Smith mixer and the distributing car.



Shaft Arrangement and Details of Shaft Members

The placing of the first two or three sets directly below the bearers presented a slightly different problem from the ordinary timbered shaft on account of the solid concrete collar section above the bearers. In a timbered shaft the dividers are left out of the collar set until the next two or three sets below have been hung. With a 6- or 8-ft. monolithic collar section including the dividers, there is not room to lower and swing into place the 20-ft. wall plates for the next two or three sets except by sinking 18 or 20 ft. without timber. This difficulty was overcome by driving a 2x3-ft. flat incline from the surface to a point just under the crossbearer at one end of the shaft. The concrete timbers were slid down this incline and hung in place until the shaft was sufficiently deep to allow lowering in the ordinary manner.

The skip guides are of wood and are fastened to the end pieces with $3\frac{1}{2}x\frac{7}{16}x7$-in. angles and to the dividers by $7\frac{1}{2}$-in. lengths of 10-in., 25-lb. channels. All ladderway sollars are $\frac{5}{16}$-in. hob steel plates with steel toe-boards of $2x2x\frac{3}{8}$-in. angles around the ladder openings and of $5x3\frac{1}{2}x\frac{3}{8}$-in. angles on the pipeway side.

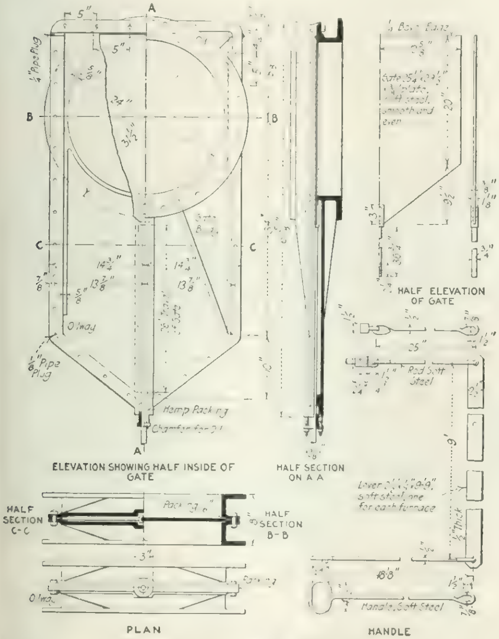
The ladders are made of $1\frac{1}{2}x1\frac{1}{2}x\frac{1}{2}$-in. angles with $\frac{3}{4}$-in. pipe rungs spaced 10-in. centers. Two pieces of $1\frac{1}{4}x1\frac{1}{4}$-in. flat iron cover the ends of the rungs and are held by $\frac{3}{8}$-in. bolts through the rungs and angles. The ladders are about 24 ft. long and extend 4 ft. through the sollars to the under sides of the sets above, making excellent hand holds. The ladderway is separated from the skipway with a No. 26A galvanized reinforcement mesh.

Details of Milling and Smelting

A 24-In. Gate Valve for Blast Furnaces

By Percy E. Barbour*

The accompanying sketch shows details of construction of the 24-in. gate valves used in the blast pipes at the furnaces of the Tennessee Copper Co. The levers, hangers and operating handles are also shown. These valves are easily operated to cut the blast instantly and have stood the test of time as to desirability of design.



Blast-Furnace Gate Valve

Valve operates normally in upright position, but is placed as shown for convenience in lettering

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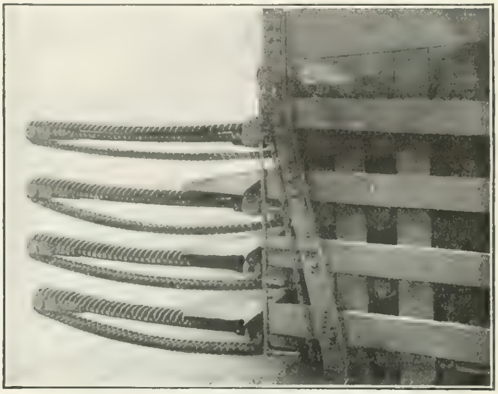
Turning a Camshaft Pulley

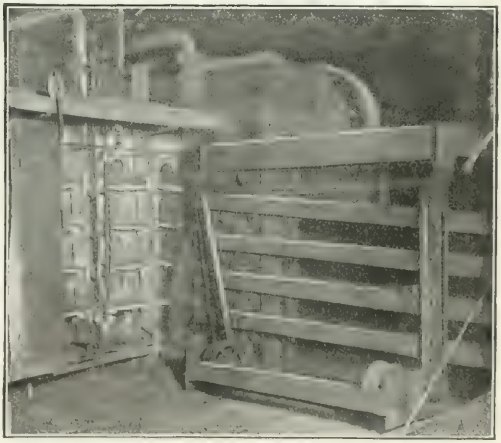
To turn down or crown a camshaft pulley, the regular driving belt is replaced by a temporary one 3 in. wide. The tool holder is removed from a lathe and bolted to the floor in front of the wheel. The face can then be turned down or crowned, the steel-cutting tool taking care of any nails that may appear on the surface of the pulley. The narrow belt can be shifted from place to place as the face of the pulley is turned, and thus kept out of the way. In this manner camshaft pulleys can be refaced, or crowned, without any great trouble, and without removing them from the shaft.

Simmonds' Retort-Discharging Machine*

The Simmonds' retort-discharging machine seems to mark an important step in zinc metallurgy. As can be seen from the almost self-explanatory illustrations, the apparatus consists of a large number of endless chains carrying scrapers, which enter the mouths of a number of zinc retorts simultaneously and scrape out the residue. At the same time the cleaning elements are advanced into the retorts, until the back of the retort is



Belt Scrapers Extended



Emptying a String of Retorts

The stream of discharged ore can be seen just to the left of the machine reached. This apparatus is mounted on a car running along a track in front of the zinc furnace whereby the scrapers can be adjusted to clean out any given vertical row of retorts.

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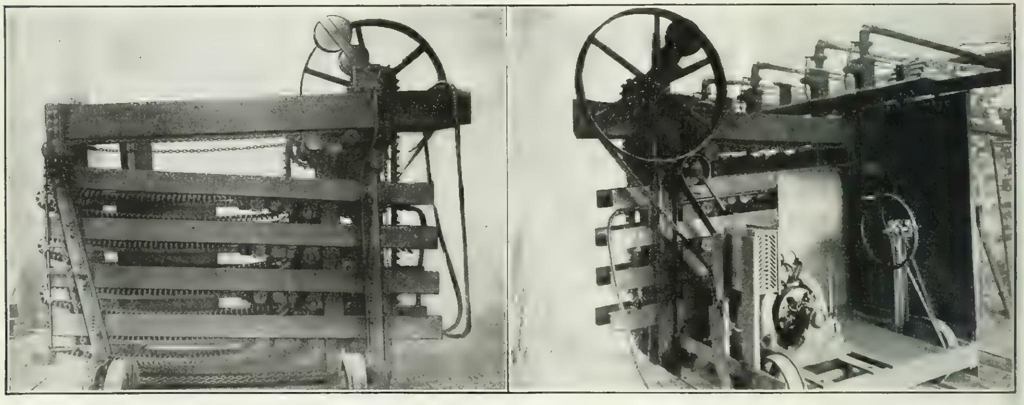
*Mining engineer, 887 Middle St., Bath, Me.

*From data furnished by the Simmonds Engineering Co. of Iola, Kan.

The drive for the scrapers and that advancing or retracting the train of scrapers as a whole is entirely independent. Motion is communicated to them by one of the sprockets over which the chain-belt scraper train runs. A hand controlling device is ordinarily supplied for reversing the dirction of this feed, but it can also be done automatically.

The machine is placed in position before a string, or vertical row, of retorts, and put in motion. The scrapers, on entering the mouths of the retorts, have a freedom of motion which allows them an angular swing upward, to climb over the heap of residue, then as the residue is scraped out, they follow the material. A stop screw, however, prevents angular motion below a certain point, so that there is no danger of going through the bottom of the retort. The retorts are then emptied, the scraper trains retracted and the entire machine run along on its track to the next string of retorts, which are treated similarly. Movement along the rails is either by means of a motor, or by a handwheel, the former used for the main motion, the latter for small adjustments.



General Views of the Simmonds' Retort Discharging Machine

The average time of the cycle of operations is 45 sec.: 5 sec. to move the plungers to the mouths of the retort; 25 sec. to discharge them; 10 sec. to withdraw the plungers; and 5 sec. more to move the entire carriage to the next string. This speed can be maintained during the entire cleaning of a furnace, and the apparatus is said to be able to handle a very slaggy residue.

The scrapers and links are cast-steel, one-piece, and are said to wear well. The chains are sprayed with water, which effectually protects them. To prevent the material scraped from the retorts falling on the scraping mechanism working on retorts lower down, there is a chute provided for each plunger which deflects the falling residue. These chutes are pressed forward by springs against the retort during the cleaning operation. On the withdrawal of the scraper mechanism from the retort these chutes are caught by hooks and drawn back, to allow the apparatus to be moved ahead.

Ash Troubles in Dust Firing

For many years the ash bugaboo kept copper metallurgists from trying coal-dust firing for their reverberatory matting furnaces. It has been the general impression that this was the reason that coal-dust firing was not continued at Cananea. When coal-dust firing was tried at Coppercliff, the Canadian Copper Co.'s metallurgist, David H. Brown, decided to use straightaway flues and to place the skimming door at the side, instead of at the end of the furnace, largely to be prepared for anticipated ash troubles. When working on cold charges, some difficulty was experienced with the ash clogging the flue at the throat of the furnace, but this difficulty disappeared when hot calcines were used and the furnace was smelting rapidly. Now the ash trouble is negligible.

It is interesting to have a corroboration of this from Anaconda. Louis V. Bender states[1] that the ash gives little trouble. The flue connection between furnace and boiler is cleaned once a day, requiring the labor of two men from four to six hours each day. It was found easier to keep the flue clean when using coal containing 22% ash than when using coal containing 9% ash; this difference was due to the physical characteristics of the ash; in the first case the ash was light and fluffy, while in the second case it tended to sinter. Approximately one-half of the ash of the coal floats on top of, or is absorbed by, the slag and does not noticeably interfere with the work of the furnace. Little of the ash goes into the boiler and the boiler tubes are cleaned no oftener than are those connected with the grate-fired furnaces. In September, 1914, when 1984.77 tons of coal dust were burned in smelting 14,272 tons of charge, there was taken from the flue 85.54 tons of ash and flue dust. The Diamondville coal used during this month contains about 8% ash.

It is worthy of note that no difficulty was experienced in using a coal giving 20% of ash. In fact, Lochray coal having 20.9% of ash was tried and actually gave less trouble than Diamondville coal, as the former ash was light and fluffy and showed no tendency to sinter. The Lochray coal will be used at Great Falls when the reverberatories there are remodeled for coal-dust firing.

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[1] "Bull. of A. I. M. E.," Jan., 1915.

Spelter Statistics for 1914

By W. R. Ingalls

SYNOPSIS—Revised statistics of spelter production in the United States in 1914 and four years previous. Statistics of ore supply by states. Analyses of figures according to the classes of smelting plants, by periods of the year, etc.

Revised and complete statistics of the zinc industry in 1914 are given in this article, reports having been received from all of the ore smelters. Reports from the dross and scrap smelters are only partially complete, however, and the production of their class of spelter is estimated on the basis of partial returns, but reports were missing only from a few of the smaller concerns. Certain smelters who treat both ore and dross are included with the ore smelters.

PRODUCTION OF SPELTER

(In tons of 2000 lb.)

By Ore Smelters

States	1910	1911	1912	1913	1914
Colorado ...	6,564	7,477	8,860	8,637	8,152
Illinois .	79,570	88,681	94,902	111,551	130,587
Missouri-Kansas. . .	112,182	106,173	111,761	85,157	53,424
Oklahoma...	34,760	46,333	76,837	83,230	92,467
East	43,989	47,172	56,278	69,687	77,731
Totals	277,065	295,836	348,638	358,262	362,361

By Dross and Scrap Smelters

1910	1911	1912	1913	1914
11,350	(a) 13,500	(a) 15,000	(a) 20,500	(a) 18,000

Total Production of Spelter

	1910	1911	1912	1913	1914
Ore smelters.	277,065	295,836	348,638	358,262	362,361
Dross smelters (a).	11,350	13,500	15,000	20,500	18,000
Totals . .	288,415	309,336	363,638	378,762	380,361

(a) Estimated. It is difficult to obtain reports from all of these smelters. The large increase in production from 1912 to 1913, as here reported, was due in part to a more complete statistical accounting.

SPELTER PRODUCTION IN 1913 AND 1914 BY QUARTERS

(Reports of Ore Smelters Only)

(In tons of 2000 lb.)

District	I	II	III	IV
1913				
Illinois .	27,924	28,523	26,118	28,986
Kansas-Missouri.	22,006	23,820	19,204	20,127
Oklahoma	21,430	21,840	18,502	21,458
Others (a)	20,722	20,153	19,238	18,211
Totals	92,082	94,336	83,062	88,782
1914				
Illinois.	31,005	32,482	32,512	34,588
Kansas-Missouri.	13,939	14,659	13,193	11,633
Oklahoma .	22,563	22,960	22,945	23,999
Others (a).	20,700	20,703	21,819	22,661
Totals	88,207	90,804	90,469	92,881

(a) With the exception of one plant in Colorado these are all Eastern works.

Production—The total production of spelter by ore smelters in 1914 was 362,361 tons, of which 8380 tons was derived from galvanizers' dross, skimmings, scrap, etc., and the remainder from ore. The production from dross, skimmings, scrap, etc., was 8764 tons in 1913; 7447 in 1912; 9030 in 1911; and 7793 in 1910. These data do not include the production by concerns which treat dross and scrap only, whose output amounts to about 20,000 tons per annum.

Ore Smelted—The smelters who treated ore reported that in 1914 they smelted 628,886 tons of blende and 226,549 tons of calamine. It should not be attempted to draw too fine deductions from these figures respecting the average yield of the ore smelted, some smelters having apparently reported "ore received" as "ore smelted." In those cases where a discrimination was made the figures showed differences between the quantities of "ore received" and "ore smelted," reflecting increases and decreases in the ore stocks at smelting works. The total report of "ore smelted" was 855,435 tons, and of "ore received" 872,767 tons. This was partly due to the stocking of the new works at Langeloth and Tiltonville, but even without that there was a surplus of ore receipts, which was the more noteworthy in view of the suspension of Butte & Superior shipments for two months.

The ore statistics show accurately, however, the relative proportion of blende and calamine smelted. With the exception of the Palmerton plant of the New Jersey Zinc Co., which smelts chiefly the willemite concentrate of Franklin Furnace, N. J., the bulk of the calamine ore was smelted by works in the gas fields of Kansas and Oklahoma. One large plant was operated exclusively with calamine. The smelters east of the Mississippi River make sulphuric acid, with the exception of two small concerns, and naturally use blende, but some of them take relatively trifling quantities of calamine.

RECEIPTS OF ZINC ORE

(In tons of 2000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the manufacturers of zinc oxide.)

State	1910 (a)	1911 (a)	1912 (a)	1913	1914
Arizona.	7,568	6,395	11,937	9,347	6,357
Arkansas.	190	860	1,567	1,500	1,737
California.	(d)	3,754	6,639	6,796	8,827
Colorado.	77,065	158,528	212,423	220,166	164,739
Idaho.	10,248	9,667	19,482	31,835	57,001
Kentucky.	179	575	947	441	434
Missouri-Kansas.	289,913	268,500	289,177	280,000	247,723
Montana.	33,514	56,593	34,034	91,257	125,663
Nevada .	4,915	5,666	20,654	22,313	20,147
New Mexico	15,959	10,184	25,889	14,593	15,369
Oklahoma . .	1,640	8,750	4,325	23,500	26,247
Tennessee.	2,775	3,439	6,635	8,297	18,708
Utah.	27,318	19,933	24,539	27,073	20,322
Wisconsin (b).	51,383	71,565	90,762	89,662	74,311
Others.	46,905	44,896	56,099	57,241	57,936
Totals	569,572	669,305	805,109	884,021	845,821
Mexico	29,198	28,596	29,436	19,965	16,114
Canada.	11,795	2,356	9,707	6,012	10,532
Grand totals (c)	610,565	700,257	844,252	(c)909,998	872,767

(a) Smelters' receipts; reports missing from three small smelters. (b) Including Illinois and Iowa. (c) In addition to the ore reported from Canada and Mexico, zinc smelters received a few thousand tons from Europe and Eastern Siberia in 1913. (d) Included in "Others."

With the movement of the zinc-smelting industry to the eastward, the separation of blende roasting and zinc distillation is becoming more marked, as it has been for a long time in Europe. It is often good business to roast the blende at a good center for the distribution of sulphuric acid and reship the roasted ore to a good point for zinc distillation. The Western Chemical Co. has for a long time roasted ores at Denver, Colo., and sold the roasted ore to other smelters. The National Zinc Co. has no roasting furnaces at its smeltery at Springfield, Ill., which gets its ore from the roasting plant of the company at Argentine, Kan. Similarly the Grasselli Chemical Co. roasts at Canton, Cincinnati, Newcastle, Cleveland and Grasselli the ore that is needed by its smelteries at Clarksburg and Meadowbrook. The New Jersey Zinc Co. has a roasting plant at Tiltonville, Ohio, which supplies other smelters.

The table showing ore receipts gives the totals of ore reported as taken in by the smelters. This is not equivalent to the ore production of the several states, inasmuch as ore that went to the zinc-oxide plants at Coffeyville, Kan., Mineral Point, Wis., and Palmerton, Penn., is not included. For this reason the ore received by the smelters of spelter was considerably less than the outputs of Colorado, New Mexico, Wisconsin and New Jersey (included in "other states"). With those exceptions, however, the figures in the table probably correspond closely with the productions of the several states.

The ore statistics have some noteworthy features. Several states exhibit important increases in 1914 notwithstanding the low average price for spelter (5.06c., St. Louis, compared with 5.50c. in 1913 and 6.80c. in 1912). In Montana the Butte & Superior company made an increased output, although it suspended production from Oct. 18 to Dec. 19. Timber Butte, a new and important producer, began operations June 1. In the Coeur d'Alene district of Idaho the Interstate-Callahan mine became a large producer. The increased output of Tennessee was due especially to the mine of the American Zinc, Lead & Smelting Co. in the Holston River district. The Yellow Pine district of Nevada, which produces calamine ore, fell off a little in output.

Leadville, the chief zinc-producing district of Colorado, made about the same production in 1914 as in 1913. The Leadville *Herald-Democrat* gives these figures: 52,689 tons of blende and 157,286 tons of calamine in 1913; 204,427 tons of blende and calamine in 1914. These figures show only a slight decrease from 1913 to 1914, which does not agree with the Colorado ore receipts reported by the smelters. The latter show a large decrease.

The zinc-ore production of the Joplin district declined on account of the low range of prices, at which many of the "sheet-ground" mines could no longer be worked profitably and were therefore abandoned. Considering the conditions it is perhaps surprising that the Joplin production did not show a larger decrease.

The outputs of both Wisconsin and Oklahoma increased, according to local statisticians, but smelters' receipts showed a decrease in Wisconsin and only a slight increase in Oklahoma. It is possible that the discrepancy in the case of Wisconsin would be explained by returns from the oxide works. In the case of Oklahoma, some of the ore originating there was doubtless reported by the smelters as coming from the Joplin district and was entered with the figures from Missouri and Kansas. In Wisconsin 46 mills and five magnetic-separating plants were in operation at various times during the year. In Oklahoma the only active mining district was Miami. Improvements in the methods of ore concentration there led to the production of blende concentrate assaying 60% Zn and as low as 2% Fe.

In New Mexico the Magdalena district was the chief producer of zinc ore, and in Utah the major part came from the mines at Park City.

The production of floated blende concentrate in 1914 was nearly 100,000 tons. In this connection let it be noted that the mills employing the flotation process produce a large proportion of jig and table concentrate as well as the floated froth. The production of floated concentrate is without doubt destined to increase materially during the next year or two.

Bonded Spelter—In 1914 there was produced 5630 tons of spelter in bond. In 1913 the production in this way was 5901 tons; in 1912 it was 10,879 tons; in 1911 it was 9598 tons; and in 1910 it was 3398 tons. The exports of bonded spelter are stated in an accompanying table.

Spelter Production According to Fuel—Of the total spelter production of the ore smelters in 1911, concerns using coal as fuel produced 119,989 tons, or about 40% of the total. In 1912 they produced 134,077 tons, which was only about 38% of the total. In 1913, their production was 157,653 tons, or about 44% of the total, and in 1914 it was 173,520 tons, or about 48% of the total. The remainder of the production was made by smelters using natural gas as fuel, with the exception that one employs a little crude petroleum along with natural gas.

Dross and Scrap—The amount of the recovered spelter that should properly be counted statistically is uncertain. A good deal of scrap zinc is remelted in the manufacturing plants where it is made, e.g., in every rolling mill, and such remelted zinc should not, of course, appear in any statistical enumeration. On the other hand, certain smelters buy and redistill and subsequently sell as spelter, often of excellent quality, what was distinctly a waste product. This is obviously an addition to the new supply of spelter and should be recognized just as is that which the ore smelters recover from dross, skimmings, etc. In my estimate I have conformed to this reasoning.

A point that deserves note is the increasing production of spelter from dross and the decreasing exports of that material. In 1911, the exportation was 2446 tons; in 1912 it was 205 tons; and in 1913 it was only 28 tons. But in 1914 the exportation of dross jumped to 2525 tons, domestic production of dross-spelter being correspondingly less. I estimate the product redistilled from dross, skimmings, etc. (by works treating this material only), at 13,500 tons in 1911, 15,000 tons in 1912, 20,500 tons in 1913, and 18,000 tons in 1914; and probably these figures are underestimates rather than overestimates. In taking a statistical view, this spelter must be added to the spelter obtained otherwise, it being sold in the same way.

Adding to the reports of the dross smelters the metal made by ore smelters out of dross, skimmings, etc., there was a total recovery of 26,230 tons of secondary spelter in 1914, compared with 29,264 tons in 1913.

Zinc Dust—The production of commercial zinc dust in 1914 was 1042 tons, compared with 423 in 1913; 492 in 1912; and 254 in 1911. In 1913 only two smelters were engaged in this manufacture; but when the outbreak of the war in 1914 cut off America's foreign supply and the price rose from about 6c. per lb. to 15*a*16c., several additional smelters engaged in the manufacture of it. The importation of zinc dust was 2302 tons in 1914, compared with 2200 in 1913; 2400 in 1912; and 1713 in 1911.

Spelter Stocks—Fifteen smelting companies reported by telegraph stocks on Dec. 31 aggregating 19,500 tons. Six companies reported works idle. Three companies, one very small, failed to report their stocks. Estimating 4000 tons for them, the total stock in the hands of smelters on Dec. 31 was 23,500 tons. The stocks at the ends of previous years are reported in an accompanying table. According to the government statistics, the stock at the middle of 1914 was 64,000 tons.

Sulphuric Acid—In 1914 there were nine smelters who produced sulphuric acid from blende, the American Zinc & Chemical Co. being an addition to the list. The statistics of the works of this class for a series of years are given in an accompanying table. It is to be remarked that although the American Zinc & Chemical Co. produced acid in 1914 it did not produce spelter, its distillation furnaces not being completed and its roasted ore being stocked.

STATISTICS OF SPELTER-SULPHURIC ACID WORKS

(In tons of 2000 lb.)

	1910	1911	1912	1913	1914
Ore received			287,205	364,741	434,666
Spelter produced	100,791	115,310	127,655	148,188	196,529
Sulphuric acid, basis 60°	202,000	252,192	262,555	305,167	355,424

As in previous years, the smelters who made sulphuric acid drew their main ore supply from the Joplin district, and from Wisconsin, Oklahoma and Tennessee, whereof the ore supply is mainly a high-grade and relatively pure blende. In 1911 these smelters received 107,995 tons of blende from the Joplin district and 71,168 from Wisconsin; in 1912 they received 117,806 and 87,676, respectively; in 1913 they received 159,540 and 84,495, respectively; and in 1914 they received 179,237 and 74,311, respectively. Oklahoma and Kansas are reckoned with the Joplin district and Illinois and Iowa with Wisconsin.

These statistics indicate the predominance of the sulphuric-acid makers in the markets for the pure, high-grade ores. They take all the blende of Wisconsin and Tennessee, which they command geographically, and the major part of the production of the Joplin district, out of which their competition has practically forced the Kansas and Oklahoma smelters, of whom the Edgar Zinc Co. is the only large buyer of the best sorts of Joplin ore.

It is noteworthy that some of the Eastern smelters are using increasing supplies of Rocky Mountain ores.

Smelting Capacity—The capacity of the zinc-smelting works of the United States at the end of 1914 is given in an accompanying table. Among the active plants, Sand Springs was new in 1914, having begun production in the third quarter. The list is classified according to (1) active plants; (2) plants that are maintained in working order but which are of uncertain future; (3) inactive plants; and (4) new plants building.

At the end of 1914 returns from nearly all of the plants of class 1 indicated that about five-sixths of this capacity was then in use. All of the plants of classes 2 and 3 were idle, and had been so during most of 1914. Of the two plants in class 4 that at Langeloth had just put its first furnace in operation, while the new Granby plant was understood to be nearly ready to run.

Among the plants of class 1 the Matthiessen & Hegeler Zinc Co. was the only one having new capacity in preparation, this building a new furnace of 912 retorts. Among the plants of class 4, the American Zinc & Chemical Co. had 1728 retorts building.

In 1914, about 362,000 tons of spelter were produced in 22 works using about 85% of their capacity. Old works if operated at full capacity were consequently able to produce about 56,000 tons more of spelter than in 1914. In addition thereto there was a new plant of 17,500 tons capacity (terms of tons of spelter) immediately available, and furnaces of nearly 11,500 tons capacity in construction and so far advanced as to become available early in 1915. There were also two inactive plants possessing a capacity of about 10,000 tons. I do not include the moribund works of Kansas, which may or may not be put into use. They had a capacity of about 62,000 tons.

The United States possesses therefore, or very soon will possess, first-class capacity for the production of 445,000 tons of spelter per annum; and second-class capacity amounting to 72,000 tons additional that may be used in emergency. These figures take no account of the dross and scrap smelters.

The estimate of a maximum capacity for 517,000 tons of spelter must be discounted, however, being based on the average yield in a year of low price when the ore treated was probably of a relatively high grade. The high price for spelter will draw out lower-grade ore and the average yield per retort will be lower. Moreover, the roasting capacity of American smelters is materially short of their distillation capacity, which means that they may not be able to attain the maximum use of their distillation furnaces unless they can secure all the calamine ore that they need, and calamine ore is generally of lower grade than blende. It is best not to undertake to draw fine points, but simply to assume that the smelting capacity of the United States is largely in excess of any use of it previous to the end of 1914.

ZINC SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation	1913	1914
	Active		
American Zinc Co., of Ill.	Hillsboro, Ill.	3,200	4,000
Bartlesville Zinc Co.	Bartlesville, Okla.	5,184	5,184
Bartlesville Zinc Co.	Collinsville, Okla.	8,064	8,064
Clarksburg Zinc Co.	Clarksburg, W. Va.	2,712	1,824
Edgar Zinc Co.	St. Louis, Mo.	2,000	1,100
Edgar Zinc Co.	Cherryvale, Kan.	4,800	4,800
Granby Mining & Smg. Co.	Neodesha, Kan.	5,760	3,840
Grasselli Chemical Co.	Clarksburg, W. Va.	5,760	5,760
Grasselli Chemical Co.	Meadowbrook, W. Va.	6,912	6,912
Hegeler Zinc Co.	Danville, Ill.	1,806	(*d*) 1,800
Illinois Zinc Co.	Peru, Ill.	4,640	4,640
Robert Lanyon Zinc & Acid Co.	Hillsboro, Ill.	1,600	1,840
Lanyon-Starr Sm. Co.	Bartlesville, Okla.	3,456	3,456
Matthiessen & Hegeler Zinc Co.	La Salle, Ill.	5,256	5,256
Mineral Point Zinc Co.	Depue, Ill.	6,800	9,080
National Zinc Co.	Bartlesville, Okla.	4,480	4,260
National Zinc Co.	Springfield, Ill.	3,200	3,200
New Jersey Zinc Co.	Palmerton, Penn.	5,760	5,760
Prime Western Spelter Co.	Gas City, Kan.	4,768	4,768
Sandoval Zinc Co.	Sandoval, Ill.	896	896
Tulsa Fuel & Manufacturing Co.	Collinsville, Okla.	6,232	6,232
Tulsa Spelter Co.	Sand Springs, Okla.	. .	4,000
United States Zinc Co.	Pueblo, Colo.	1,920	1,920
Totals	.....	93,200	98,592
	Operated Irregularly		
Altoona Zinc Smelting Co.	Altoona, Kan.	3,300	(b)3,840
American Zinc, Lead & Smg. Co.	Dearing, Kan.	3,840	(a)3,840
American Zinc, Lead & Smg. Co.	Caney, Kan.	3,648	(b)3,648
Chanute Zinc Co.	Chanute, Kan.	(b)1,280	(a)1,280
La Harpe Spelter Co.(c)	La Harpe, Kan.	1,856	(b)1,856
Totals	......	13,924	14,464
	Inactive		
Collinsville Zinc Co.	Collinsville, Ill.	(b)1,536	(a)1,536
Pittsburg Zinc Co.	Pittsburg, Kan.	(b) 910	(a) 910
Totals	.....	2,446	2,446
	New		
American Zinc & Chem. Co.	Langeloth, Penn.		864
Granby Mining & Smg. Co.	E. St. Louis, Ill.	. .	3,240
Totals			4,104
Grand totals		109,570	119,606

(a) Inactive throughout year. (b) Inactive during latter part of year. (c) Plant being dismantled. (d) No report received; entered the same as last year.

Imports and Exports—In 1914 there was a larger exportation of spelter than ever before in the history of the United States, the total being 70,242 tons, including 5580

IMPORTS AND EXPORTS BY QUARTERS

Imports	Ore, Long Tons	Spelter, Lb.	Dust, Lb.
I	3,350	500,273	1,288,259
II	4,722	[illegible]	1,256,559
III	6,849	691,012	525,161
IV	31,329	[illegible]	1,624,128
Year	46,250	[illegible]	4,694,107
Exports	Ore, Long Tons	Spelter, Lb.	Dust
I	5,883	812,165	572,477
II	1,297	[illegible]	0
III	1,319	[illegible]	1,239,576
IV	1,421	[illegible]	3,239,020
Year	9,920	140,181,[illegible]	5,051,067

tons of spelter smelted in bond. The government figures of the exportation of bonded spelter are a little different from those reported by the smelters. However, this is explained by difference of the period comprised within the respective reports.

The government reported the importation of 28,050 long tons of zinc ore in 1913 and 46,260 long tons in 1914. The former figure checked with the smelters' reports of receipts; the latter is much in excess thereof. This difference may be in part explained by an increased supply of incoming ore not yet received by the smelters at the end of 1914.

The exports of zinc ore from the United States dropped from 15,815 long tons in 1913 to 9920 long tons in 1914. This was due chiefly by the impossibility of exporting New Jersey willemite to Belgian and German smelters after the outbreak of the war.

Deliveries—Estimated deliveries are given in an accompanying table. Deliveries are computed by difference between (*A*) stocks, plus production, plus imports, and (*B*) exports plus stocks, but experience shows how futile it is to attempt to compute consumption in that way, and how important a part is played by the stocks in the yards of galvanizers and brass makers, the invisible supply.

DELIVERIES FOR CONSUMPTION

	1910	1911	1912	1913	1914
Stock, Jan. 1..........	11,500	23,000	9,323	4,264	40,115
Production	288,415	309,336	363,638	378,762	380,361
Import	3,452	1,637	11,115	6,100	880
Totals..............	303,367	333,973	384,076	389,126	421,356
Exports, domestic.....	3,989	6,872	6,634	7,782	64,802
Exports, foreign.......	4,468	11,270	8,700	6,526	5,580
Stock, Dec. 31.........	23,000	9,323	4,264	40,115	23,500
Deliveries............	271,892	316,508	364,488	334,703	327,474

The statistics in the table of deliveries are incomplete because of their omission of stocks held by dross smelters. Moreover the statistics of stocks and exports, the former reported by the smelters as what was at their works and the latter reported by the government as what was shipped abroad from our ports, do not register exactly. The exports reported in December would register approximately with the stock at the end of November, at which time the stock at smelteries was undoubtedly higher than at the end of December. In other words the deliveries in 1914 computed by the only method available, which is admittedly imperfect, are probably larger than in fact they were.

Remarks—The revised report of the production of spelter in 1914 is 1672 tons more than was reported in the ENGINEERING AND MINING JOURNAL of Jan. 9, 1915. The increase is due to an underestimate for the smelter who did not report for the preliminary statistics, while several of the other smelters who estimated their output for the last 15 days of 1914 actually made a little more than they expected.

Deducting from the total production the amount that was derived from dross and skimmings, and adding 90% of the production of zinc dust, the zinc yield of 855,435 tons of ore smelted in 1914 was 41%, corresponding to average grade of 47½% Zn for the ore, assuming an average extraction of 86%. We do not possess corresponding figures for 1913 and therefore can not make any comparison. In view of the low prices prevailing in 1914 it is not an unreasonable surmise that the average grade of the ore coming to the smelters was higher than usual. The decrease in ore receipts indicates that the miners felt the pinch of low prices. Even so there was less ore smelted than was taken in, which is easily explained in part by the necessary accumulation of stocks at two new smelting works. The large increase in imports of ore in the fourth quarter and the difference between the government report of imports and the smelters' reports of foreign receipts indicate that a large quantity of foreign ore was in transit at the end of the year. The exports of spelter in December amounted to the huge figure of 20,192 tons, as reported by the government.

A surprising feature of the statistics for 1914 is the large proportion of calamine smelted in this country. Not requiring roasting this is a particularly desirable class of ore for the smelters of Kansas and Oklahoma whose gas supply is scanty.

The statistics of imports and exports by quarters reveal some of the interesting effects of the war in the cases of spelter, dross and ore exports and zinc-dust imports.

February Mining Dividends

Dividends paid in February, 1915, by 20 United States mining companies making public reports amount to $2,182,338, as compared with $2,004,300 paid by 21 companies in February, 1914. Industrial and holding companies allied to mining paid $8,175,267, as compared with $9,309,427 in 1914. Canadian and Mexican mining companies paid $689,474 in 1915, as against $909,050 in 1914.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alas	$0 20	$36,000
Alaska Treadwell, g	Alas.	1.00	200,000
Alaska United, g	Alas.	0.30	54,060
Arizona, c...	Ariz	0 18	277,001
Bunker Hill & Sullivan, l.s	Ida.	0.25	81,750
Bunker Hill Con. g	Calif.	0 02½	5,000
Caledonia, l.s	Ida.	0.02	52,100
Duluth & Utah, l.s	Utah	0 04	2,000
Golden Cycle, g	Colo.	0.05	75,000
Goldfield, g..............	Nev.	0.15	533,872
Hecla, l.s	Ida.	0.01	10,000
Homestake, g	S. D.	0 65	163,254
May Day, g.s.l	Utah	0 02	16,000
Mohawk, c..	Mich.	1.00	100,000
Parrott, s.c.	Mont.	0.15	34,477
Shattuck-Ariz., c.	Ariz	0.50	175,000
South Eureka, g......	Calif.	0 05	14,999
Stewart, s.l.	Ida	0.10	123,826
United Verde, c.	Ariz	0 75	225,000
Yellow Aster, g	Calif.	0 03	3,000

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Amalgamated, c	U. S.	$0 50	$1,154,159
Cambria, pfd	Penn.	0 62½*	562,500*
International Nickel	N. J.	1.50	133,689
U. S. Steel, pfd.	U. S.	1.75	6,304,919
White Knob, pfd.	Calif.	0.10	20,000

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Amparo, g.s	Mex.	$0 03	$60,000
Buena Tierra, s.l	Mex	0 24	80,190
Coniagas, s	Ont.	0 30	240,000
Dominion Steel	N. S.	1 50	105,000
Hollinger, g	Ont.	0 20	120,000
Lucky Tiger, g..	Mex	0 10	71,534
Rea	Ont	.	12,750

*Scrip.

Shattuck-Arizona resumed dividends after having passed its previous quarterly disbursement. Rea's dividend is its initial payment.

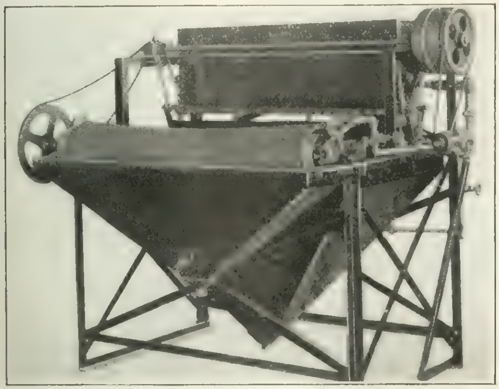
Butte & Superior Copper Co., Ltd.

The report of this company for the fourth quarter of 1914 shows that 33,520 tons of ore, containing 19.45% zinc and 8.928 oz. silver per ton were milled. The mining cost was $3.288 per ton and the milling cost $2.466 per ton. The low tonnage was due to a wreck in the shaft, which made retimbering necessary, consequently the operation was cut off between Oct. 17 and Dec. 17. The percentage of total zinc recovered in concentrates during the operating period was $4.65. The total zinc in concentrates was 11,039,557 pounds.

Profit for the quarter was $251,786, based on an average price of 5.012c. per lb. for spelter, and net operating profit was $252,051. Development work amounted to a total of 2242 ft. Many improvements to plant and surface development were made during the period when the plant was shut down.

The Wood Flotation Machine

The accompanying engraving from a photograph shows the type of flotation apparatus designed by Henry E. Wood & Co., of Denver, Colo. (previously described in the Journal), which has been shipped to the San Francisco Del Oro mine, near Parral, Chihuahua, Mexico. In experimental work in Denver very satisfactory results were obtained in the treatment of the difficult San Francisco Del Oro ore by this apparatus.



The Wood Flotation Machine

Brick from Flotation Tailings at Anaconda

At the recent A. I. M. E. meeting in New York, E. P. Mathewson exhibited a brick that had been made from tailings of the experimental flotation plant, and announced that the Anaconda company would shortly go into the manufacture of such brick, having already ordered machinery having a capacity of 50,000 brick per day.

The brick exhibited had a clear ring, was exceedingly fine grained, without a heat crack, and had much the appearance of a gray pressed brick, well suited for building-face brick. It had been tested to 15,000 lb. per sq.in. and was in other respects superior to the ordinary pressed brick. Owing to its composition, it could be used as a firebrick, the tailings from which it was made being high in silica and alumina.

These brick will be made from material much of which is ground to 200 mesh—the discharge from the slime-tailings flotation plant. From 2000 to 2500 tons of this material will be discharged daily, but only about one-tenth of these tailings will be required by the brickmaking machinery now ordered, so that it will be possible to supply any demand that may arise in the territory that can be covered from Anaconda.

Superior & Boston

The report of the Superior & Boston Copper Co., Copper Hill, Ariz., for the year ended Sept. 30, 1914, states that the company had been operating on a producing basis throughout the year until the war in Europe necessitated the discontinuance of ore shipments in August. During the period 25,625 tons of ore were produced for which the company received $291,515; other receipts brought the total to $293,236. Total expenditures were $309,218, making an excess of $15,982 over receipts which was made up from the balance carried forward from 1913, thereby leaving a balance of quick assets amounting to $59,285 at Oct. 1, 1914. It is stated that aside from a few hundred tons of ore which came from the 600 level east from the Quo Vadis fault, all ore mined came from the ground lying between the McGraw and Quo Vadis faults and between the 600 and 800 levels. There were 5424 ft. of development work and 563 ft. of diamond drilling performed during the year.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATING MACHINE. Matthew Arnold, San Jose, Calif. (U. S. No. 1,127,845; Feb. 9, 1914.)

AMALGAMATOR. John A. Macdonald, Boston, Mass. (U. S. No. 1,128,024; Feb. 9, 1915.)

CHLORIDIZING ROASTING of Ores. Arthur Ramén and Knut Jakob Beskow, Helsingborg, Sweden. (U. S. No. 1,129,123; Feb. 23, 1915.)

CLASSIFIER. Robert H. Richards, Boston, Mass. (U. S. No. 1,129,522; Feb. 23, 1915.)

COBALT-SILVER ORES—Process for Treating Cobalt-Silver Ores. William Phillips, Swansea, Wales. (U. S. No. 1,127,506; Feb. 9, 1915.)

CONCENTRATION—Improvements in and Relating to Apparatus for Ore Concentration. A. H. Higgins, W. W. Stenning and Minerals Separation, Ltd., London, Eng. (Brit. No. 21,650 of 1913.)

CRUSHER. Charles S. Lincoln, Milwaukee, Wis., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,128,015; Feb. 9, 1915.)

CRUSHING—Process of and Apparatus for Crushing Ore. Hans Charles Behr, Scarsdale, N. Y. (U. S. No. 1,127,853; Feb. 9, 1915.)

DRILL—Rock Drill. George R. Bennett, Denver, Colo. (U. S. No. 1,127,396; Feb. 9, 1915.)

DRILLING—Fluid-Operated Drilling Machine. Louis W. Greve, Cleveland, Ohio, assignor, by mesne assignments, to Cleveland Rock Drill Co., Cleveland, Ohio. (U. S. No. 1,129,347; Feb. 23, 1915.)

DRILLS—Relief Valve for Rock Drills. Thomas E. Sturtevant, Dover, N. J., assignor to McKiernan-Terry Drill Co., Dover, N. J. (U. S. No. 1,127,823; Feb. 9, 1915.)

EXCAVATING MACHINE. Charles B. King, Marion, Ohio, Grant Holmes, Danville, Ill., and Benjamin Jacoby and Herbert E. Roush, Marion, Ohio, assignors to The Marion Steam Shovel Co., Marion, Ohio. (U. S. No. 1,128,151; Feb. 9, 1915.)

GOLD SEPARATOR. Dirk Hoogendorn, Deering, Alaska. (U. S. No. 1,129,678; Feb. 23, 1915.)

MAGNETIC SEPARATOR. Georg Ullrich, Magdeburg, Germany, assignor to Fried. Krupp Aktiengesellschaft, Grusonwerk, Magdeburg-Buckau, Germany. (U. S. No. 1,129,822; Feb. 23, 1915.)

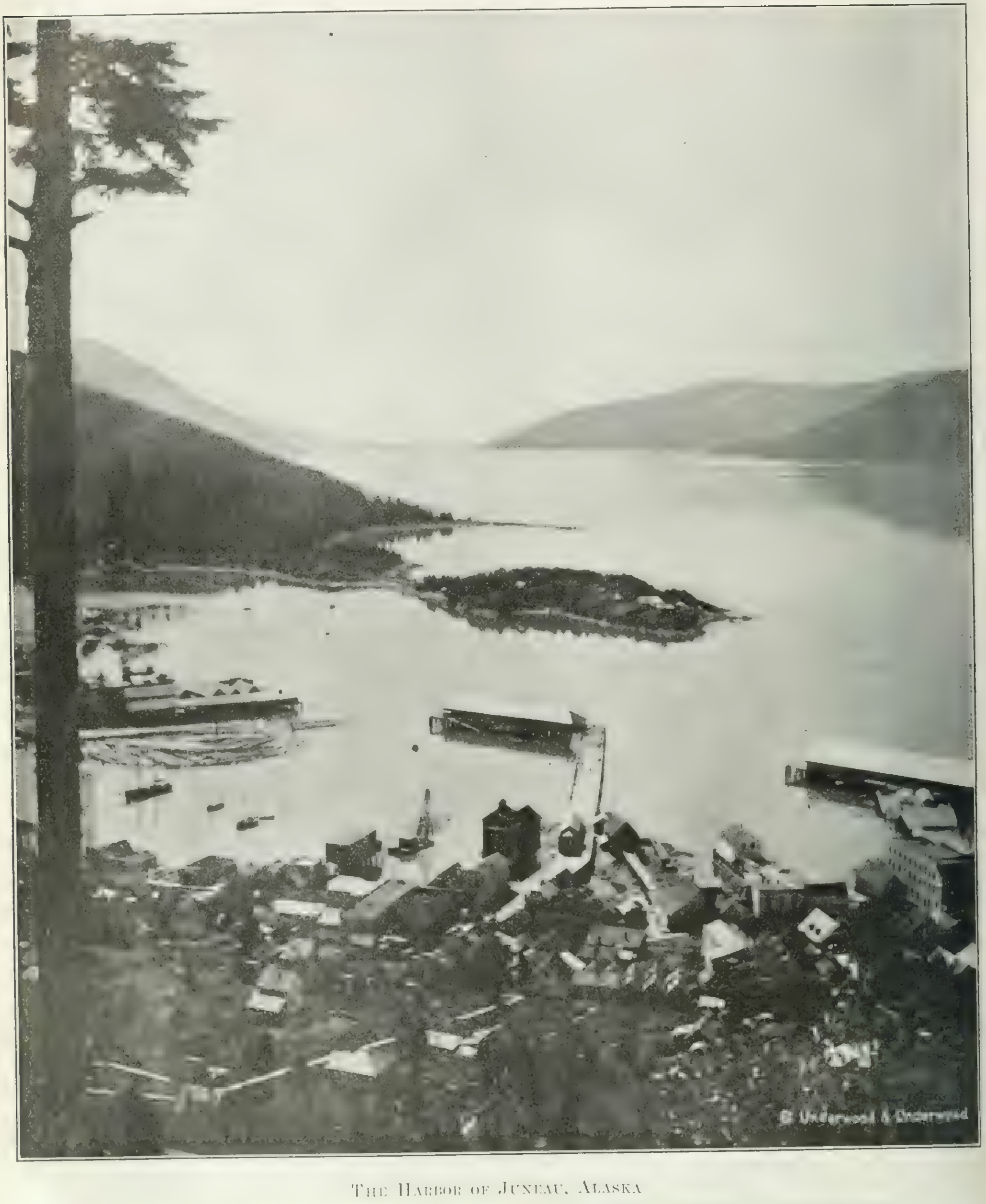
METALLIC COATING—Method of Plating or Coating with Metallic Coatings. Max Ulrich Schoop, Hongg, near Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S. No. 1,128,059; Feb. 1, 1915.)

PHOSPHATE ROCK—Process of Treating Pebble Phosphate Rock. William F. Lay, Boston, Mass. (U. S. No. 1,129,107; Feb. 23, 1915.)

PLACER CONCENTRATING MACHINE. John F. Newsom, Palo Alto, Calif. (U. S. No. 1,127,667; Feb. 9, 1915.)

SILICON—Process of Making Silicon Compounds and By-Products. Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corporation, New York, N. Y. (U. S. No. 1,129,506; Feb. 23, 1915.)

Photographs from the Field



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THE HARBOR OF JUNEAU, ALASKA

Headquarters and commercial center for the large gold-mining developments now in progress nearby

Landing at the Tantalus Coal Mine on the Yukon River, Near Dawson

Gold Cliff Mine and Mill, Valdez, Alaska

Copper in Germany

An article in the London *Times* on "War and Copper" has attracted wide attention. It is said to be the work of a high authority on the statistics and use of copper. We reproduce the article, through the *Journal of Commerce,* as follows:

Probably one of the most pressing questions in Germany at the present hour is her need of copper and the means by which she shall provide for that need. If consumption exceeds production, copper must be imported, however large the accumulated stores; and if the blockade of the seas instituted by France and England is effective—that is, if no copper can reach Germany, either directly or through neutral ports—then Germany's fate is sealed. And for this reason: Without copper there can be made no ammunition; and, the expenditure of ammunition being immense, the consumption of copper is immense.

The front upon which the troops of the five great nations are fighting extends to some 400 miles in the west and more than 560 miles in the east, Serbian battlefields excluded. As in Poland the concentration of troops does not seem to be as great as it is in France and Belgium, we cannot reckon the firing line at more than, let us say, 750 miles (1,320,000 yd.).

In Germany the men under arms certainly exceed 4,000,000; in Austria-Hungary, at the same rate, they exceed 2,500,000. These 6,500,000 men represent roughly five men per yard. If we reckon half of this number as employed in the rear, there remain at the front 2½ men per yard. Of these, again, a portion belong to the artillery and cavalry, the officers, the sappers and miners, the medical corps, etc. Making all due allowances for these, we may safely reckon on one man and a half per yard. Reckoning conservatively, let us admit only one man per yard. This represents, for 750 miles 1,320,000 yd., roundly 1,300,000 rifles.

What is now the average number of shots per rifle per day? With reference to the many daily "engagements" at several points, where thousands of shots are fired in a few hours over a short front, it is probably not an exaggeration to put it at 20 per man: 26,000,000 shots for every 24 hr. A rifle cartridge weighs about 6.77 drams, equal to 184½ grains. The total weight of brass necessary for this daily rifle fire is therefore 26,000,000 by 6.77 drams, equal to 687,578 lb., or, roundly, 305 tons. If we calculate Maxim gun fire at 10% of the rifle fire, we have: Rifles, 305 tons; Maxim guns, roughly, 30 tons; making a total of 335 tons.

Doubtless upon a hard soil some small portion of the expended cartridges is recovered. But in the mud nothing. Estimating on an average, it can hardly reach 5%. We therefore get about 17 tons recovered. The weight of brass lost is, accordingly, 335 tons, less 17 tons, equal to 318 English tons.

To these figures must be added those for artillery fire. This it is difficult to estimate. It is said that on some of the "hottest" days of the battle of the Marne the Allies fired 180,000 shells. On the other hand, certain authorities claim that France cannot manufacture more than from 70,000 to 80,000 shells per day. To be brief and to be well within the truth, suppose we admit for the English, French and Belgian artillery an expenditure of 90,000 shells a day. The Germans must respond with at least an equal number, especially if we consider the greater length of the fighting line on her eastern frontiers and the numerous important battles which have there taken place. This gives a total of 180,000 shells a day. Let us say 150,000. The brass used for these shell cases and shells may be estimated as follows:

	Lb.
First—150,000 fuses of an average weight of 7 oz. fully lost, roundly	65,625
Second—150,000 cartridges of an average weight of 61 oz., of which about 80% are recovered $\frac{150,000 \times 61 \times 0.2}{16}$ roundly	114,375
Third About 200,000 rings (to fit the rifling) for shells entirely lost	56,250
Total	236,250

The weight of brass lost will be 105 tons and 1050 lb., making, with the above mentioned 318 tons, a total of 433 tons 1050 lb., say 430 tons. The copper in the brass used by Germany and Austria-Hungary forms 72% of this metal. The total need of copper for the above mentioned weight of brass is therefore 430 × 0.72, equaling 309 tons 2 cwt. These 309 English tons each day make in round numbers 112,000 tons a year.

To face such a need of copper Germany has, of course, her accumulated stores. But these are not inexhaustible [illegible] uninterruptedly renewed. She has, too, the importation of metal through neutral countries. In time of peace Germany produces on an average 26,000 tons of copper. This output can be increased, but not indefinitely. At the utmost we do not think it could be increased by 40%. Let us admit, however, that Germany can produce 36,000 tons.

It is said that Austria produces 4000 tons of copper yearly. This is highly problematical. Indeed, the production of Austria might, in all likelihood, be estimated at nothing. However, admitting 4000 tons, we get a total output for both empires of 40,000 tons a year. Their annual need of copper for the actual war will then be 112,000 — 40,000, equaling 72,000 tons; that is, about 7200 railway wagons, 360 trains of 20 wagons each.

CONCLUSION

Now, in spite of the fact that Germany has for years been preparing for this war and has probably laid by large stores of copper, that already she is feeling the pinch is apparent. She is making efforts to obtain this metal from any quarter and at any cost. She is said to have denuded Belgian domiciles of their kitchen utensils, to have wrenched off and removed the brass doors of the railway station of Antwerp. Copper is smuggled across her frontiers in cotton bales and orange boxes.

Moreover, according to the "Frankfurter Zeitung," even the electric-light installations in Germany are being dismantled for the sake of their copper. This extreme measure is at present resorted to only in the smaller towns which have to substitute acetylene gas as an illuminant. Furthermore, the price of copper in Germany has increased 200% since the commencement of the war! And this situation will become every day more strained, for the war will not continue upon the same scale as heretofore and will be more and more expensive in men and ammunition. The artillery is being constantly increased, and the main body of English forces has still to come to the front. And to the increase of firing Germany must respond in equal measure.

The estimate of 112,000 long tons per annum for the military requirement of copper in Germany and Austria-Hungary agrees closely with an estimate recently made in the *Weekly Report,* published in Berlin by the American Association of Commerce and Trade, which undoubtedly repeats German information. In that publication it was stated that "the yearly volume of copper required for war purposes in Germany has reached now 100,000 metric tons, of which amount only 25,000 metric tons are being produced in Germany. Assuming that copper cannot be brought into Germany at all, an amount of 75,000 metric tons must be drawn from the supply on hand in order to comply with the demands of warfare. In view of the fact that during the last five years the import of copper has exceeded the export by at least 200,000 metric tons per year, the actual copper material in Germany has increased by approximately 1,150,000 metric tons including the volume of the home production. This material must serve eventually for war purposes, in case the ready supply gives out."

It is inconceivable that Germany is going to be hampered in its military operations by shortage of copper, for it will naturally draw upon its present installations of copper if worst comes to the worst; but if the military waste be as great as these figures indicate there will be a great void to be filled when rebuilding is done after the war.

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American Institute of Mining Engineers

At the first meeting of the board of directors of the American Institute of Mining Engineers, Philip N. Moore, of St. Louis, was elected first vice-president of the Institute. The other vice-presidents are Sidney J. Jennings, Thomas H. Leggett, F. W. Denton, H. C. Hoover and L. D. Ricketts.

Correspondence and Discussion

Ownership of Bolivian Mines

May I correct the statement in the JOURNAL of Oct. 31, p. 797, that much German and British capital is invested in Bolivian mines? By the following list, which is correct to my best knowledge, although there may be slight variations in the production figures, you will perceive that nearly all the tin from this country is produced by Bolivian- or Chilean-owned mines and that European and American capital is very meagerly represented. Aramayo, Francke & Co. is the only English concern of importance, but it cannot be called an English investment. The mines have for many years belonged to Avelino Aramayo and Mr. Francke, and as far as I understand all the stock is at present privately held, Mr. Aramayo, who lives in London, being the principal shareholder.

BOLIVIAN-OWNED MINES

Names	Situation	Owned by	Approximate Monthly Production of Concentrate in Quintals
Uncia	Dept. of Potosi	S. I. Patiño	20,000 - 25,000
Huanuni	Dept. of Oruro	S. I. Patiño	5,000 - 8,000
Cerro Rico de Potosi	Dept. of Potosi	Various	2,000 - 3,000
Andacaba	Dept. of Potosi	Quesada Alonso	1,000 - 2,000
Avicaya	Dept. of Oruro	Abelli & Cia. (Banco Argandoña)	1,000 - 1,500
Many small mines, alluvial workings, and dumps		Various	1,500 - 2,000
			30,500 - 41,500

CHILEAN MINING COMPANIES*

Cia. Estañifera de Llallagua, Dept. Potosi	8,000 - 15,000
Cia. Minera de Oruro, Dept. Oruro	2,500 - 3,500
Cia. Minera San José de Oruro, Dept. Oruro	800 - 1,000
Sociedád Estañifera de Totorál, Dept. Oruro	800 - 1,000
Cia. Minera de Colquiri, Dept. Oruro	800 - 1,000
Cia. Minera de Monteblanco, Dept. La Paz	500 - 1,000
Cia. Minera y Agricola Oploca, Dept. Potosi	2,000 - 3,000
Cia. Minera de Antequerra, Dept. Oruro	300 - 500
	15,700 - 26,000

*Head offices in Santiago.

ENGLISH MINING COMPANIES

Aramayo, Francke & Co., Dept. Potosi	6,000 - 7,000
Porco Tin Mines, Ltd., Dept. Potosi	500 - 800
Royal Silver Mines of Potosi, Dept. Potosi	500 - 1,000
Berenguela Tin Mines, Ltd., Dept. Cochabamba	300 - 500
Morococala, Dept. Oruro, Penny & Duncan (English)	2,000 - 3,000
Nané, Dept. Oruro, Duncan, Fox & Co. (English)	300
	9,300 - 12,600

MINES OWNED BY OTHER FOREIGNERS

Lower levels in Cerro Rico de Potosi, L. Soux (French)	3,500 - 4,000
Araca, Dept. La Paz, Harrison & Bottiger (German)	2,000 - 3,000
Cerro Rico de Potosi, Belan Hermanos (French)	800 - 1,000
Huayno Potosi, Dept. La Paz (French)	1,000 - 1,500
Jatuncaca, Dept. Cochabamba, Schlüter & Co. (German)	300
Catorce, Dept. Cochabamba, Mr. Nicolai (German)	100 - 200
Ocuri, Province Charcas, Mr. [illegible]asser (German)	300
Tucsuhuma, Dept. Cochabamba (an Argentine company)	300 - 500
	7,700 - 10,800

Total monthly production	63,200 - 90,900	quintales barrilla
Produced by Bolivians	30,500 - 41,500	or about 46%
Produced by Chileans	15,700 - 26,000	or about 28%
Produced by English	9,300 - 12,600	or about 14%
Produced by French	5,500 - 6,500	or about 7%
Produced by Germans	2,100 - 3,800	or about 4%

The production figures refer of course to normal times; at present the production has shrunk very much. The Llallagua mine has suspended exploitation and confines its work to development, Aramayo, Francke & Co. only works bismuth, copper and silver ores, the Cia. Minera San José de Oruro only works silver ore, the Cia. Minera de Oruro is working principally silver ore with little tin, Avicaya is only developing, but the Uncia and Huanuni mines are in full swing.

I am sending you these figures without further comment. I only intend the Bolivian situation to be well understood, and want to prevent the Americans thinking there are obstacles when none exist.

M. G. F. SÖHNLEIN.

Machacamarca, via Oruro, Bolivia, Dec. 14, 1914.

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Transportation of Debris by Running Water

Copies of U. S. Geological Survey Professional Paper No. 86, reviewed in the JOURNAL of Sept. 6, have just reached this country, and as a practicing alluvial miner I must confess to a feeling of disappointment that we are still left without guidance from the research physicist. That there is considerable room for the employment of "efficiency" methods in our handling of gravel by flowing water no one will deny, but so far we are without a reliable lead in the principles of our art.

Mr. Gilbert's paper consists of two main parts—experiments in a level trough, in which the flowing sand formed its own bed at a gradient appropriate to the conditions, and a much smaller number of experiments in which the sand flowed in a trough given a definite slope over a smooth or artificially roughened bottom. The slopes studied rarely exceed 3% and consequently lie outside our particular field, the investigation not being carried on for the miner's benefit, but for the Débris Commission's.

In the discussion on the experimental data the relation of capacity to slope is first studied and a formula derived to express the relations discovered. This formula implies the universal application of the law throughout the whole range of slope, but I am inclined to think, from a study of some of Overstrom's experiments at the Utah School of Mines,[1] to which the author makes no reference in his review of previous work, that while it may be adequate, as a mathematical expression, for the low grades with which he deals, it cannot be relied upon in the region of higher slopes. However, in the particular field studied, it serves to give a harmonious and close approximation to the experimental data, and is useful, if not indispensable, as a basis for further discussion.

The next chapter deals with the relation of capacity to form-ratio, and an expression is evolved which the author confesses (p. 191) has hampered the discussion of the laboratory data at every stage of the investigation, and next comes a discussion of the relation of capacity to discharge, followed by chapters on the relation to depth and to mean velocity.

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[1] "Mines & Minerals," Feb., 1909.

It was my hope, while waiting for the paper to come, to find that a quietus had finally been given to the ideas which made it possible for the following to appear in the *School of Mines Quarterly* for April, 1913: "In designing a sluice then we must study, *from a hydraulic standpoint,* to get the perimeter which gives least friction and highest velocity. The main point is to get the greatest capacity per unit quantity of water. This can only be done by building the sluice so as to get the right depth of water in the sluice at the right grade." The author of the Bulletin, however, follows nearly every other writer on the subject, with the conspicuous exception of Bowie, in believing that the capacity of a channel is derivable from its shape, and that this shape can be expressed as a ratio of depth to width.

The relation of capacity to discharge receives scant justice after this, and in spite of his admission that "for every combination of slope, discharge and fineness, it is possible to reduce capacity to zero by making the stream very wide and shallow or very narrow and deep," the author puts forward a formula implying that capacity continually increases with discharge.

What actually happens is this: When a trough of fixed width and slope is supplied with water in increasing quantity, its capacity as a conveyer of débris increases, and rapidly at first, until a certain point is reached when its capacity commences to fall off, and will eventually reach zero. In fact the condition "narrow and deep" is attained, "narrow" and "deep" being relative terms. The capacity of the water per unit is by no means at a maximum when maximum capacity for that particular trough width is attained; far from it, maximum duty having been reached and passed long before. The data presented do not contain instances of maximum capacities for individual trough widths, though but a slight extension of the range of quantity might have been necessary in the narrowest trough. As it is, the author is inclined to treat data from the narrowest troughs as discordant.

Considering now the effect of constant slope and water supply with varying trough width, it is the case that an increase of width increases the capacity of a fixed quantity of water, and consequently the duty, up to a limit beyond which increase of width reduces it. The attainment of maximum capacity and duty consists then in correctly proportioning the width of the trough to the available water supply—nothing more. Nothing about depth, or mean velocity, or form-ratio. These things will take care of themselves.

The data to enable this to be done (for maximum duty) are sufficiently given in Table 12, Table 32 in this chapter being unnecessary except to betray the inadequacy of the formula, while the graph that accompanies it, Fig. 47, with the zeros of C. scattered all over the place, is worse than useless. If capacity is plotted logarithmically against quantity of water, for a constant slope and distinguishing the graphs of the different widths, an orderly series of curves is disclosed, those corresponding to the narrowest widths being met with first along the ordinate of increasing quantity, followed by those of greater width which rise more steeply and cut all those which preceded them. At the point where two curves intersect, the capacity and duty of the indicated quantity of water are the same for the two different trough widths represented, and the width of the trough necessary to secure maximum duty for that particular quantity lies somewhere between these two values, its width and capacity being usually indicated fairly well on the chart by an existing graph. The capacity thus indicated for the appropriate trough width does not, of course, indicate the maximum capacity of that trough as a conveyor. That still goes on increasing for a while with further augmentation of the water supply.

It ought not to be impossible for a mathematician to arrive at an expression of the law governing the ratio of capacity to quantity for particular widths of channel, but it will not be done by ignoring the essential characteristics of the relation. The law is probably of a simple type. But any law connecting capacity and slope (with constant width and quantity) cannot be simple, inasmuch as efficiency varies from point to point; and moreover the direction of variation of the efficiency may be reversed, it being possible for a slope to give maximum duty with certain quantity and width factors at one point and maximum capacity with different quantity and width factors at another point. The undulations of Overstrom's curves figured in Richards' "Ore Dressing" strongly suggest something of the kind.

The discovery of these laws will no doubt be useful to the débris commissioner and the reclamation engineer, but we shall be satisfied if we can be told the appropriate trough widths to employ per miner's inch on the narrow range of slopes we use and for average gravel. Surely this is not too much to ask.

R. T. HANCOCK.

Wembley, Middlesex, England, Jan. 5, 1915.

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The Kinds of Spelter

There is a clerical error in the editorial on "The Kinds of Spelter" which appeared in the JOURNAL of Feb. 6. The requirements for intermediate spelter are therein stated to be:

Lead	0.20%
Iron	0.03%
Cadmium	0.05%
Total not over	0.50%

The cadmium is erroneously given as 0.05% whereas the specifications of the American Society for Testing Materials place the cadmium limit at 0.50%. In this connection, it may be of interest to say that manganese, in very minute proportions—generally not over 0.01%, is frequently present in high-grade spelter. This element is not mentioned in the specifications of the A. S. T. M., or in any specifications that I have seen; nor is it usually determined in routine analysis; yet a rather extended experience with spelter analyses shows it to be a usual rather than an unusual occurrence. Manganese, in greater or less amount, is found in nearly all zinc ores; more of it, probably, exists in high-grade spelter made directly from ore than in that made by redistillation. Although I have no data on this point, one would naturally think this to be the case.

It is an interesting question whether or not minute amounts of manganese may impart toughness or other desirable qualities to the spelter and thus give some ground to the claim that direct distilled high-grade is superior to redistilled.

A. M. SMOOT

New York, Feb. 15, 1915.

Editorials

Alcohol and Inefficiency

A strong effort is being made to upset the prohibition law adopted in Arizona last November. This appears to have been a poorly drawn law and vulnerable because of its carelessness. However, it is unlikely that any upset will be more than temporary, the sentiment in favor of the abolition of the use of alcohol having gained such headway everywhere on economic grounds.

Some recent statements by financial authorities in Russia, which is furnishing the greatest object lesson respecting prohibition, are illuminating. Mr. Bark, the Minister of Finance, in reviewing the recovery of Russian industry after the first shock of the war said recently:

> Unemployment in the various industries is not noticeable, except in the regions where the war is in progress. Except in the small portion of Russian territory occupied by the enemy, industrial activity shows no important slackening. This comparatively favorable showing is due, in the first place, to the greater productivity of labor following the cessation of the sale of spirits. Productivity has increased from 30 to 50%, and this, to a large extent, makes up for the shortage of labor consequent upon the calling of the workers to the colors.

The Comptroller of the Treasury announced in the Duma on Jan. 25, 1915, that there was no great suffering, although the war had produced certain economic difficulties. He ascribed this condition to the prohibition of the sale of spirits. In proof of this statement he gave statistics of the national savings banks to show that the people were better off financially than before the war. The number of depositors in December, 1913, was 70,000, while in December, 1914, 291,000 persons had accounts. The total amount of deposits in December, 1913, was $17,000,000. In December, 1914, these accounts had increased to $42,000,000.

In an interview in Paris, Feb. 5, Mr. Bark reiterated his previous statements, saying: "The suppression of the alcohol monopoly entailed a diminution of 470,000,000 rubles ($235,000,000) in the budget of 1914, but the benefits of this suppression are already being felt. Although it was feared that the calling of so many men to the colors would seriously embarrass industry it has been found that thanks to the suppression of the traffic in alcohol the results of labor are from 30 to 50% higher than before the first half of 1914, when the budget showed a surplus of 155,000,000 rubles ($77,500,000)."

These are surprising figures, but the experience in some of the cities of New England that have prohibition by local option are confirmatory of them, and we do not think that any of the mine managers of Montana, Colorado, Nevada, Utah, Arizona, etc., seeing them in the light of their own observations, will find them incredible.

A London newspaper, reporting affairs in Great Britain, remarked that: "Labor still dominates the national situation. Mr. Tennant suggested that Lord Kitchener—or the King—should grant a medal to any British workman in the engineering trades who graciously consents to do his best upon Government contracts at nearly double wages during the war. If what we now hear is correct, the situation is steadily growing worse, especially on the Clyde, and many cases could be mentioned where men scarcely put in a 40-hour week. Rates of pay have risen, with the only result that the men do less work, and are even demanding extra and unearned money on Saturday, as a bribe to prevent them seeking a job elsewhere.

"Many of the employers are convinced that the Government will have to close public-houses in the armaments areas if they want the output to increase. If the men like to drink away their money, that is no affair of the state's; but they are drinking away their time and their energy, which is a very different matter at a time when the acceleration of contracts is of vital consequence. If we had heard this view expressed by temperance fanatics, we should have dismissed it for an *ex-parte* attempt to make the nation sober by martial law. But when Glasgow ironmasters talk like this, and order water instead of whisky with their mutton, one must take the proposal seriously."

Now comes the Anaconda Copper Mining Co. with the following statement in a recent issue of the *Anode*, saying: "Among the rules appearing on the bulletin boards at the mines is the following:

> Never go to work after drinking liquor, and if you must drink, Stay Home. Experience has proven that a great many accidents are caused from drinking intoxicating liquors.

"It will be remembered that from Sept. 1, 1914, to Sept. 14, all saloons in Butte were closed; that from Sept. 14 to Sept. 24 they were open only from 8 a.m. to 7 p.m., and that for the remainder of the month they were open only from 7 a.m. to 10 p.m. The accident records of the Anaconda Copper Mining Co. show the following significant figures: Number of accidents per 10,000 shifts: July, 6.22; August, 11.25; September, 4.21; October, 7.58; November, 6.07."

There is thought to be a good prospect that the states of Montana and Idaho will soon follow the example of Arizona and Colorado in declaring for prohibition and there is a prospect that even Great Britain will do something. The Chancellor of the Exchequer, in a speech at Bangor, Wales, March 1, made the following significant remarks:

> Some workmen in the armament works refuse to work a full week's work for the nation's need. They are in the minority. The vast majority belong to the class that we can depend on, but a small minority of workmen can throw whole works out of gear by reason sometimes of one thing and sometimes of another. But to be perfectly candid it is mostly the lure of drink. They refuse to work full time and when they return their strength and efficiency are impaired through the way they have spent their leisure.
>
> Drink is doing us more damage than all the German submarines put together. Russia has stopped drink. Mr. Bark, the Russian Minister of Finance, with whom I conferred in Paris, told me that the output of Russian workmen had increased from 30 to 50% since the sale of vodka had been prohibited. He admitted that he had lost £56,000,000 in yearly revenue, which he certainly could not afford, but he added that if it was proposed to revert to the old conditions there would be a revolution in Russia. The stoppage of the sale of drink in Russia had been due entirely to the Czar, and it was one of the most heroic things of the war.

The sincerity of the Russian prohibition of alcohol has heretofore been acepted by some persons *cum grano salis*, but after these official statements there ought not to remain any doubt about it.

The Blast Furnace Vanquished

To adopt the military vernacular, the blast furnace is routed and is about to retire to a more strategic point—in the background. For a number of years the blast furnace held the premier position in copper smelting. In recent years this position has been hotly contested by the reverberatory furnace, especially since it was enlarged by the Anaconda practice to its present great length; this advantage was further increased by the adoption of oil firing, and now with the perfected application of pulverized coal as a fuel and the feeding of the furnace along the side, it seems destined to outstrip the blast furnace completely in many districts. This too at a place where the blast furnace has reached its highest development, namely, at Anaconda, where the long Mathewson blast furnaces did such excellent work that the length of the blast furnace has been extended at nearly every new copper smelting works, or wherever a copper furnace was reconstructed.

At Anaconda, for the last few years, the cost of briquetting part of the charge and smelting in the large blast furnaces has been about equal to the cost of concentrating, roasting and reverberatory smelting. Mr. Mathewson now announces that it is likely that blast-furnace smelting will soon be discontinued by the Anaconda company.

With the introduction of coal-dust firing and feeding the charges along the side walls of the furnace, Mr. Mathewson states that the tonnage of the reverberatory furnace has been so increased as to represent a saving in cost of 50c. or more per ton of charge. As the reverberatory and blast furnaces were on about an even keel before, this difference in smelting cost now gives the advantage decidedly to the reverberatory furnaces. As soon as all the reverberatory furnaces at Anaconda are equipped for coal-dust firing, blast-furnace smelting will be abandoned but the plant will be maintained in good repair so that the furnaces may be available in emergencies or at times when the price of copper is high and the maximum output desired.

Under the new plan, all ore will pass through the concentrator, and there will be no division of first- and second-class ore as heretofore made at Butte. With the lower reduction costs, practically everything between the walls will be available for treatment; the cheaper reduction will thus also cheapen mining and add to the life of the Butte mines.

Copper in Warfare

Elsewhere in this issue is an article on the consumption of copper in the warfare in Europe, wherein there is an English estimate of a consumption by the German and Austro-Hungarian armies at the rate of 112,000 long tons per annum; and a German statement that the German consumption is at the rate of 100,000 metric tons per annum. These estimates are interesting both for their close agreement and for the magnitude of the figures.

If the Teutonic allies are consuming 100,000 metric tons per annum, their opponents must be using a quantity that is at least as large, which would indicate a total of 200,000 tons, or 20% of the world's maximum production. At present the rate of production is materially less. Germany and Austria-Hungary are not buying copper outside of their dominions, but the British, French and Russian demands have been an adequate explanation of the large foreign buying of copper that has been going on since last October.

Flotation Oils

The mills using the flotation process employ a variety of oils, but pine oil is probably the most extensively employed. This is an oil obtained by the distillation of yellow pine in Georgia and Florida. The first distillate is a product from which turpentine and pine oil are got by refining. The next distillate yields pine-tar oil and other products.

The total production of pine oil in the United States is not very large and with the probable extension of the flotation process there is some question as to whether enough of it will be available. We estimated that about 1,000,000 tons of ore were treated by flotation in America in 1915, requiring about 3,000,000 lb. of oil, including pine oil, pine-tar oil, creosote oil, coal-tar oils, etc. An expert in the pine-oil trade estimates that the present production of that oil in the United States is about 20,000 bbl. = 1,000,000 gal. = 7,700,000 lb. per annum. There are a great many uses for this fragrant, agreeable oil other than in the flotation process.

If, however, there should some day prove to be a scarcity of pine oil a good many mills may turn to the use of pine-tar oil, which is produced in much large quantity and is materially cheaper than pine oil. An analogous product is imported from Scandinavia, but there is no use in anybody going so far abroad inasmuch as plenty of material corresponding in everything but in name is made in America. Reverting to pine oil, about two-thirds of the American product is steam-distilled, which process is considered to give superiority in quality. As the lips of the flotation operators become unsealed we shall hear a lot about the relative merits of the several oils.

The Juneau Gold Mines

It is interesting to draw attention to the beginning of the new gold production at Juneau, Alaska. The whole United States has in recent years been producing about $90,000,000 of gold per annum. A large proportion of this has been derived from the smelting of copper and lead ores, much of which yields a little gold per ton of ore, but a great deal in the aggregate. Of gold ores pure and simple the United States mines about 10,000,000 tons per annum. The three companies that are developing the great lode at Juneau contemplate the mining and milling of about 12,000,000 tons per annum, which is expected to yield about $18,000,000 in gold Thus from this single group of mines will be extracted more tons of ore than come from all of the gold mines of the United States at present; and they will make an output equivalent to 20% of the entire present production of gold in the United States. It may be five years before this program is realized, but the stamps of the first 1500-ton unit of the 6000-ton mill of the Alaska Gold Co. began dropping on Feb. 18.

BY THE WAY

The copper investments of Exploration Co., Ltd., now amount to over $1,000,000. At the recent annual meeting in London, Chairman R. T. Bayliss stated that the investment in the shares and bonds of copper-mining companies amounted to £220,129, more than £200,000 of which is in the Chile Copper Co., the Greene-Cananea Copper Co. and the Inspiration Consolidated Copper Co. The copper investments were increased £57,318 during the last year by the final payment on bonds of the Chile Copper Co., and by the purchase of 10,000 shares of Inspiration, which cost £35,748. The Exploration Co. is receiving 7% on its Chile Copper Co. bonds, which are also convertible into stock. Greene-Cananea is, of course, idle owing to the Mexican difficulties, and Inspiration has not yet come to bearing.

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One afternoon in the summer of 1908, when the promotion of Mexican mines was still active, a few mine-owners and engineers met at the Waldorf to see what might be the chances of doing something interesting with the Refugio mine. While chatting in the lobby, Jim Flinn of Chihuahua was recounting what had already been accomplished with the Palmilla by A. J. McQuatters, of Ft. Worth, introducing that individual to the rest of the party. As the talk progressed, along strolled a pleasant old gentleman who gave a bow of recognition. "There's a man who can tell you about the early history of the Palmilla," said Flinn. "Palmilla? Palmilla?" mused the old fellow, and a sickly grin spread over his countenance. "Yes, I sold my half-interest in that mine to the father of Pedro Alvarado for one hundred pesos, and I thought at the time that I was getting the best of the bargain. Oh, yes, indeed, I remembered the Palmilla very well." And Beckman sadly dismissed the subject with one of those gestures which one acquires perfectly only through long association with things Mexican.

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It is now announced that the Solvay Process Co. made an examination of Searles Lake in 1910 and discovered the brine to contain potash and other valuable salts. This was prior to any knowledge on the part of the California Trona Co. of the potassium content of the brine. From experiments, the Solvay Process Co. concluded that these salts were present in commercial amounts, but it was deterred from undertaking a potash enterprise by the difficulty of obtaining a good title to Searles Lake and its underlying brine. It is interesting to note that the San Bernardino Borax Co., which owns a small fraction of the crystal area of Searles Lake, is now conducting a pumping campaign to determine the effect of continued pumping on the physical condition of the well and the chemical composition of the brine. The Borax company patented its land many years ago. No other portion of the crystal body has been patented and the Federal leasing bill now before Congress contemplates the disposal of lands containing petroleum, phosphates and potash by leasing. Three applications for patent, however, have been filed by the California Trona Co. The rights of this applicant, as well as those of the holder of the earlier patented land, under the proposed leasing bill will doubtless be a subject of much discussion in the General Land Office this year.

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Death or injury resulting from "skylarking" among employees is covered by the Employer's Liability Act according to the New Jersey Supreme Court. This decision has just been handed down in the case of the dependents of William Hulley, a journeyman plumber, against Herman F. Moosbrooger, a boss plumber, of Somerville. Hulley died a year ago from injuries sustained while "fooling" with a fellow employee. Judge Daniel H. Beekman of the Somerset County Common Pleas Court awarded his dependents $6.20 a week for 300 weeks. An appeal was taken on the ground that the injury and death did not rise from Hulley's employment. The Supreme Court of the state of New Jersey confirmed the award. It apparently decided that it is natural to expect that young men will play pranks upon one another while at work and that injuries resulting from "skylarking" are covered by the Employer's Liability Act. So the employer must pay the dependents of the late William Hulley about $6.20 per week for 300 weeks because of the passing of William to some other realm as a result of the injuries he sustained while fooling with a fellow plumber instead of attending strictly to the business of plumbing. A little nonsense now and then is relished by all of us fool mortals; but when the courts get to playing such serious practical jokes on employers of labor, the latter class may quit subscribing to the New Jersey funny papers.

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In his book on Mexico, W. E. Carson makes a few of the blunders so common among authors who do not study thoroughly the language of the country they describe. The most ludicrous is the one where he speaks of an Indian hotel waitress as a "criador," thus unsexing the poor creature without deifying her. In the description of conditions at the Zavalete gold mine, near Oaxaca, a tribute is paid to the rough-and-ready Americans who put the mining properties of Mexico in conditions of commercial prosperity. But, in telling of the comfortable quarters and the road-building and other improvements installed by the inefficient Englishmen entrusted with the early exploitation of the Zavalete mine, the author either consciously or unconsciously reveals some of the prime factors which ultimately contribute to the efficient exploitation of such mines. Good trails and sanitary habitations alone do not make a mine; but a mining prospect without them often remains merely a prospect. In the western part of the State of Durango there is an excellent prospect which will eventually be a greater mine than it was in the days of the Spaniards; by them abandoned because of excessive loss of mercury in the patio-amalgamation of the complex ores. Several years ago an American rough-and-ready miner installed a small stamp and concentrator mill at the property, but a contagious disease at the camp bereaved him of wife and two charming daughters. Disheartened, he left the country, and the mill never turned a wheel or stamped a ton of ore. Such a mine *needs* a few fastidious Englishmen who insist upon conveniences for their morning tub, bah Jove; not to mention facilities for the safe and speedy transport of marmalade.

PERSONALS

Dr. John C. Branner has submitted his resignation as president of Stanford University, California, to take effect on July 31, next.

Dr. Willett G. Miller, provincial geologist of Ontario, has been awarded the gold medal of the Institution of Mining and Metallurgy, London.

Edwin E. Chase and R. L. Chase, of Denver, have been engaged in examination work in the Cripple Creek District for the past few weeks.

A. F. Main, manager of El Oro Mining & Ry. Co., Ltd., who has been in the United States for several months, leaves New York, March 5 for El Oro, Mexico.

C. R. Olson, formerly with Aurora Ore Purchasing & Reduction Co., is now mill superintendent Pittsburg Dolores Mining Co. at Rockland near Yerington, Nevada.

Guilford D. Scholl, who recently returned from an engagement in Australia, is now in the engineering department of Phelps, Dodge & Co. at Douglas, Arizona.

Fred G. Farish, of Denver, has recently been made manager of the Lluvia de Oro Gold Mining Co., Chihuahua, Mexico, and is now on his way to take charge of the property.

P. H. Argall, of Victor, Colo., has been in Denver defending his company—Stratton's Independence, Ltd.—in the suit brought by ranchmen who claim damages to their crops from mill tailings.

A. N. Nadeau, of Juneau, Alaska, one of the owners of the Jualin mine, was in Montreal recently. He was intending to sail for Paris on financial business but his trip was unexpectedly cancelled.

J. R. McWane, vice-president of the American Cast Iron Pipe Co., of Birmingham, Ala., has been elected president of the company, succeeding J. J. Egan, who has been made chairman of the board, a new position.

Joseph Daniel, assistant professor of mining in the Washington State University, is in San Francisco completing the installation of an exhibit from the mining department of the University at the Panama Pacific Exposition.

W. J. Loring, member of Bewick, Moreing & Co., London, is in San Francisco looking after interests of the company and paying a visit to the Panama Pacific Exposition. Mr. Loring has just returned from an inspection of the company's interests in Burma and Chosen.

Ricketts & Banks, New York, announce that the co-partnership heretofore existing between Pierre de P. Ricketts and John H. Banks terminated by mutual consent on March 1, 1915. From that date each carries on the same line of business independently. The address of Dr. Ricketts will be 80 Maiden Lane; of Dr. Banks, 61 Broadway, New York.

Arthur Crowfoot, who was employed at the Boston & Montana reduction department of the Anaconda Copper Co. for 19 years, has been appointed superintendent of the concentrator of the Arizona Copper Co. at Morenci, Arizona. During his term of service Mr. Crowfoot filled many different positions and had a wide experience in the operations of nearly all departments of the Great Falls plans. As chief sampler he had charge of testing and experimental metallurgical work that developed many features of the reduction processes used by this company.

OBITUARY

Otto Olsen of Trinity County, California, died at Redding on Feb. 14 of spinal meningitis. He was 35 years old. He was largely interested in gold mining in Trinity County, and was well known throughout Northern California.

W. F. Englebright of Nevada City, Calif., died at Oakland on Feb. 10, aged 57 years. He was born in Massachusetts and went to California when five years old, spending his boyhood in Vallejo. He was elected to Congress to fill the unexpired term of J. N. Gillett when the latter was elected governor. Englebright was twice reelected to Congress. He was largely interested in mining and his record in Congress was of work on behalf of the mining industry.

Thomas Henry Oxnam, one of the best known mining engineers on the Pacific Coast, died at his home in Los Angeles, Feb. 16. He was born Sept. 17, 1854, at Pool, Carn Brea, Cornwall, England, and as a very young man began his mining career in the tin mines of Cornwall. In 1875 he left England and spent two years in South Africa on railroad-tunnel work for the Government, and in 1877 came to America and settled at Virginia City, Nev. From 1877 to 1884 he worked in various mining camps of California, Arizona and Colorado. In 1884 he entered the employ of the London Exploration Co. and remained with it until 1895. During this period Mr. Oxnam was located at Marysville, Mont., De Lamar, Idaho, Elkhorn, Mont., and Harqua Hala, Ariz., and rose from foreman to mine manager of the famous De Lamar mine at De Lamar, Idaho. In 1895 he left the employ of the London Exploration Co., and became manager and consulting engineer for Capt. J. R. De Lamar. In 1901 he was made manager of the Palmarejo & Mexican Gold Fields, Ltd., Chinipas, Chihuahua, Mexico. Ill health caused him to leave Mexico and in 1907 he became associated with the Consolidated Arizona Smelting Co. as vice-president and general manager. From 1908 until his death he devoted his time to private practice. He is survived by his wife, three sons and one daughter.

SOCIETIES

American Institute of Mining Engineers—A meeting of the New York Section was held on Mar. 5, at the Machinery Club, 50 Church St., New York. Following a dinner George Otis Smith, director of the U. S. Geological Survey, opened the discussion of "The War's Opportunities to make America Mineralogically Independent," in which a number of prominent members took part.

A meeting of the Southern California Section was held Feb. 24 at the Hotel Clark, Los Angeles. W. L. Austin, of Riverside, Calif., read an important paper on the "Hydrometallurgy of Copper," which was generally discussed.

INDUSTRIAL NEWS

The General Filtration Co. announces that on Mar. 15 its Pittsburgh sales office will be consolidated with its executive offices in Rochester, N. Y.

F. O. Williamson, sales representative for the Hardinge conical mill, has removed his offices from Room 330 to Room 545 Old Colony Bldg., Chicago. Mr. Williamson has been identified with the Hardinge mill for more than six years.

Information as to sluicing or hydraulicking outfits, to be used in cutting away a dirt overburden to get down to gravel bedrock, is desired by the Sydnor Pump & Well Co., of Richmond, Va. Especially are information and prices on nozzles desired.

TRADE CATALOGS

Waterbury Co., 80 South St., New York. Catalog. Fibreclad wire rope. 24 pp., Illus., $3\frac{1}{2}$x6 inches.

Pelton Water Wheel Co., 90 West St., New York. Bulletin No. 8. Water wheels. 64 pp., Illus., 6x9 inches.

Wile Electric Furnace Co., 8066 Jenkins Arcade, Pittsburgh, Penn. Catalog. Electric furnaces for smelting ores, precipitates, melting metals, alloys, etc. 42 pp., Illus., 4x7 inches.

Chalmers & Williams, Chicago Heights, Ill., has recently issued a new pamphlet entitled "Modern Crushing Machinery." The machines that are featured are the bronze ball gyratory crusher, Symons coarse disc crusher, tube mill with adjustable quick discharge, ball mill, Symons fine reducing disc crusher and Burt revolving filter.

"Centrifugal Pumps" is the title of a 64-p. bulletin just issued by The Terry Steam Turbine Co., giving details and data on various turbo-pump applications. The principles of operation and construction of the centrifugal pump are clearly explained, as are the details of the steam turbines which have been successfully used during the last 10 years for driving them.

The Harbison-Walker Refractories Co. has issued a book "A Study of the Malleable Furnace," the third in its series of monographs. Its purpose is summed up in its own introduction: "It aims, however, to present the vital points in as clear and concise a form as may be, so that a fair understanding of its (the malleable furnace's) principles can be had by those to whom many of our valuable scientific treatises are by no means an open book."

Editorial Correspondence

SAN FRANCISCO—Feb. 24

Protection of Oil and Gas Wells from water infiltration by a system of state control, as provided in Senate Bill No. 916, is being generally approved by oil men interested. The system of district control conducted by voluntary subscriptions of funds by owners and operators of wells affected has proved satisfactory so far as it related to or concerned the persons affected by operation of the system. In carrying out this plan, the majority of well owners or operators in fields where the system is in progress, voluntarily supported the plan and have given themselves no concern about the minority who opposed the plan. In other words, they have made the best of their opportunities and gained a great deal of profit from their experience. But the voluntary plan cannot be made to operate in all parts of the state where it is necessary to protect the oil and gas wells from water. No satisfactory bill has yet been drawn providing for district control, and it is not believed by men acquainted with such operations that any law can be satisfactorily carried out with that end in view. There were some objections to the proposed state control in the beginning of the discussion between the oil men and officials of the State Mining Bureau. But much of that objection was based upon politics. There are a number of men in California representing various industries who would prefer to let things go uncontrolled rather than submit to the control of state administration. A larger proportion, however, of mining and oil men are inclined to any administration that will give them the sort of legislation they require. The chief advantage of state control of this branch of oil operation is that every oil operator or owner will be obliged under the law not only to protect his own property, but to do it in such a way that it will act as a protection of his neighbor. Another advantage is that the operation of the system will be under the control of one supervisor who is responsible to his superior, the state mineralogist. All of the district supervisors will be held accountable to the supervisor in charge. A board of arbitration is provided for so that no operator, owner, or community of operators and owners can be imposed upon by the action of the supervisor. Under this bill, if it becomes a law, the state mineralogist will have the choosing of the chief supervisor. The bill as it has been written contains numerous minor and possibly some major faults which can be easily corrected in committee. But as a whole, it should be satisfactory, or sufficiently so to insure it a practical try-out in the desire to protect the oil and gas wells of the state from further damage by water. One advantage the bill has over others that have or may be presented is the greater probability of its passage.

DENVER—Feb. 25

Another Crusade against High Grading has started in the Cripple Creek district. Operators complain that this practice is increasing. Feb. 23, Sheriff David Kingston arrested five miners who have confessed and implicated about twelve other men, including owners of assay offices.

Cripple Creek is resuming its former distinction as a busy place. During this winter, there has been a decided revival in activities. Leases are being sought more than ever before and are being more freely granted. Many small operations are being added to the district's relatively few large-scale operations. All mills are working to capacity, while several new mills are contemplated. There is no chance now to speculate in located claims for every square foot of the inside district is patented. Hence it is simply a matter of developing patented properties in a proved region.

A Tunnel Commission was authorized by public election in this city at the time of the general excitement, last summer, over the proposed driving of the Moffatt railroad tunnel through the Front Range, and it was made a bureau of the city of Denver. Doubt was expressed regarding the constitutionality of the city driving a public-utility tunnel; some persons declared it was merely a way of giving salaried jobs. The commissioners opened elaborate offices and these were maintained until the regular city commissioners refused to meet the bills further. There has been a nice controversy between the two sets of commissioners, each set having sound arguments to back their position. Right now the matter may come to a head for the city council has balked against the payment of bills submitted by engineers engaged by the tunnel commission to report on the project a year ago. City Attorney Isaac Stevens advises the council to stand pat on these accounts until fully satisfied that they are reasonable. This, therefore, leads to a public consideration of what constitutes a reasonable engineering fee. Bills of this kind were filed by the following who claim expenses and $100 per day: David W. Brunton, $1054; John W. Finch, $907; Jacobs & Davies, $1894.

Annual Meetings of mining companies are frequent here, this time of the year. Reports rendered at recent meeting of the Elkton Consolidated M. & M. Co. state that the mine, in 1914, produced 29,509 tons of ore with gross returns of $373,423, or close to $12.65 per ton. While this is only a fair grade of ore, the company was able to distribute $200,000 in dividends and accomplish over 3900 ft. of development. It will be remembered that this mine has no means for treating its ore as have so many of the large Cripple Creek mines. Election resulted in retention of last year's officers. At annual meeting of the Portland Gold Mining Co., the president announced the net profit for 1914 as $590,594. Of this, $360,000 was disbursed in dividends. During last year new development was nearly three miles, the total length of mine workings being now over 51½ miles. The Colorado City mill treated 62,997 tons ore, making recovery of about $23.25 per ton. The Victor mill is credited with handling 210,132 tons low-grade stuff—largely dump material—having average value of $2.56 per ton. This company also reëlected its 1914 officers, headed by Frank G. Peck, president. The regular annual meeting of the El Paso Consolidated Gold Mining Co. will occur Mar. 8, in Denver, but a special meeting of stockholders has been called for Feb. 25 to consider renewal of incorporation for another 20-year term.

SALT LAKE CITY—Feb. 20

Mine Taxation, as affected by any change in the tax laws, was discussed at a meeting between the members of the committee on revenue and taxation, mining men, and members of the State Board of Equalization, Feb. 16. The committee on revenue and taxation wants the constitution relative to the taxing of mining property amended, according to the Rideout and Page bill, which proposes to amend Section 4 of Article 13 of the constitution so that mining property may be taxed the same as other property. The State Board of Equalization wants the present law relative to taxing lands, etc., at their full cash valuation enforced, instead of on a general average of 33⅓%, but at the same time to have the tax rate reduced to a point where only the necessary money would be raised. The proposed Rideout and Page amendment of Section 4, Article 13 of the state constitution, that mining property be taxed the same as other property, would necessitate some method of arriving at the cash valuation of the mining property to be taxed. How such a valuation could be placed upon a mining property was the chief point at issue. The fallacy of placing a value on mineral ground on the basis of sales of adjoining properties, as is done in the case of real estate, was pointed out. Also that valuation according to the market value of the stock was misleading, as this depended upon the speculating public. The net-proceeds plan was held to be the most equitable basis. The State Board of Equalization proposes to treble the present assessed value of farm lands and other property, to fix the valuation of mines and mining claims at three times the net proceeds, and limit the tax levy to 15 mills per annum, while the tax on net proceeds, as such, is to be abolished. Speaking on this subject, R. C. Gemmell stated that the Utah Copper Co. and the Bingham & Garfield Ry. paid total taxes amounting to $201,427 in November, 1914. The assessed valuation of both companies in round numbers was $7,300,000, and the levy was at the rate of 27.3 mills. If the assessed valuation is trebled, making it $21,900,000, and a tax rate of 15 mills assumed, the amount of taxes would be $328,500, an increase of over 60%. This illustrates the great difference between taxes as they now are, and those which would be paid under the proposed plan. While other property has been assessed at a fraction of its value, mines have always been assessed on at least 100% of their net proceeds, and in some cases on 115 to 120% of their net proceeds. There would be danger that in the future mines would be discriminated against by gradually lowering the assessed valuation of other property, and if necessary arranging to have a new law passed raising the maximum rate of levy above 15 mills. By varying the assessed valuation, any desired result could be obtained in taxes on other property, but the mines would always pay on a basis of at least 100% of their net proceeds. The protection given to mines by Section 4 of Article 13 of the constitution, on the basis of taxation on annual net proceeds, was considered fair and just at the time the constitution was adopted. It was understood that this would serve as a guarantee that mines would not suffer from unjust discrimination and would never be called upon to pay more than their just proportion of the taxes. No especial favors are expected by mining men, who simply ask that justice be accorded to men and corporations which assume the risk that always accompanies the development of the mineral resources of any state. Others who addressed the meeting were: W. H. Dickson, C. E. Allen, T. P. Page, W. L. Mangum, W. Bailey, F. W. Kirkham, R. Tanner, and Walter Fitch. Much opposition to the measure has developed. The committee on revenue and taxation took the various proposals under advisement. No action has yet been taken

SEATTLE—Feb. 20

The Tolovana District has found no real pay as yet, according to the most reliable reports, although good prospects have been found on several creeks. There are many prospectors at work and indications are that the district will receive a thorough testing before spring. Marsh & McQueen, laymen on the Wheeler ground, No. 2 below discovery, Livengood Creek, are down 90 ft. with their shaft. Encouraging prospects have been found and the shaft will be continued to bedrock if possible. Dave Cascadan, who is prospecting with a small drill on No. 5 above, is reported to have obtained 25c. pans from the drillings, but whether the occurrence is such as to constitute a paystreak has not been proved. From the results of the prospecting done so far it is evident that the gold occurs in strata of clay-bearing gravel separated by layers of loose, barren gravel and is not concentrated in a definite paystreak. No shaft has yet been sunk to bedrock, except on some of the unimportant tributaries of the main creeks, but it is the general belief among prospectors in the district that a real paystreak will be found on Livengood Creek as soon as bedrock is reached. This belief is based on the reasoning that, where there is much gold at a considerable distance above bedrock there should be more at the bottom of the gravel. This theory is based on the experience at Fairbanks, Circle, Hot Springs and other adjacent mining camps, where the upper gravel is practically barren and the gold is concentrated in a thin paystreak next to bedrock. The occurrence of gold in layers of tight gravel near the surface on Livengood Creek indicates, however, that the sorting action of the stream has been less thorough than at Fairbanks and elsewhere and that there is thus less likelihood of the greater proportion of the gold lying next to bedrock. This has been the general experience in the Tanana; when the top gravel carries gold in important quantities there is not usually a corresponding concentration in the bottom layer of gravel and the probability of finding a paystreak is no greater than when the upper gravel is barren.

Changes in Mining Laws of Alaska are proposed from many sections of the North, and the second session of the Alaska territorial legislature, which will open March 1, at Juneau, will consider several of the proposed measures. That there will be changes there is no doubt as many of the members are pledged in their districts to see that they are made. Particularly will a change be made in the association-claim law, though not until after a spirited fight. Under the Federal mining laws, $100 assessment work was required on any claim regardless of size. Thus when an association was formed taking up eight claims of 20 acres each, only the same amount of work had to be done on the entire 160 acres. The law passed in 1913 made $100 assessment work obligatory on every 20-acre unit, whether part of an association claim or not, and it is this section of the law which the operators are endeavoring to have repealed. Those in favor of the repeal of the 1913 law hold that it works too great a hardship on those who have taken up claims and who are unable to get the required capital to work them at once. On the other side it is claimed that unless high assessments are charged against these association claims there is too great a chance of property being held for speculative purposes only. After years of operating under the Association Claim Law, many operators have acquired properties which could be injured by such a radical change as made by the 1913 law without providing some provision for protecting those whose rights were acquired under the operation of the original act. There are too many instances of old pioneers who have held their ground for years under circumstances and conditions which showed honesty of purpose and faith in the future of the country where the pencil-and-hatchet man has not been, or if so, has long since abandoned his claims because of lack of easy money in them. The great majority in the North are in favor of the repeal of the law of 1913 levying an assessment of $100 against every 20 acres for the reason of the injustice to those who have in good conscience sacrificed much in money, labor and time under the provisions of a law to which they had a right to look for protection. This ruthless taking away of what so many have worked hard to retain without passing consideration is causing much bitter feeling in all sections of the North country. The eight-hour bill will come up again. While the general eight-hour law was defeated at the last session, an eight-hour law for quartz miners was passed and is reported to be working out successfully. The bill this time will apply however to all forms of mining and considerable opposition will develop from the placer operators on which the law would work a tremendous hardship. They were the ones who last year caused its defeat. The principle argument against the adoption of the eight-hour law as to placer mining is from the fact that so little of the year can be used in many sections of Alaska for placer work. The provision for underground placer workers may go through, but because of the fact that the operators of open-air placers must make the most of the little time they can work, there will be a concerted attempt to defeat the bill insofar as it applies to them. While a workmen's compensation bill will be introduced its future is uncertain, as not one successful candidate for the legislature had it incorporated in his platform. There will also be several changes in the Roden mining law under which all staking of claims is now being done. Mistakes are being made in all sections of Alaska in the recording of all kinds of location notices and affidavits of labor because the people as a rule, be they staker or the person who makes out the paper, fail properly to interpret the law. Even attorneys in making out papers sometimes fail to make them correctly which, in itself is an evidence that the law is vague. It is freely predicted that unless some radical changes are made in this law, the courts of the North will be choked with litigation for the next hundred years.

NEWPORT, ORE.—Feb. 17

Summer and Abert Lakes in Lake County are a subject that the State Legislature, now in session, will soon be called upon to consider, and to ratify or reject a lease recently entered into between the State Land Board and Jason C. Moore, covering their beds and waters. Since the time when it was brought to public attention that the beds and waters of these lakes carried deposits of mineral salts, numerous parties have negotiated with the board for the lease to the premises. About two years ago the properties were leased to C. M. Sain, but owing to his failure to comply with the terms of his contract it was canceled. Since the cancellation of the Sain lease other applicants have appeared, and their coming prompted the board to advertise for bids. The bids were opened at the appointed hour and a lease awarded to Jason C. Moore of New York subject to ratification of the legislature. While the State Land Board had full power under the law to lease the properties, it felt the transaction was of sufficient importance and magnitude to demand submission to the legislature for ratification or rejection. At the request of former Governor West, the State Bureau of Mines made an investigation as to the extent of the deposits, also as to the feasibility of separating and marketing the commercial salts. The report of the said bureau is now on file with the clerk of the State Land Board.

Analysis of the water of these lakes shows the following:

	Summer Lake %	Abert Lake %
Potassium sulphate	2.04	2.63
Sodium sulphate	3.37	0.40
Sodium carbonate	41.75	26.70
Sodium bicarbonate	23.63	12.67
Potassium-chloride	28.70	57.40
Silica	0.53	0.23
Total	100.01	100.03

The existence of these deposits is the result of precipitation of the salts through the process of evaporation during the summer season. As the lakes are without an outlet, the only escape for the water is through evaporation. Summer Lake covers an area of about 15,500 acres, and Abert Lake an area of about 40,000 acres. The title to the properties is in dispute. While ownership is claimed by the state, there are many who insist that title is in the Federal Government and that individuals may enter and secure title under the mineral laws of the United States. By virtue of sovereignty the state owns the beds of navigable lakes and streams. If these lakes are navigable title must be in the state. If they are not navigable the title may be in the Government or the riparian owners, or it may have inured to the state under the Federal swamp-land grant. These are questions, however, for the courts to decide. The state, in order to fully protect its rights, must proceed upon the theory that it owns the properties. Should it develop, however, that title to these lake beds is not in the state, it would still be in position to control the situation, for an act of Congress of 1877, known as the Desert Land Act, provides that the waters of all non-navigable lakes shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes. The waters of these lakes have, therefore, been filed on by ex-Governor West, and are being held in trust for the citizens of this state, and the rights therein will, in due time, be assigned to such parties as may be favored with a lease at the hands of the legislature. The lease between the State Land Board and Jason C. Moore is for a period of 40 years It is made on a royalty basis, yielding the state 50c. per ton for potassium salts, 10c. per ton for sodium chloride, and 25c. per ton for all other commercial salts. Should the salts and other commercial products extracted in any one year be insufficient to yield royalties to the extent of $25,000, then the said sum shall be paid in lieu of said royalties as a rental for the year. Entering into the lease, the board exercised its best judgment. Members of a joint committee of the legislature are now investigating Mr. Moore, and the Portland Commercial Club and Chamber of Commerce claim to have found that he is responsible and will go ahead with the work if the lease is approved.

WALLACE—Feb. 20

A Railroad Up Beaver Creek, to afford an outlet for the Sunset section on the north side of the divide, is attracting much attention and it is believed that definite understanding has been reached with the O.-W. R. & N. Co. to construct a branch up that stream, a distance of about 10 miles, just as soon as the tonnage is in sight. The traffic manager of the railroad company was in conference with the directors and manager of the Interstate-Callahan company in this city about a week ago, and it is understood that by the time the mining company is prepared to deliver tonnage on the Beaver Creek side, the railroad company will be ready to handle it. Following the conference with the railroad official, the manager of the mine announced that the capacity of the present small mill near the mine on this side of the divide, and about two miles from the railroad, would be increased about one-third, evidently for the purpose of getting the greatest possible benefit from the high price of spelter, and in the meantime a crosscut will be run to give the mine a deep tunnel outlet on the Beaver Creek side.

The Interstate-Callahan Company, which is controlled by Duluth capitalists, many of whom are prominent in the iron-mining industry, has made overtures for the purchase of the Ray-Jefferson, which has great and valuable holdings west of and adjoining the big zinc mine and covers the extension of its great orebodies. It can be stated, however, that up to this time the Ray-Jefferson people have declined to enter into negotiations. The company is in the hands of Wallace and Montana men who have ample means to develop the property, and who fully appreciate the fact that the next few months will make a wonderful difference in its value. Even now the company contemplates erecting a mill this summer, and development now in progress, together with recently acquired ground, will greatly increase the amount of ore, both lead and zinc, that is in sight. That Ray-Jefferson would be a highly valuable addition to the holdings of Interstate-Callahan is apparent, for it would not only greatly increase its ore reserves, but it would also simplify the question of a permanent millsite and railroad transportation. The Interstate-Callahan is a very strong corporation and it has the making of a great zinc mine With the great financial resources at its command, it would not be surprising if eventually the big zinc company should make a proposition that the Ray-Jefferson would not feel justified in turning down.

DEADWOOD—Feb. 25

Harney Peak Tin Mining Co. has been purchased by C. H. Kamman, of Hill City, S. D., for a number of years superintendent of the properties, who thus becomes owner of lands and improvements in Pennington and Custer Counties that represented a cash outlay on the part of the original corporation of close to $5,000,000. Nearly thirty years ago the Harney Peak Tin Mining, Milling & Manufacturing Co. was organized by New York parties Much of the stock was placed in London, and with a treasury abundantly supplied, work was commenced under the superintendence of James Wilson. A vast acreage was purchased, much of it at exhorbitant prices, and two tin-milling plants erected. One of these was at the Etta mine, near the present town of Keystone, and the other at Hill City. As is the case with many properties where mills are constructed before the mines are sufficiently developed, milling proved a failure, and all work was discontinued. Later Dr. A. R. Ledoux of New York was appointed receiver, and in 1909 he was instrumental in organizing the Pahasa Mining Co., which took over the assets of the original corporation. This company made a careful examination of the property and offered for sale all but the choicest portions. A very large proportion of the machinery has been disposed of, and of the two big, fully equipped mills, little remains but the buildings. The many mining plants, a score or more in number, which were erected at various mines, have been sold, their hoisting engines, compressors, boilers, pumps, etc., going to other properties in the Black Hills. Among the valuable assets were many placer locations covering valuable agricultural lands in many of the fertile valleys of the Southern Hills; some of these were disposed of. Mr. Kamman has purchased, as has been stated, the remaining interests, which include a number of highly regarded tin prospects, the machinery, buildings, placer claim ranches and the townsite of Hill City. It is stated that at the figure at which he purchased he will be able to secure a good return on his investment, merely from rentals of farms and town lots, so that in this way his property will be self-supporting aside from the mineral portion, which has great possibilities.

HOUGHTON—Feb. 25

The Douglass Houghton Monument, dedicated at Eagle River, Keweenaw County, Oct. 10, 1914, is composed of irregularly shaped pieces of typical copper-country and iron-country rocks. Prof. Hopper of the Michigan College of Mines has prepared a description of the several specimens. The most noticeable rock in the monument is the large angular piece of typical Keweenaw greenstone, in which the tablet is imbedded and which rests upon the base of the monument. This greenstone forms the high bluff extending along the west side of the valley from Cliff to Phoenix and Central. The other important rocks are: Calumet & Hecla conglomerate, foot-wall trap of the Calumet & Hecla conglomerate, hanging wall of the Calumet & Hecla conglomerate, great conglomerate, sandstone from Eagle River, amygdaloid from the Eagle River group, amygdaloid from the Ashbed group, trap from the Ashbed group, Ashbed lode, ophite, gabbro, calcite, mohawkite, native copper, Kearsarge amygdaloid, Osceola amygdaloid, sandstone from Portage Entry, copper-bearing conglomerate from Isle Royale, white marble from Dickinson County, banded jasper from ~~the~~ Marquette range, hard steel ore from the Marquette range, birdeye diorite from the Marquette range, Goodrich quarzite from the Marquette range, granite boulder from Eagle River.

The Trend of Exploration in the copper country is an interesting thing to observe. When the district was opened, over 60 years ago, production centered around the extreme ends of Keweenaw Point. In the vicinity of Eagle Harbor, Copper Harbor, Phoenix and other villages in Keweenaw County, such mines as the Phoenix and Cliff were the big producers, while almost 100 miles to the southwest, Ontanagon County had such mines as the Minnesota, National, etc. These properties, however, were mined principally for mass copper and with the discovery of the Calumet conglomerate near Calumet, a new era opened for the copper country. The original mass copper mines lost their importance and soon dropped out of sight and existence. For many years after, and including the present, the great amygdaloid and conglomerate mines in the vicinity of Houghton, Calumet and Hancock, also on the south range, have furnished the production of copper from the district. About 10 or 12 years ago, however, exploration activities were directed further to the south and north, notably at the White Pine, then known as the Nonesuch, and at the old Phoenix and other properties. Of course, though, it was amygdaloid or conglomerate deposits that were being sought. There is no question but that these explorations have been more or less successful At the White Pine, for instance, it has led to the construction of a 1000 ton mill, with underground developments in proportion The success here has led to other explorations in the vicinity At the north end, work continues at the Keweenaw properties, and is not unlikely to extend to other lands in the general vicinity. While it would not be particularly surprising, it would be unusually interesting if the two extremes of the district should come back into their own after a period of 50 years. There is much still to be learned and found in the Lake Superior copper country, and there is every indication that, if money and well directed efforts can find it, it will be found

The Mining News

ALASKA

ALASKA GARNET MIN. & MFG. CO., operating garnet mine near mouth of Stikine River, plans to ship 12 tons of garnets to be offered for sale at Frisco exposition.

AMOK (Unack)—Will start 10-stamp mill on Mar. 1. Force of 16 men in mine and mill.

No. 6, BONANZA CREEK (Shushana City)—On 11 and 12 upper Bonanza a cut of 5 ft. shows ground carrying $3 per sq.ft.

ROLAND & McDANIELS (Ruby)—Operators have obtained pans running as high as $2.25 on Alabam association claim at mouth of Straight Creek. Depth to bedrock is 80 ft.

14 BELOW, CLEARY CREEK (Fairbanks)— Magnusson & Hansen and Sam Weiss, operating on 14 below, Cleary, have driven into pay. Troseth & Carlson, on 10 below, Cleary, have also discovered pay.

NO. 6 BELOW, ESTER CREEK (Fairbanks)—Charles Lynn and company, operating on this claim, were recently drowned out. The ground is 140 ft. deep and, although in good pay at the time they struck water, the operators have decided to abandon the lease rather than sink a new shaft.

KYAGANA CREEK (McCarthy)—Conrad J. Miller has taken in drill to prospect Kyagana Creek, which enters Chitina River 80 miles below McCarthy. Some prospecting was done last summer but water prevented thorough testing. Deepest shaft sunk, 17 ft., showing entire deposit to carry gold.

GOLDEN EAGLE (Golden)—Five-stamp mill at Golden Eagle mine has been completed. Will be run by water power but will not be started until spring. Tunnel driving to tap vein at 300 ft. is in 300 ft. has about 50 ft. to go. Considerable development work has been done on other veins owned by company.

MOTHER LODE COPPER MINES CO. (Kennecott)—Operating across divide from famous Bonanza mine, is shipping to Tacoma smeltery. Ore averaging 50 to 60% copper. Hauled by horses distance of 14 miles from end of tram to railway station at McCarthy. Company plans to ship more than 1000 tons before spring thaw stops hauling.

SLENNING & SLEPSOE (Fairbanks)—Nugget Creek a tributary of Goldstream, shown to have paystreak. There are 16 men working on creek and five shafts sinking. Slenning & Slepsoe, working with windlass and small prospecting boiler, have driven 118 ft. through ground estimated to run $1 per sq.ft. of bedrock.

ROGERS & KELLEY (Fairbanks)—J. C. Rogers and Michael Kelley have located 70-ft. lode on Wood River, 80 miles from Fairbanks. The lode where exposed is cut by deep cañon and can be developed in two directions at once. Abundance of water and coal for power near at hand. Little development work will be undertaken pending construction of government railway to Interior.

DENVER ASSOCIATION (Rampart)—Archie McIntosh and associates have taken five-year lease on Denver Association claim on Volcano Creek, a tributary of Clum's Fork in Birch Creek district. Ground has been thoroughly prospected and arrangements have been made to install hydraulic plant. Half-mile ditch will furnish at least three sluiceheads of water during driest part of season.

JUNEBUG ASSOCIATION CLAIM (Ruby)—Powell, Wolff & Bailey have found rich pay on lower end of claim, on Tamarack Creek. One pan taken in testing yielded $6 and 20 pans averaged $1 each. On upper portion of Junebug, McGillis, Cowan, Collins & Floyd have fair pay. About 3500 ft. upstream from Junebug claim, Crary & Olsen have pay said to go $1 per sq.ft. across a width of 40 ft.

ARIZONA

Greenlee County

ARIZONA COPPER CO. (Clifton)—Is increasing its production.

DETROIT COPPER CO. (Morenci)—Is again working full time in all departments.

SHANNON COPPER CO. (Clifton)—Work at mines at Metcalf has been resumed and smelting plant will be blown in in a few days.

CALIFORNIA

Amador County

BUNKER HILL (Amador City)—High-grade ore is being extracted from the 2100-ft. level.

ORIGINAL AMADOR (Amador City)—Reported important changes will be made in milling plant and that Hardinge mills will be installed. Stamp mill has 20 stamps and crushes about 90 tons per day. Expected that changes will increase tonnage to about 200 tons per day.

Butte County

ORO WATER, LIGHT & POWER CO. (Oroville)—First payment has been made on dredging ground at Clear Creek, near Redding, in Shasta County.

Calaveras County

BRUNNER (Angels Camp)—Work has been resumed and drifting on the vein is progressing.

FINNEGAN (Carson Hill)—Work recently resumed and mill will again go into commission.

JACK RABBIT (Angels Camp)—This gravel mine at Dogtown has been unwatered and development will be resumed. Tunnel is 2000 ft. long.

NUNER (Mokelumne Hill)—Gravel reported to average $3 per car being extracted from this mine on Stockton hill. Property is equipped with a mill. Two years have been spent in development.

MAGEE & MEGAW (Mokelumne Hill)—New mill being installed at this gravel mine on west slope of Stockton hill. Mine was worked a number of years ago and developed by 2000-ft. tunnel.

Eldorado County

LITTLE VALLEY (Brandon)—Property sold at sheriff's sale on account of mortgage for a small amount.

Inyo County

SKIDOO (Skidoo)—The five-stamp mill is being equipped with electric power.

HARRISBURG (Ballarat)—The mine is equipped with 10-stamp mill. Cyanide plant will be installed.

MINNIETTA (Johannesburg)—H. H. McCarthy has leased this mine situated in Argus Range northwest of Trona. Ore is hauled by autotruck 20 miles to Trona for shipment by rail.

Kern County

TUNGSTEN reported to have been discovered on property owned by D. E. Thompson near Randsburg.

SUNSHINE (Randsburg)—Second recent strike of good ore disclosed on the 500-ft. level. Mill is running steadily and seven men are employed.

KAOLIN reported discovered at Black Mountain a few miles northwest of Randsburg by Manuel Rodgers. Clay has been tested and said to be of commercial value.

MONTE CHRISTO (Randsburg)—Neal & Sons have taken a lease on this property situated east of the Good Hope and south of the Butte and King Solomon. Property owned by J. T. Roberts.

WINNIE (Randsburg)—Murphy & Garnier, of Butte and San Bernardino Counties have taken lease on part of this property; 50-ft. shaft will be deepened and property developed. Koehn & Cram working main ledge are crosscutting 225-ft. shaft level. Prospects good for opening up high-grade ore. Crittenden & Keller working lease on another part of this property, extracting ore from the 80-ft. level. Ore will run about $100 per ton.

Merced County

MERCED RIVER MINES CO. (Mariposa)—Fourteen claims situated above Tarantula Flat owned by R. A. Keller, of Coulterville, have been bonded to San Francisco men.

Nevada County

IDAHO-MARYLAND (Grass Valley)—Negotiations looking to renewal of bond are reported to be in progress by George W. Nellis representing men who formerly operated property. Mine is equipped with complete hoisting and pumping plant and 40-stamp mill. S. P. Dorsey and others are owners.

RAGON DEVELOPMENT CO. (Nevada City)—Organized to take over and develop Ragon and Mt. Auburn claims, which are said to be on extension of Champion vein. R. H. Countiss of Chicago and R. Chester Turner, general manager of the Brunswick Consolidated, are interested in the enterprise.

Orange County

SILVERADO (McPherson)—This old mine has been reopened. Ore is shipped to Selby. Five new shoots of ore reported disclosed by tunnel.

Plumas County

MOUNTAIN MEADOWS DREDGING CO. (Greenville)—Reported that dredge will be installed in the present year. Property consists of 3000 acres, eight miles from Greenville. Property was located by Lloyd Baker, of Chicago. E. E. Stirling, of New York is now in charge.

Riverside County

THE ONE-STAMP MILL installed by Charles Reches northeast of Banning is producing $15 per day.

San Bernardino County

ORANGE BLOSSOM MINING CO. (San Bernardino)—John Denair and associates have filed an appeal from decision of local court recently made requiring the books of the company to be produced in court. The company was financed largely by local stockholders.

Shasta County

ASBESTOS CLAIMS on Mears Creek west of Sims have been sold by E. W. Hayden, of Oakland to H. L. Smith. There are 44 claims, and the purchase price is said to be about $8000.

MOUNTAIN COPPER CO. (Keswick)—Mining resumed at Horner mine employing 40 miners. Another crew of men is employed at Iron Mountain mine preparing for resumption there.

RUSSELL (Igo)—Keystone drill has been installed, ready for extensive prospecting of ground formerly known as the Russell Ranch. Good values have been disclosed in former prospecting on the bedrock.

VICTOR POWER & MINING CO. (Knob)—Eighty-five men are employed by this company in Harrison Gulch district. Cyanide plant running full time treating tailings in old dumps. The three mines Victor, Gold Hill, and Midas are being developed on large scale.

DREDGE will be installed on Bulls Bar south of Copley on Sacramento River by Dr. James M McIntyre, of Sacramento. The dredge is to be 100 ft. long and 40 ft. wide, to cost about $25,000. Nine claims are to be worked. Press Lockhart of Centerville is superintendent.

Trinity County

LA GRANGE (Weaverville)—Half a mile of flume in the 4-mile line leading from Stuarts Fork, Trinity River, was washed out by recent storm. Repairs immediately undertaken.

Tuolumne County

SUGARMAN (Sonora)—Reported that Robert Watson and Charles Smith have made a strike of rich ore

SPRINGFIELD TUNNEL & DEVELOPMENT CO. (Sonora)—The drainage tunnel is now in more than 2400 ft. A station has been cut and a raise will be driven to tap the gravel channel above.

RAWHIDE (Jamestown)—Reported that John L. Whitney who developed Atlas mine has secured bond on the Rawhide from Alex Chalmers, who represents control of property which is held by Patterson Estate of Fresno.

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—New hoisting plant will be installed at 1905 shaft. Shaft will be sunk to about 500 feet.

HOMESTAKE MINING CO. (Boulder)—West heading of 280-ft. level from main shaft is being advanced toward Ward Rose property. Drift is developing payable ore ranging in value from $60 to $80 a ton. The company intends to develop property as rapidly as possible. J. E. Yearick is manager.

FOREST MINING CO. (Wallstreet)—Main shaft is 300 ft. deep and sinking in progress to 400-ft. level. Vein has been opened for length of 200 ft. and has width of 5 ft. in new development. Considerable low-grade ore has been developed ranging from $5 to $10 a ton. The property has recently been placed in good repair and equipped with an electrically driven mining plant. A. H. Scruggs is manager.

Clear Creek County

LITTLE EDGAR (Idaho Springs)—Lessees French & Horn will develop and operate west workings of this property through Big Five tunnel. Work has commenced.

TENNESSEE TUNNEL (Idaho Springs)—A contract will be let to advance this tunnel 1000 ft. to develop veins west of Little Mattie and Silver Glance properties in Freeland District.

SUN & MOON (Idaho Springs)—Lessees Olson & Co. are advancing east drift from tunnel level. Large body of low-grade ore being developed and mined. Material is shipped to Argo mill for treatment.

GOLDEN EDGE (Idaho Springs)—A winze which has been sunk 80 ft. below tunnel level has opened body of low-grade ore It will be sunk to 110 ft. and drifts driven on the vein. J. P. Ruth is superintendent.

VITAGRAF MINING CO. (Idaho Springs)—This company has lease on block of ground in Big Five tunnel. A winze has been sunk to a depth of 60 ft and payable ore has been opened. Sinking will continue and drifts will be driven on the vein.

PEWABIC MINING & LEASING CO. (Idaho Springs)—This company has a lease in Big Five tunnel on block of ground 500 ft. long, east of Vitagraf Co's ground Development work will begin at once and a winze sunk 100 ft. on the vein. Ed. Quigley is manager.

Eagle County

ALPINE (Red Cliff)—Pool of Leadville men is developing mine under lease and reports striking vein of gold-silver ore from which shipments will soon begin.

Lake County

GARBUTT (Leadville) Daily production continues close to 200 tons of 1-oz. gold ore.

LITTLE CHIEF (Leadville) Lessee Austin Blakey has begun shipments of zinc-carbonate ore.

NEW VINNIE (Leadville)- This mine, contiguous to the Ibex property and under lease to Cortellini and Hahnewald, is showing up well in drift from Little Jonny No. 1 shaft and will soon become regular producer.

San Juan County

HERCULES CONSOLIDATED MINING CO. (Silverton) On March 10, the entire property of company, in Animas Mining District, San Juan County, will be sold at sheriff's sale in Silverton to satisfy a judgment amounting to about $87,100 Property includes 25 lode claims, 13 of which are patented; 13 mill sites, of which 9 are patented, six tunnel sites; the Whitman flume and water right and Melville Mining and Reduction Co.'s water right. Bulk of property is on Sultan Mountain.

San Miguel County

LAKE SUPERIOR-OPHIR MINING CO. (Ophir) - Short tramway from mine to mill is complete and in satisfactory operation. Development in progress in lower level of mine and pay ore now being opened.

BLACK BEAR (Pandora)—Tramway, which was recently damaged by snowslide, is again in operation. Enough ore be ng delivered to the Smuggler-Union mills to supply 20 tamps. Systematic development in progress in the mine, nd four levels are opening milling ore of encouraging alue.

Teller County

MONUMENT (Victor)—Rose and Cammenish, lessees have 3-ft. shoot of 1-oz. ore.

ISABELLA (Altman) - High grade was recently found on 5th level of Empire shaft by lessees

JOHN A. LOGAN (Cripple Creek)—Ordered new compressor with capacity for 25 additional drills.

HALF MOON (Cripple Creek)—Palace Leasing Co. will install air drills and push development

PINTO (Independence)—In addition to rich ore, mill is treating much low-grade stuff assaying less than $4.

ANCHORIA (Cripple Creek)—Inactive for years, again on shipping list. Plans made for extensive development.

MARY McKINNEY (Anaconda)—All company operations will be suspended below 7th level while shaft is being sunk 100 ft from 1100-ft station.

DOCTOR-JACK POT (Anaconda)—Starkweather and Potts, leasing the Ingham vein, are developing 20-ft. shoot said to run nearly 1 oz. gold per ton.

ABE LINCOLN (Cripple Creek)—A 4-ft., $15-per-ton orebody has been found on 5th level west of shaft by lessee who has developed it about 100 ft.

GOLD KING (Cripple Creek)—This Poverty Gulch mine has been for some time under lease to Owen Roberts, who produces about 20 cars of low-grade ore per month.

SITTING BULL (Independence)—New lift of 250 ft. will be sunk in main shaft while developing proceeds in upper levels. An electrically driven compressor is being installed.

BUENA VISTA (Independence)—Development being pushed on level 13 where vein is 5 ft. wide, shipments running about 1½ oz. gold per ton. Campbell lease shipping from strong shoot at junction of Buena Vista and Cheyenne veins.

VINDICATOR (Independence)—Slime-treating addition is being made to new concentrating mill that now handles nearly 100 tons per day. A steel headframe will be erected over No. 2 shaft. Systematic development maintains good ore reserves.

C. O. D. (Cripple Creek)—Freiberg lease has discovered a 3-ft. vein, of which 8 in. assays 15 oz. gold per ton. Sinking will be continued to depth sufficient for drifting and stoping. Owners propose to sink main shaft 500 ft. more and develop at greater depths.

C. K. & N. (Cripple Creek)—Three sets of lessees are producing good ore, some shipments running 4 oz. gold per ton. Strong oreshoots have been disclosed within and in contact with a 20-ft. phonolite dike that previously proved productive in Old Gold, Lonaconing and Henry Adney mines.

IDAHO

SUNSET BANNER (Wallace)—Two feet of zinc-lead ore exposed in drift which promises importance.

INTERSTATE-CALLAHAN (Wallace)—Machinery arrived for addition to mill increasing capacity from 300 to 400 tons. Northern Pacific engineers now in Nine Mile said to be endeavoring to locate line to mill.

MICHIGAN

Copper

AHMEEK (Ahmeek)—No increase in production for at least 3 months, because of no milling capacity. Within 30 days after the resumption of full-time operations at mines in this district every stamp head is working full tilt. Subsidiaries of Calumet & Hecla are working to capacity owing to destruction of the Isle Royale's 3-head plant. Two more heads in Ahmeek mill will be ready for operation not later than May 15. The work on their installation is going forward rapidly. The Ahmeek has two heads beside these which can be put into condition for work in a few months.

Iron

PALMS (Bessemer) Nearly 1000 men are now employed at this property, rushing work on lease which has not long to run. There is still a large orebody to be taken out. This mine is controlled by the Newport Mining Co

RAVENNA (Crystal Falls)—Hollister Mining Co. closed this property last week, throwing 130 men out of work. Local management does not know how long mine will be idle, but pumps will be kept in commission. No reason given for shutdown

BALKAN (Alpha) Stripping operations will be resumed here with drag lines about May 1 New level is being opened 100 ft. below the first level, which is 160 ft. below surface. New level being opened up with drifts and raises ready to supplement first level when milling operations commence next fall The opening up of this level so far in advance will drain the orebody above and make mining easier.

INDIANA (Iron Mountain)- Drift on 90-ft level almost completely filled with sand a few days ago. Work of reopening mine was started a few weeks ago by Thomas Furnace Co., of Milwaukee It was supposed that drift was low enough to find solid ground, but it developed that there was a deposit of fine sand occupying a trough whose bottom was below level of drift. Work of clearing out sand is now in progress

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Some difficulty has been experienced in keeping this concrete drop shaft straight during sinking It has been found necessary to change from clam shell bucket to pick-and-shovel excavation in bottom of the shaft

Mesabi Range

LEONARD (Chisholm) Large coal docks are being constructed here for Arthur Mining Co., the Great Northern subsidiary

HAWKINS (Nashwauk)—New shops of steel construction have been completed Much of old machinery has been replaced by new and uptodate equipment. A club house for company's employees has also been erected

MISSOURI-KANSAS-OKLAHOMA

S. PATRICK & SONS (Galena, Kan.)—This company has one of richest openings in district on N. J. Ryan lease, southeast of Galena. Will assay 30% as hoisted. Company has had trouble with soft ground but believe it to be safely timbered now.

PORTIA MINING CO. (Galena, Kan.)—Struck good body of zinc ore at a deeper level than heretofore worked. This is a new mine on old tract. Recently opened, and now making good returns. Mine has good ventilation as it recently drilled air holes and cased them so as to give the drifts good air. Two more mill propositions have been let by Mr. Ping. Will be in operation before long, the parties having machinery ready to move up on ground.

MONTANA

Granite County

MONTANA PHOSPHATE CO. (Maxville)—This company capitalized at $5,000,000 and financed in New York, was organized to develop Philipsburg phosphate beds, and has planned to construct a mill at Maxville after having executed a contract with a Japan firm to furnish 80,000 tons of phosphate annually. Product is guaranteed to contain 62% phosphate of lime. John D. Field, in charge of the operations, says Montana phosphate can be put on market for $2 or $3 lower than any other.

ROYAL BASIN (Maxville)—At a conference held in Butte Feb. 16, between John D. Field, member of the Royal Basin Mining & Milling Co. at Maxville, and Sanford McKeever of New York, it was decided to sink a 2000-ft. shaft from the 200-ft. level of the Royal Basin property developing levels at every 200 ft. Ore will be treated by a leaching and flotation process evolved by Mr. Field. The mill has capacity of 500 tons. Mr. Field will hereafter devote his time to the Field's Metal Recovery Co., a new $5,000,000 corporation which will build a 100-ton testing plant at Butte or Maxville.

Silver Bow County

BUTTE-BALLAKLAVA (Butte)—After having been down for several weeks to permit retimbering of shaft and making other improvements, mine resumed operations on Feb. 15 under direction of leasers. Production will reach 100 tons per day. Shaft sinking from the 1600- to the 2000-ft. level will be carried on as well as development work on lower levels. About 50 men will be employed.

LA FAYETTE (German Gulch)—A lease on these claims was given to C. M. Lane by O. Rouleau and E. R. Page. Option is for $165,000. Claims are at head of German Gulch near Durant, and comprise the La Fayette and five other claims. McLane is to begin work by Mar. 1 and patent claims in the name of the lessors and to pay them a royalty of 25% of net profits. Samples of the ore have run as high as $70 and $75 a ton in gold. Development work comprises between 700 and 800 ft. of tunnels. Another lease was given by Perry Beal and associates to James Breen of Spokane for five claims adjoining the La Fayette group. Ore in this group assays between $7 and $8 a ton. Property is well developed. On surface ore shows a width of 40 to 60 ft. Both groups are low-grade propositions and will use cyanide process.

NEVADA

Churchill County

GOLD STRIKE NORTHEAST OF BROKEN HILLS DISTRICT. Will be developed by San Francisco men.

Esmeralda County

GOLD STRIKE AT KLONDYKE made recently. Shallow shaft opened 2-ft. shoot of ore showing free gold. Ore being sacked for shipment.

BLUE BULL (Goldfield)—Development work resumed; work confined to 700-ft. level.

LONE STAR (Goldfield)—Hoisting plants installed at two shafts and development work progressing at both points.

GOLDFIELD SHALE MINING CO. (Goldfield)—Operating lease on Spearhead ground installed hoisting plant; will sink at once to 750-ft. level.

JUMBO EXTENSION (Goldfield)—Shipments of 100 tons of $80 ore made daily. Two oreshoots of importance in addition to main oreshoot opened recently.

YELLOW TIGER (Goldfield)—Machinery recently damaged by fire replaced and new compressor and motors received. Work will be resumed on 700-ft. level where shipping-grade ore exposed.

Lyon County

RESCUE (Yerington)—Two-foot oreshoot assaying $100 per ton cut on 180-ft. level.

APRIL FOOL (Manhattan)—Mill run netted $50 per ton; development work progressing steadily.

VALLEY VIEW (Manhattan)—Recent milling test gave satisfactory results; considerable milling-grade ore opened.

BULL HEAD (Manhattan)—Formerly known as Gold Crater. Shoot of enriched schist cut in drift on 150-ft. level, supposed extension of Big Pine shoot.

EMPIRE NEVADA (Yerington)—Lessees Oberg & Taylor are sinking new shaft in ore, shipments will be made to Salt Lake. Other lessees are working.

JIM BUTLER (Tonopah)—Production from Wandering Boy shaft now 50 tons daily, from 6th, 7th and 8th levels. Development work progressing with satisfactory results.

Storey County

MERGER OF GOLD HILL MINES made; includes Crown Point, Belcher and Yellow Jacket. Combined resources will permit development work that any one company could not undertake.

Washoe County

NEVADA'S MINERAL EXHIBIT has been shipped to San Francisco and will be installed by Prof. J. C. Jones and J. H. Price, of University of Nevada. Exhibit includes high-grade ore valued at $20,000.

NEW MEXICO

Grant County

CHINO COPPER CO. (Hurley)—New turbine engine being installed at power plant.

JIM CROW MINE (Steeple Rock)—Shipments to begin. Unwatering completed. Branch railroad from near Duncan to Steeplerock reported under consideration.

SILVER GLANCE MINING & DEVELOPING CO. (Silver City)—Company has filed incorporation papers. Capitalization $25,000. Have holdings near Cliff, N. M. Baylor Polk, R. P. Barnes and C. C. Royall, incorporators. Expect to do immediate development work.

Sierra County

BARNEY CABALLERO MINE (Kingston)—Two-year lease and bond taken on claims. Shaft sinking in progress. Reported compressor and drills to be installed.

SOUTH DAKOTA

Lawrence County

SNOWFALL THIS WINTER, to Feb. 17, totals 50¼ in. as measured by the Government's voluntary observer at Deadwood. All but a few inches of this has fallen since the first of the year. A generous supply of water for mining purposes thus seems assured for the coming summer and fall. Wasp No. 2 company is working day shift only in the opencut and producing about 250 tons daily. Other producers have been enabled to operate at full capacity despite weather conditions.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Feb. 12 amounted to 79 cars; those for week ended Feb. 19, to 50 cars, by seven shippers. The lowered tonnage is due to recent severe snowstorm, which prevented many properties from shipping. Damage was done to power and telephone lines. The advance in the price of spelter will enable May Day, Lower Mammoth, Gemini, East Tintic Development, Yankee, and others, to mine ore carrying as low as 24% zinc.

Piute County

ARMOUR & CO. of Chicago and Florence Mining Co. of Pittsburgh preparing to open alunite deposits in vicinity of Marysvale. Contracts signed to furnish these companies several million board feet of lumber for building material and cross-ties for tramways. Beaver River Power Co. has let contract for $350,000 plant on the Beaver River and Florence Mining Co. purchased 10 acres of land to erect power plant on the Sevier River.

Salt Lake County

CARDIFF (Salt Lake)—Work in raise continues, but no effort is made to break ore, owing to adverse shipping conditions.

WASATCH MINES (Alta)—This company whose property embraces former Columbus Consolidated has two cars of ore ready for shipment.

ALTA CONSOLIDATED (Alta)—Three cars of ore of good grade have been accumulated. The ore recently opened has been drifted on for 50 ft., averaging ½ to 2½ ft. thus far. A raise is up 35 ft. with ore in the breast.

Tooele County

DULUTH-UTAH (Stockton)—A dividend of 4c. per share has just been paid, amounting to $2250, as a result of part payment for claim sold to E. J. Raddatz and associates for $15,000. In all $12,000 will have been paid since April, 1914.

VIRGINIA

S. L. BOGGS of Ivanhoe, developing zinc mine, will build 100-ton mill this spring.

WASHINGTON

BLACK PINE will install five additional stamps in its mill, according to Hunter B. Supplee, formerly manager now president of company.

LAST CHANCE (Northport) lately acquired by Norman Lead Mines Co. of Spokane, will start development at once. A 1500-ft. tunnel will be driven to cut vein 770 ft. on its dip. Sidney Norman is manager.

CANADA

British Columbia

BRITISH COLUMBIA COPPER CO. (Princeton)—Will build concentrator at Princess camp near Princeton, B. C., where diamond drilling has proven much ore. Company has good force at work during winter and accommodations for large mining population have been constructed. It is reported that railway construction will begin early from Princeton to Princess and Voigt camps. At present the company hauls all material and supplies from Princeton.

Ontario

DOME LAKE (South Porcupine)—The production of the mill to end of January amounts to $19,850. The main shaft is down to the 400-ft. level.

NORTHERN ONTARIO POWER (Cobalt)—Gross earnings for 1914, $875,195. Operating expenses, $211,023, net profits, $664,172, as compared with $658,408 for the preceding year. Bond interest took $273,360 and preferred dividend $142,758 leaving surplus of $248,054.

PETERSON LAKE (Cobalt)—Ore being taken from a branch vein at 200-ft. level averaging about 3 in. wide of medium grade. Winze being put down 100 ft. Gould leasehold is likely to revert to the Peterson Lake, in which case it will be worked by the company.

HOLLINGER (Porcupine)—Statement for four weeks ended Jan. 28, shows gross profits of $150,986, from treatment of 22,849 tons ore averaging $11.10 per ton, working cost $3.96 per ton. High-grade ore encountered on the 800-ft. level of No. 1 vein. No. 16 vein has been cut on 300-ft. level and No. 2 vein crosscut on 425-ft. level. Working force increased by about 200 men.

The Market Report

Metal Markets

NEW YORK—March 3

Copper was dull and, toward the close of the week, weaker. Lead and tin were both stronger. Spelter advanced further, but relatively little business was done, and this market is considered to be arriving at an impossible position.

Copper, Tin, Lead and Zinc

Copper—During the first half of the week the market was rather flabby, with only a moderate business done at 14½@14¾c., regular terms. Business was so dull that several agencies reported no sales. A good deal of talk was made of some sales to Europe at about £69¾, or 14¾c., c.i.f., but it was figured that they did not net over 14.30c., f.o.b., New York.

In the latter half of the week, the market became very dull indeed and turned a shade weaker. At the close, copper was freely offered at 14½c., regular terms.

In spite of irresponsible reports to the contrary, the copper market is believed to be statistically in a strong position. Statements as to this are supported by the knowledge that the principal producers have lately been increasing their output. Although business has been dull during the last few weeks, deliveries on old orders have been made at a large rate.

Copper sheets base price is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15½@15¾c., carload lots at mill.

Tin—Only a small business was done, and this market is characterized as dull. However, there was a sharp advance in price which is ascribed to uncertainty of delivery owing to the withdrawal of ships from the trans-Atlantic service. The New York price which was previously below the London equivalent is now above it.

Visible stocks of tin reported on Feb. 28, including tin afloat: London, 7210; Banka and Billiton, 1927; United States, excluding Pacific ports, 5411; total, 14,548 long tons, an increase of 647 tons during February.

Banka tin in hands of the Trading Co., Jan. 31, was 3995 tons. A report comes from Europe that 2000 tons of Banka tin have been sold to Germany at about £200 per ton, which is equivalent to 43.5c. per lb.

Lead—Up to the end of February lead was freely sold at 3.85c., New York, while the St. Louis market was at 3.80c., which was quite out of joint with things here. Sales for export could be made, however, at 3.90c., f.o.b., New York. Conditions generally had been stiffened by large sales for export previously made. During the morning of March 1 the A. S. & R. Co. raised its price to 3.90c., New York. Relatively little business was reported after the advance. Demand from domestic consumers is very light.

Spelter—During the first half of the week the market was at about 9@9½c. Prices of 10c. and upward were realized for spot metal, but such transactions were only lots of a few tons. In fact, nothing but small lots were available. Some lots amounting to several hundred tons, for prompt and March delivery, were bought at 9½c. Spelter for April and May delivery was held at 9⅛@9¼c., and for June at 8¾@9c. There was practically no demand from domestic consumers and Europe would not buy at current prices here. The London price of £43 was figured as equivalent to 8.60c., St. Louis.

During the latter half of the week this market was quite at sixes and sevens, sales of spot, prompt and March spelter being reported above 10c., and sales of May-June at 9c., with all kinds of bids in between. Bids of extravagant prices appear to be made by dealers and speculators for deliveries that they know to be impossible and do not expect to get. On the other hand, producers appear to be unwilling to loosen up on April and May deliveries, which they can supply. They are keen about selling May-June and later deliveries for which there is not at present any large demand.

Neither the fancy prices that are paid by belated customers for small quantities of near-by metal, nor the relatively low prices at which distant futures are offered represents the basis at which spelter can be bought and sold in quantity for the purposes of consumption. It is extremely difficult to determine what that basis is, and we are able to quote only aproximately. Spelter is fast arriving at an impossible position, if it has not already arrived. Smelters who buy ores on sliding-scale contracts find themselves obliged to take in quantities far in excess of the spelter they can sell. The present level of spelter price is killing consumption for purely industrial purposes. Galvanizers who have sold ahead, and have not covered their spelter requirements, will of course, pay whatever price they have to, but when present contracts are filled, they will sell black sheets, etc., instead of galvanized sheets.

The exports of spelter from the United States in January were about 16,000 tons. In February an exportation of 5444 tons is reported from New York, Philadelphia and Boston.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Feb. Mar	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts per Lb.
25	4.8013	48⅝	14.35 @14.55	38⅝	3.85 @3.90	3.77½ @3.82½	8.92½ @9.67½	8.75 @9.50
26	4.8000	48⅝	14.35 @14.55	38¼	3.85 @3.90	3.77½ @3.82½	9.17½ @9.67½	9.00 @9.50
27	4.7988	48⅝	14.35 @14.55	39¼	3.85 @3.90	3.77½ @3.82½	9.17½ @9.67½	9.00 @9.50
1	4.7975	49¼	14.35 @14.55	40½	3.90	3.80 @3.85	*9.67½ @10.17½	*9.50 @10.00
2	4.7988	49	14.35 @14.45	41	3.90	3.80 @3.85	*9.67½ @10.17½	*9.50 @10.00
3	4.8000	49½	14.30 @14.40	40½	3.90	3.80 @3.85	*9.67½ @10.17½	*9.50 @10.00

* Nominal.

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts; and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.-Mar.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb	£ per Ton	Cts. per Lb
25	22⅞	64½	14.01	64¾		178	157½	20 1/16	4.36	42⅛	9.15
26	23	64½	14.01	64⅞		180	158	20¼	4.45	42½	9.22
27	23 1/16										
1	23¼	64⅝	14.04	65⅛		183	161½	20¼	4.40	43	9.34
2	23¼	64⅛	13.93	64½		183	162	20 3/16	4.39	43	9.34
3	23¼	63	13.69	63⅜		178	160	20 3/16	4.39	43	9.34

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17⅓c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

Zinc sheets are again a little higher and are quoted today at $13 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Other Metals

Aluminum remains quiet with deliveries mainly on contract. Prices are not quite so strong, 19@19¼c. per lb. being quoted for No. 1 ingots, New York—**Antimony** is strong, supplies being short, though business has been rather light. Ordinary brands are 18½@19½c. per lb. Cookson's is entirely nominal; 23@24c. per lb. has been bid, but there is none to be had—**Nickel** is unchanged, ordinary forms being 40@45c. per lb. according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** continues strong, though business has been rather more quiet. New York quotation is a shade easier at $60 per flask of 75 lb. for large lots. San Francisco $59 for domestic orders. London quotation is £12 15s. per flask.

Gold, Silver and Platinum

Gold—Arrangements were reported Feb. 27 for the transfer of $3,250,000 gold to New York from the special reserve of the Bank of England at Ottawa. A total of $1,000,000 gold is reported coming from Japan, $250,000 having already arrived at San Francisco. A shipment is reported of $750,000 from London for New York.

Gold production of Rhodesia in January was $1,223,912 in 1914; and $1,467,198 in 1915; an increase of $243,286 this year. There was, however, a decrease of $78,691 from December, 1914.

Platinum—The market continues dull and unchanged, with little trade outside of contract business. Dealers still ask $42, but sales are reported at lower prices. We continue to quote $38@42 per oz. for refined platinum and $44@49 per oz. for hard metal.

Silver—The market has been stronger the last week owing, it is thought, to Continental orders, while supplies have not been overplentiful in the London market.

Gold and Silver Movement in the United States in January is reported by the Department of Commerce as follows:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$6,914,056	$ 691,509	$4,009,539	$5,187,662
Imports.	10,442,373	6,896,398	2,318,352	2,286,796
Excess	I $3,528,317	I $6,204,889	E. $1,691,187	E $2,900,866

Exports of merchandise in 1915 were valued at $267,801,370; imports, $122,265,267; excess of exports $145,536,103. Adding the gold and silver, leaves $142,232,080 as the net export balance.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 27

Blende, high price $76; assay base 60% zinc low lead $73@68; high lead, $68@65; metal base suspended; calamine base 40% zinc low lead, $45@42; high lead $42@38; average, all grades of zinc, $68.84 per ton. Lead, high price, $49; base, $47 per ton of 80% metal content; average, all grades of lead, $47.05 per ton.

SHIPMENTS WEEK ENDED FEB. 27

	Blende	Calamine	Lead	Values
Totals this week..	9,037,530	1,179,960	1,754,920	$394,020
Totals two months.	91,319,310	8,840,950	13,746,440	$3,180,860

Blende value, the week, $324,820; two months, $2,699,430.

Calamine value, the week, $27,910; two months, $158,840.

Lead value, the week, $41,290; two months, $322,590.

PLATTEVILLE, WIS.—Feb. 27

The base price paid this week for 60% zinc ore was $70@72 per ton; one or two settlements of last week's sales were made on a $74 base. The base price paid for 80% lead ore was $48 per ton.

SHIPMENTS WEEK ENDED FEB. 27

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	[illegible]	165,000	256,800
Year	33,174,000	470,000	3,133,100

Shipped during week to separating plants, 3,510,410 lb. zinc ore.

Iron Trade Review

NEW YORK—March 3

The general situation is not materially changed. New business continues to come in at a moderate rate, and there is confidence in a steady though slow improvement in the situation.

More orders for rails are reported. The structural situation is improving, negotiations being on foot for several large contracts which are likely to go through soon. Some round orders for export are reported, especially for steel bars, wire and rails. The ocean freight situation is still discouraging for this trade. The mills again report an increase in the rate of production.

The Algoma Steel Co. at Sault Ste. Marie, Ont., has taken a contract for 25,000 tons of rails for the Illinois Central.

Pig Iron Production in the United States in the second half of 1914, according to the preliminary statement of the American Iron & Steel Association was 10,796,150 long tons. This gives the make for the entire year as follows:

	1912	1913	1914
First half	14,072,274	16,488,602	12,536,094
Second half	15,654,873	14,477,699	10,796,150
Total	29,727,147	30,966,301	23,332,244

The corrected production for 1914 shows a decrease of 7,634,057 tons, or 24.7%, from that of 1913; and of 6,394,903 tons, or 21.5%, from 1912. The second half of 1914 showed a drop of 1,739,944 tons from the first half.

HOBART

PITTSBURGH—Mar. 2

Steel-mill operations continue at 55 to 60% of capacity, showing no change for two or three weeks. Orders are unchanged in volume and are just about sufficient to maintain the present rate of operation. In many directions the demand is fairly satisfactory, this being particularly true with tinplate, wire products and steel pipe. Demand for all railroad material is exceedingly slack, showing scarcely any improvement over the late months of last year, and structural business is also slack.

In accordance with the announced program of the mills the 1.10c. price on bars, plates and shapes was withdrawn last week, and the market is now 1.15c. for March and 1.20c. for second quarter. Large buyers are well covered by old contracts and the new price is not likely to be subject to much pressure, but should it once yield the market might drop considerably. Effective yesterday the differential for galvanizing wire was increased from 40 to 50c. per 100 lb., making galvanized wire 1.90c. and galvanized barb wire 2.10c. The sheet mills are firm at 3.40c. for galvanized sheets, making an advance of $15 a ton in a few weeks, due to the very high cost of spelter.

Pig Iron—Demand for merchant iron has continued of moderate proportions, but there is a slight increase in small-lot business in foundry grades. The market is unchanged: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report the pig-iron averages for February, computed from actual sales, at $13.60, Valley, for bessemer and $12.50 for basic.

Ferromanganese—Hopes are somewhat increased of a resumption of ferromanganese shipments from England, on a moderate scale. Many of the steel mills have agreed to purchase additional tonnages at $68, Baltimore, to match the tonnages due them on old contracts at $35 to $38. Small lots of prompt are quotable at about $100.

Chemicals

NEW YORK—March 3

The general market is quiet, with only a little special activity here and there.

Arsenic—Business is dull and sales small. Prices are unchanged at $3.75@4 per 100 lb., for both spot and futures.

Copper Sulphate—Business is steady and sales fair. Quotations have been advanced 25c. and are now $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is moderate, but steady, and prices are advancing. Quotations are 2.20c. per lb. for spot and up to July 1; 2.15c. per lb. for later deliveries.

Potash Salts—The total sales of the German Kali-Syndikat in 1914 amounted to 156,000,000 marks -$37,128,000—showing a decrease of 36,000,000 marks from 1913. Up to the end of July there was an increase in 1914 of 11,000,000 marks. The cost of production has increased owing to scarcity of labor and higher cost of materials

A cablegram from the American Embassy at Berlin says:

"Foreign office states that the exportation of kainit (a potash salt containing less than 20% of potash) will be permitted"

Imports of kainit into the United States were 329,611 tons in the year 1914, and 465,650 tons in 1913; a decrease of 136,039 tons.

Assessments

Company	Delinq	Sale	Amt
Belcher Silver, Nev.	Feb. 8	Mar. 1	$0.10
Booth, Nev	Jan 25	Mar 1	0.02
Brunswick Con., Nev.	Feb 16	Mar. 9	0.01
Caledonia, Nev	Mar. 8	Mar. 31	0.05
Cedar-Talisman, Utah	Feb 8	Mar 1	0.005
Clear Grit, Ida (post.)	Feb 9	Mar 3	0.0015
Confidence, Nev	Mar 11	Mar 31	0.10
Con. Virginia, Nev	Feb 24	Mar 18	0.10
Copper King, Ida	Mar. 1	Apr. 1	0.005
East Hercules, Ida, (post.).		Mar 3	0.001
Emerald, Utah (three instal		June 9	0.01
Gethin Le Roy, Utah (post	Feb. 16	Mar 7	0.02
Idaho-Nevada, Ida	Mar. 10	Apr 2	0.002
Index, Ida	Feb. 27	Mar 27	0.005
Indiana, Mich	Feb. 4		1.00
Iron King, Ida	Feb. 18	Mar. 19	0.001
Jack Waite, Ida	Mar 1	Mar 24	0.01
Kentuck, Nev	Mar 18	Apr 7	0.02
Keystone, Utah (post)	Feb. 23	Mar. 23	0.02
King Pine Crk., Ida	Feb 12	Mar 13	0.002
Laclede, Ida	Mar 20	Apr 6	0.003
Majestic-Idol, Nev	Dec. 15	Jul 20	0.005
Manhattan Con., Nev	Feb 28	Mar 1	0.01
Nor. Bnkr. Hill, Ida	Jan 30	Mar 6	0.002
Ophir, Nev.	Feb 11	Mar. 5	0.10
Oreano, Ida	Mar 25	Apr 26	0.0015
Overman, Nev	Mar 8	Mar 26	0.05
Pioche Coalition, Nev	Feb. 10	Mar 1	0.025
Reindeer-Queen, Ida	Feb. 15	Mar 8	0.003
Rescue-Eula, Nev	Feb 11	Mar 22	0.01
Saltese, Ida	Mar 1	Apr. 1	0.002
Selma, Utah	Mar 20	Apr. 6	0.0025
Sierra Nevada, Nev.	Feb 8	Mar. 2	0.05
Snowstorm Ex., Ida	Feb. 19	Mar 22	0.003
Sonora, Ida	Mar. 15	Apr. 15	0.002
Syndicate, Ida (post.)		Jan. 28	0.001
Tarbox, Ida (post.)	Jan 28	Mar. 25	0.0025
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev.	Mar. 12	Apr. 12	0.01
Tonino, Ida	Feb. 20	Mar 20	0.001
Utah, Nev	Mar. 25	Apr 15	0.02
Utah-United, Utah	Feb. 20	Mar 15	0.01
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

The interesting financial feature of the week is the $16,000,000 note issue of the Anaconda company, to finance its purchase of the United Metals Selling Co.

COLO. SPRINGS Mar. 2		SALT LAKE Mar. 2	
Name of Comp.	Bid	Name of Comp.	Bid
Acacia.	05½	Beck Tunnel	06½
Cripple Cr'k Con.	007	Black Jack	09
C. K. & N.	06	Colorado Mining	12½
Doctor Jack Pot	08¼	Crown Point	01
Elkton Con	47	Daly-Judge	5.25
El Paso	1.50	Gold Chain	‡08¼
Findlay	03	Grand Central	63
Gold Dollar	04	Iron Blossom	99
Gold Sovereign	.03	Little Bell	‡10
Isabella	16½	Lower Mammoth	06
Jack Pot	06¼	Mason Valley	1.25
Jennie Sample	03	May Day	11
Jerry Johnson	03	Opohongo	01½
Lexington	007	Prince Con	41½
Old Gold	‡01	Seven Troughs	02½
Mary McKinney.	.32	Silver King Coal'n	3.05
Pharmacist.	01	Silver King Con	1.90
Portland.	1.12½	Sioux Con	05
Raven B. H.	03	Uncle Sam	06½
Vindicator.	1.29	Yankee	07

TORONTO Mar. 2

Bailey	01½	Dome Exten	06
Coniagas	4.75	Foley O'Brien	15
Peterson Lake	23	Hollinger	22.12
Right of Way	02	Imperial	01½
Seneca Superior	1.12	Jupiter	08½
Silver Queen	‡02	McIntyre	30
T. & Hudson Bay	20.00	Pearl Lake	01½
Timiskaming	16	Porcu. Gold	‡25
Wettlaufer-Lor.	05	Preston E. D.	01½
Big Dome	6.00	Rea	10

SAN FRANCISCO Mar. 2

Comstock Stocks		Misc. Nev. & Cal.	
Alta	16	Belmont.	3.75
Belcher	32	Jim Butler	65
Best & Belcher.	07	Lone Star	06
Caledonia.	16	MacNamara	03
Challenge Con	05	Midway	10
Confidence	14	Mont.-Tonopah.	45
Con. Virginia.	19	North Star	13
Crown Point (Nev	‡19	Rescue Eula	08
Gould & Curry	05	West End Con	52
Hale & Norcross	05	Atlanta	29
Julia	01	Booth	31
Mexican	39	C. O. D. Con	05
Occidental	80	Comb. Frac	08
Ophir	13	Jumbo Extension	67
Overman	05	Pitts.-Silver Peak	10
Potosi	01	Round Mountain	37
Savage.	05	Sandstorm Kendall	08
Sierra Nevada.	11	Silver Pick	06
Union Con	19	Central Eureka	‡25
Yellow Jacket	38	So. Eureka	‡2.25

N. Y. EXCH. Mar. 2

Name of Comp.	Clg.
Amalgamated	53¾
Am. Sm. & Ref., com.	62⅝
Am. Sm. & Ref., pf.	101
Am. Sm. Sec., pf. B	‡78
Anaconda	25¾
Batopilas Min	.50
Bethlehem Steel.	54¼
Bethlehem Steel, pf.	103½
Chino.	35⅜
Colo. Fuel & Iron	23
Federal M. & S., pf.	24½
Great Nor., ore., ctf.	31¼
Guggen. Exp.	50
Homestake	117
Inspiration Con	19⅞
Mex. Petroleum	66
Miami Copper.	19⅜
Nat'l Lead, com.	50½
National Lead, pf.	106½
Nev. Consol.	12
Ontario Min	2
Phelps Dodge.	‡175
Quicksilver, pf.	1
Ray Con.	16⅜
Republic I&S, com.	19¾
Republic I&S, pf.	75½
SlossSheff'd, com.	24
Tennessee Copper.	27
Utah Copper	51½
U. S. Steel, com.	42¾
U. S. Steel, pf.	104¾

N. Y. CURB Mar. 2

Name of Comp.	Clg.
Beaver Con	26
Big Four	07
Blue Bell.	04
Braden Copper.	6⅜
Buffalo Mines.	.75
Can. Cop. Corpn.	15/16
Can. G. & S.	04
Caribou	50
Chambers Ferland	11
Con. Ariz. Sm.	25
Coppermines Cons.	‡1¼
Davis-Daly	94
Diam'field-Daisy.	07
Dia. Black B.	03½
Ely Con	‡01
Florence.	54
Goldfield Con.	1⅝
Goldfield Merger.	21½
Greene Cananea.	26½
Kerr Lake	4⅜
La Rose.	11/16
McKinley-Dar-Sa.	42
Mines of Am.	2
Mutual Min., pf.	‡2½
Nevada Hills	26
New Utah Bingham	‡7/16
Nipissing Mines	5⅜
Ohio Copper	05
Oro.	08
Pacific Smelt	1/32
South Utah	10
Stand'd Oil of N. J.	387
Standard S. L.	1¼
Stewart	1¼
Tonopah	7
Tonopah Ex.	2¼
Tonopah Merger	37
Tularosa	3/16
West End Ex.	03
Yukon Gold	2½

LONDON Feb. 15

Alaska Tre'dwell	£7 10s 0d
Camp Bird	0 7 6
El Oro	0 9 9
Esperanza	0 9 0
Mexico Mines	4 2 6
Oroville	0 12 0
Philippine Dr.	1 0 0
Santa Gert'dis	0 11 3
Tomboy	1 3 1
Tough Oakes.	0 13 9

BOSTON EXCH. Mar. 2

Name of Comp.	Clg.
Adventure	1
Ahmeek	250
Alaska Gold M.	28⅛
Algomah	0
Allouez	40½
Am. Zinc.	26¾
Ariz. Com., ctfs.	4⅜
Bonanza	31
Butte-Balaklava	2⅜
Butte & Superior	49½
Calumet & Ariz.	53½
Calumet & Hecla	375
Centennial	16½
Copper Range.	33½
Daly West	2
East Butte	9½
Franklin	4½
Granby	66½
Hancock	11½
Hedley	27
Helvetia	25
Indiana	3¾
Island Cr'k, com.	44
Island Cr'k, pfd.	88¾
Isle Royale	21
Keweenaw.	2½
Lake	5⅜
La Salle.	3½
Mass.	4¾
Mayflower	‡4⅜
Michigan	70
Mohawk	55½
New Arcadian.	4¾
New Idria Quick	‡3½
North Butte.	23½
North Lake	1
Ojibway	50
Old Colony.	3½
Old Dominion.	41½
Osceola.	70
Quincy	57
Santa Fe	1¼
Shannon	5¾
Shattuck-Ariz.	21½
Superior	27
Superior & Bost.	1¼
Tamarack	30¾
Trinity.	2⅜
Tuolumne	25
U. S. Smelting	20¾
U. S. Smelt'g, pf.	40½
Utah Apex	2
Utah Con	9¾
Victoria	1¼
Winona	2
Wolverine.	48
Wyandot	50

BOSTON CURB Mar. 2

Name of Comp.	Bid
Alvarado	70
Bingham Mines.	‡3⅜
Boston Ely.	14
Butte & Lon'n Dev	17
Calaveras	1⅝
Calumet-Corbin.	11
Chief Con.	70
Corbin.	‡1
Cortez.	17
Crown Reserve.	75
Eagle & Blue Bell	75
First Nat. Cop.	1
Houghton Copper	1¼
Iron Cap Cop., pf	3
Majestic	12
Mexican Metals	13
Nevada-Douglas	32
New Baltic	1 7/16
Oneco	50
Raven Copper	07
Smokey Dev.	10
So. Lake.	4¾
Tonopah Victor	‡17
Trethewey	10
United Verde Ext.	2 11/16

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067		26.669	26.788	
April	59.490	58.519		27.116	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082	......	27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January.	14.223	13.641	64.304	60.756	69.488	65.719
February.	14.491	14.394	65.2[illegible]	63.494	70.188	
March	14.131		64.7[illegible]		69.170	
April.	14.211		64.717		69.313	
May	13.996		63.18[illegible]		67.786	
June	13.603		61.3[illegible]		66.274	
July	13.223		60.530		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December.	12.801		56.841		*	
Year	13.602		61.521		68.168	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038		173.619	
April	36.154		163.963	
May	33.360		150.702	
June	30.577		138.321	
July.	31.707		142.517	
August	*		‡	
September.	32.675		‡	
October.	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year.	34.301		156.564	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970		3.850		19.651	
April.	3.810		3.688		18.225	
May	3.900		3.808		18.503	
June	3.900		3.810		19.411	
July.	3.891		3.738		19.051	
August	3.87[illegible]		3.715		‡	
September	3.828		3.658		‡	
October.	3.528		3.384		‡	
November	3.683		3.585		18.500	
December.	3.800		3.662		19.097	
Year	3.862		3.7[illegible]7		19.079	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March.	5.250		5.100		21.460	
April.	5.113		4.963		21.569	
May.	5.074		4.924		21.393	
June.	5.000		4.850		21.345	
July.	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October.	4.909		4.750		‡	
November	5.112		4.962		25.016	
December.	5.592		5.430		27.369	
Year	5.213		5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January.	$14.94	$14.59	$13.23	$13.4[illegible]	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07		13.94		14.1[illegible]	
April	14.90		13.[illegible]		14.1[illegible]	
May	14.90		13.[illegible]		14.27	
June	14.90		13.90		13.96	
July.	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October.	14.84		13.75		13.97	
November	14.59		13.4[illegible]		13.83	
December	14.70		13.4[illegible]		13.83	
Year.	$14.88		$13.78		$14.01	

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The Engineering and Mining Journal

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In and Out of the Caucasus in War Time

By Leonard C. David*

SYNOPSIS—The Caucasus embraces the country between the Black and Caspian Seas and between the Caucasus mountains and the Turkish border. Population is Oriental, Georgians predominating. Mines are 40 miles from Batoum. Turkish invasion was not at first regarded seriously, but their troops soon captured the surrounding country, obliging foreigners to take to flight. An American manager was wounded, but managed to escape with the others. The flight from Batoum to London is described.

The Caucasus district of Russia, where fierce fighting is now in progress, is that part extending from the northern limits of the Caucasus mountains, south to the Turkish frontier, bounded on the west by the Black Sea and east by the Caspian Sea. The principal cities are Tiflis, the home of the viceroy; Batoum, Russia's most southern Black Sea port; and Baku, a Caspian sea port; all on the railroad running between Batoum and Baku.

A Caucasus Mining Village

Country of the Georgian Military Road

Russians a Minority in Population

The Caucasus is inhabited by Oriental people, but the Georgians predominate. The Russians are vastly in the minority, and it is distinctly an Asiatic country, rather than European, in dress as well as customs. The Christian Georgian, the original Caucasian, occupies a district called Georgia. The Mohammedan Georgian, made Mohammedan by Turkish invasions, occupies all the farming land near the Turkish frontier. The land is fertile, although the farms are of small extent because flat country is only found in spots. The people raise tobacco, corn, vegetables, fruits, etc., for their own consumption, and the work incident to this is all done by women, who, with veils on their faces, babes on their backs, and interested husbands as onlookers, work diligently in the fields. As a European passes, however, the instinctive womanly curiosity impels them slyly to lift the veil and see the latest styles in dress. Plowing is with oxen and antiquated wooden plows. The natives make their own flour by grinding corn in their little mills close to the house. They hew out logs and use them as launders to gather the little mountain streams and lead them to the mill for power.

The principal industries are mining of oil, copper and manganese and farming. Oil is pumped in 6-in. lines from Baku to Batoum, a distance of about 300 miles, and thence is shipped to all the world. This oil, or *mazoot* as it is called locally, is pumped through branch lines to industrial plants and used as fuel, although the development of water power from mountain streams is slowly replacing the use of oil.

The Georgian Military Road

Our mines were situated 6000 ft. above the sea and 40 miles from Batoum. One travels from Batoum by phæton on the beautiful Georgian military road, which winds its way up through the mountains along the river Churuk, which figures so largely in Caucasus war news. It is interesting to see a roller, manufactured by the Austin Manufacturing Co., of Chicago, at work on this road. On each side of the road one sees here and there a little farming settlement. The mountains are precipitous, vegetation luxuriant and scenery beautiful. Leaving the Churuk River at a station called Borchka, one crosses by ferry and follows the Mourgul River, a branch of the Churuk, which follows the road that leads to the Caucasus Copper Co.'s smeltery. A final sudden ascent on a zig-zag road terminates at the mines, 2000 ft. above. The mines are in the midst of farming settlements, but there are no farms above them, as the country above is rough and mountainous.

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*Formerly mine superintendent, Caucasus Copper Co.

About 75% of the employees were Mohammedans from Turkey, the border being only a day distant, and the Turks walk back and forth. The rest of the employees were Persians, Armenians, Greeks, Georgians (Christians) and Russians. The native Russian subject Turks did no manual labor at the mines, but were used as foremen, tally men, etc. The laborers for the most part work seven days a week. They even found time to make their own socks, and it was a common sight to see the men at night busily engaged with their knitting needles. A more peaceful class of labor could not be found anywhere, due, no doubt, to the fact that the Turks do not indulge in intoxicating liquors. I have, however, seen a few boys overcome by eating native honey. The Turks are religious fanatics, but only have two sets of holidays, Ramadan Byram and Kurban Byram, and their antics at these feasts arouse the interest of the Occidental. During Ramadan, which precedes Ramadan Byram, they work every day, but do not eat, drink or smoke while the sun shines. This lasts for 30 days, and it is a common sight, near the end of Ramadan, to see a laborer in the hot sun succumb to exhaustion and have to be taken home. There is no false modesty about their religion. A laborer will drop his tools in the midst of work, wash his hands, face and feet, spread out the prayer rug or handkerchief and pray toward Mecca. The prayer lasts about twenty minutes.

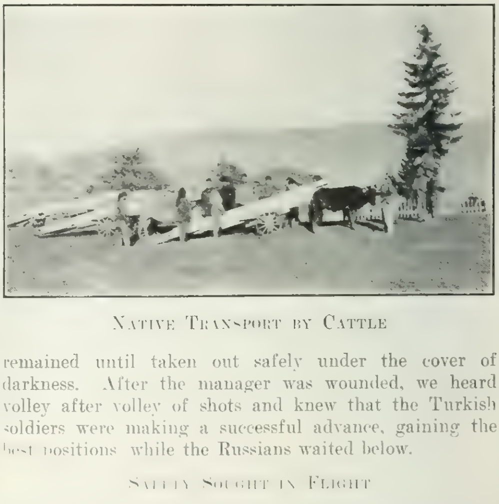
In dress the laborers all look alike, handkerchief turban or fez on their head, wall-paper patterned blouse shirt, Eton jacket, and pantaloons which are always very baggy. Their footwear consists of a piece of cow's-hide with the hair on, sandaled with string around the heel and ankle.

War Declaration Changes Conditions

As soon as war was declared between Russia and Turkey, many of our Turkish and Persian subjects left. The Georgians also departed for their beloved Georgia, fearing trouble between Christians and Mohammedans. Before and after war was declared the Russian military and civil officials came to visit us and granted immunity from arrest to Turkish subjects if they remained at work at the mines. An explanation of this may be that Russia needed copper and was willing to make concessions to keep the mines going. The officials repeatedly insisted that we were absolutely safe and out of the danger zone. Russia was making inroads into Turkey near Erzerum, and we felt that with all the mountains on the border covered with snow we were quite safe. Moreover we could not imagine a military operation being carried out in such mountainous country. The Russian military authorities insisted that they were prepared for any emergency, but were sure that no trouble would arise. In justice to the American Consul, I would say that he had reminded us by letter of our proximity to the frontier and the possibility of our being exposed to danger, but we rather put our faith in the manager, who, we thought, had inside information from the Russian military officials. He acted in good faith, but the Russian officials did not understand what was going on.

Min. Manager Wounded by Turks

On Friday, Nov. 13, we heard rifle shots several times during the day. Naturally excitement ran high. Most of our Turkish laborers ran away for parts unknown and the rest of us were trying to get the truth of what had happened. The Russian military officials explained the shooting by saying that Russian soldiers at the smeltery fired up the valley on their own soldiers, thinking they were Turkish soldiers. The truth was, as we learned after, that the Turks started an advance through the only pass left open, Kura pass, and had taken the Russian outpost with little resistance. On Saturday, the Governor came up to tell us all how safe it was and that the Russian army was moving the Turkish frontier farther away from us each day and the conditions were changing only for the better. Sunday, we were mining nearly a normal tonnage of ore, when about twelve o'clock we heard some shots below us in the valley. Then the telephone bell rang and we received word from the smeltery saying that the native aide of the general manager returned to the smeltery with the news that the manager, an American, was wounded en route from the smeltery to the mines. The afternoon was spent in a search for the wounded man and he was found hiding behind rocks where he remained until taken out safely under the cover of darkness. After the manager was wounded, we heard volley after volley of shots and knew that the Turkish soldiers were making a successful advance, gaining the best positions while the Russians waited below.



Native Transport by Cattle

Safety Sought in Flight

That evening the Russian police advised us to sleep with our clothes on, but we feared that if the Turkish soldiers captured the smelting plant before we got there, our only exit to Batoum would be cut off. So we decided to pack up and leave at midnight with all the women and children, going down the ropeway foot road, as the Turks controlled the wagon road. This flight, as well as the rest of the trip home, had its dramatic side and was replete with hardships. Space does not permit telling of the misfortunes suffered by many of the employees, but the manager did all in his power, in his injured condition, to aid in the flight to safety. We didn't feel very safe on this trip as we did not know the attitude of the native Russian subject Mohammedans, as they say "blood is thicker than water." Also we could use no lights as we feared drawing the fire of the Turkish or of the excited Russian soldiers. The Russian guards met us at the smeltery with drawn bayonets until they learned who we were.

I met the Vice-Governor at the works. He told me that instead of 2000 soldiers that we were led to believe were guarding us, there were only 180 on hand. The Vice-Governor said, "There are not more than 100 Turkish 'marauders' in the mountains. In the morning we will bring up six cannon and more soldiers and when we start to shoot the cannon, the Turks will just run." But he neglected to say which way they would run. We all left at daybreak, traveled to Bortchka by phaeton, then down the current of the Churuk in a *kyyook*, the native gondola, and then another short phaeton ride to Batoum. We did not have phaetons for the complete trip, as there were too many fugitives for the supply of phaetons.

Typical Scenes in the Caucasus

A merry-making group of native laborers Group of young Turkish girls A Greek mine foreman and a Russian policeman

On our way down we passed the artillery and motor trucks laden with soldiers on their way to the smeltery from Batoum. It looked good and we felt that we were going to Batoum to stay but a few days until the Russian soldiers cleared the mountains of "marauders." We found the people of Batoum more excited than we were, fearing attacks both from sea and land. The police of Batoum were so excited that they arrested all suspicious people as German spies. Even an Irishman of our party, who talks very broad Irish, was arrested as a German spy because he smoked a curved-stem pipe. Everything was dark in Batoum at night. At the hotels, we could not use the electric lights and the windows were covered with dark paper to keep the candle lights from showing through. They had a spot lit up a few miles from the city so as to have the lights, rather than the town, draw the fire from enemy's boats, should they make a visit at night.

Turks Capture Russian Artillery

The following morning the Turks met the Russians at the smeltery, the Turkish soldiers having secured all the good positions. The Russians started to shoot their cannon at 8 a.m., and at 8 p.m. the Turks had the cannon and the Russians retreated. We had fled in time. Unfortunately some did not realize the gravity of the situation, and when we called the roll in Batoum, one American and one Englishman were missing. Every effort was immediately made to locate them. The American Government located the American at Trebizond, where he was a prisoner and later was released. We have not yet learned of the whereabouts of the Englishman. Instead of a few "marauders," it was a part of a great movement the Turkish army was making. The Turkish soldiers were supplied with smokeless powder and the latest equipment and were led by German officers. Shortly after we arrived in Batoum, we saw Russian officers who had been at the smeltery, riding around in phaetons and automobiles. We left Batoum the next day, after spending all night in the depot waiting for a train that had sufficient room. It seemed as if all Batoum was at the depot. The military authorities were no longer taking chances and had advised the people to seek a place that was more safe. The scenes at the depot were beyond description. It took us sixteen hours to make the trip from Batoum to Tiflis, a trip usually made in nine, but we were delayed by troop trains which had the right of way and were rushing soldiers, ammunition and supplies, all packed in box cars, to Batoum.

Tiflis to Petrograd

We rested up in Tiflis and bought what clothes we needed for our return trip, as all our baggage had been intercepted by the Turks. We left Tiflis for Petrograd via Baku and Moscow. We spent six days and six nights traveling from Tiflis to Petrograd, the first three nights sleeping in our clothes, inasmuch as there was no bedding obtainable on these trains, the government having commandeered all for hospital purposes. This did not add any to the comfort of the trip. I carried a small enameled teapot which I used to fill with hot water for bath purposes, or else to hold tea or coffee at restaurant stations.

When we got to Moscow we had the extreme pleasure of a restaurant car. We feared that our only way out of Russia was to go to Archangel, a port on the White Sea which was being kept open by Canadian ice breakers, sail around the Scandinavian Peninsula and then down the North Sea. All British subjects had to take this trip home, but the American embassy had another route figured out for us which was far shorter and more comfortable. The reason that British subjects had to take this trip was that it was the only safe route for them, and the only route on which the Germans could not hold up their boat.

Back to Uncle Sam's Country

From Petrograd we went to Raumo, Finland, and sailed across the Gulf of Bothnia to Stockholm. From here we traveled via Christiania to Bergen in Norway and then down to the North Sea to Newcastle. We made the last trip that passengers made between Finland and Sweden, and the next day German mines blew up three Swedish steamers near Raumo and stopped all this traffic. On our train going to Raumo, there were 13 coaches of German subjects being sent out of Russia. All windows of the coaches were painted so as to be opaque, and each coach was guarded by a *gendarme*. Of course the North Sea trip made many passengers fearful of mines, but we got to Newcastle safely the day before the German fleet bombarded Scarborough, Hartlepool and other English ports. On our arrival in London, we found the Batoum darkness in even greater measure, as London feared air attacks. Even trains took the precaution to pull all shades if the lights were on, and the locomotives operated without headlights.

Our trip across the Atlantic was without incident. We were six weeks en route, but felt mighty fortunate to have made such a trip, under the strained conditions, without mishap and to have returned to the good old United States where all was quiet and peaceful.

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Placer-Mining Law

By A. L. H. Street*

"Float, outcroppings, lodes and abandoned locations, separately or combined, are not sufficient to constitute a 'known lode' within the exclusion of the placer-mining law. To be impressed with such character the lode must, at the time of application for the placer patent, be clearly ascertained and defined, and of such extent and content that it will then, in view of conditions then, justify development and exploitation, and because of which the placer claim is valuable and more valuable than for placer-mining purposes. Subsequent development, however marvelous the results, is immaterial if the lode be not thus 'known' when the application for the placer patent is made. And the reason is that lode outcrops exist everywhere in the mining country. Not one in hundreds develops into a profitable mine. Valueless, no reason exists to exclude them from public grants and patents, and under such grants made and patents issued without excluding them *prima facie* lodes of value do not exist" (United States District Court for the District of Montana, Barnard Realty Co. vs. Nolan, 215 *Federal Reporter,* 996). This decision was announced in a case involving the superiority of a placer patent over lode locations made subsequently.

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Dedication of the New Building of the Mellon Institute

By W. A. Hamor*

The new $350,000 building which will form the permanent home of the Mellon Institute of Industrial Research and School of Specific Industries of the University of Pittsburgh was formerly dedicated on Feb. 26. This building, the gift of Andrew William and Richard Beatty Mellon, of Pittsburgh, was especially designed for the needs of the Institute; it is distinctly modern in every respect and complete facilities are provided for the investigation of manufacturing problems and for conducting industrial research according to the practical system of coöperation between science and industry, founded by the late Director of the Institute, Dr. Robert Kennedy Duncan. By this system, an industrialist having a problem requiring solution may become the donor of a fellowship by providing the salary of the investigator selected to carry out the research desired, the Institute supplying every facility for the work—laboratory space, the necessary apparatus and supplies, library facilities and advice of a staff expert in industrial research, etc.

The new home of the Mellon Institute is a five-story and attic building. The basement contains seven rooms: The main storeroom, the boiler room, the electric furnace room, a heavy apparatus room, a room equipped for low-temperature work, the machine shop and the kitchen. On the first, the main floor, are located the general office, the director's offices, the office of the editorial department, the library, the office and laboratory of the assistant directors, the assembly hall, a special-apparatus room, and a dark-room laboratory. The second and third floors each contain 10 large research laboratories and nine small ones; the fourth floor, which is not finished, will contain an identical number of laboratories as soon as the growth of the Institute warrants its completion. At the present time 23 fellowships are in operation and 40 research chemists are engaged in a study of the variety of industrial problems under investigation at the Institute.

While the Mellon Institute possesses an endowment of its own and has its own Board of Trustees it is an integral part of the University of Pittsburgh. The dedicatory ceremonies were accordingly held in conjunction with the annual Charter Day exercises of the University.

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The Production of Phosphate Rock in Florida in 1913 amounted to 2,545,276 tons. At the values set by the Florida Geological Survey, this constituted 90% of the entire worth of the state's mineral output.

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*Attorney, St. Paul, Minn.

*Published by permission of Dr. Raymond F. Bacon, director of the Mellon Institute

Comparative Hydraulic-Mining Methods

By Lewis H. Eddy*

SYNOPSIS—Practice at the Lorenz and Union Hill placer mines are compared. The Lorenz has to elevate to the flume and stack the tailings, while the Union Hill has grade at the gravel entry and discharges tailings by gravity. Riffles are different at the two mines. Costs of flumes are given and a general comparison made.

Comparison of the methods of hydraulic mining of placer ground at the Lorenz and the Union Hill mines in Trinity County, Calif., is interesting because of the essential differences in gravel formation and topographical situation affecting their operation. Lorenz mine is situated two miles south of Weaverville on the east side of Weaver Creek, and owned and operated by J. N., W. D. and G. C. Lorenz. Union Hill mine is situated three miles farther south and is one-quarter mile north of Trinity River. It is owned and operated by the Trinity Consolidated Hydraulic Mining Co., D. W. Shank, manager. The mines were not operating at the time of my visit in the middle of November, so my observations were confined to such details of practical methods and costs of construction as could be gained from preparations for the beginning of the fall season, which at both mines include proposed improvements of flume riffling-blocks.

LORENZ GRAVEL ELEVATED

The Lorenz ground is so situated along the bank of the creek that the gravel must be elevated to the flume and the tailings stacked well away from the end of it. Union Hill ground has a down grade to the head of the flume, and the gravel is carried by the flume through a tunnel to Trinity River. A portable flume is necessary at the Lorenz and a stationary flume is permitted at the Union Hill. The Lorenz equipment requires six giants and permits the constant use of one or two, according to the amount of water available, for piping in and requires one for stacking tailings, while three giants are used for moving the gravel toward the head of the flume. The Union Hill equipment requires only four giants, one or all of which are used for piping in, according to the supply of water. Lorenz flume is 168 ft. long. Union Hill flume is 1300 ft. long. These are the essential differences between the two mines.

The Lorenz placers lie in a narrow strip between the Weaverville-Lewiston wagon road and Weaver Creek and have an average depth of 20 ft. from surface to bedrock, which is only about 6 ft. higher than the bed of the creek. The ground is so situated as to necessitate working up-stream, the depth of the deposit increasing as the elevation of the creek bed increases, so that the deposit at no great distance up-stream reaches a depth of 30 to 40 ft. Five hundred inches of water are taken from Brown's Creek, through a six-mile ditch, and passed through a 15-in. pipe 150 ft. long, and taken into the giants under 250-ft. head. The giants are supplied by 24-, 22- and 18-in. pipe and require a total of 3000 ft. of pipe. There are two 11-in. giants, using 4-, 5- and 5½-in. nozzles and four 9-in. giants using 3- and 4¼-in. nozzles, according to various conditions of the gravel, the volume of available water and the situation of the giants. The giants are so placed that one or two may be used for piping direct into the flume, while three others are used for moving the gravel to a position ready for piping in. One giant is placed at the tail end of the flume, which is used only for stacking the tailings along the bank of the creek.

The flume is 168 ft. long, composed of 14 removable boxes or sections and is placed crosswise of the strip of ground to be worked, the head toward the wagon road and the tail toward the creek, but not reaching it. The surface ground or light overburden covering a plot of ground to be worked is first blown off with giants and the pay gravel along the creek side elevated to higher ground before the regular operation begins and the stacking of flume tailing is necessary. The giants used for moving the gravel forward for piping in are so situated that the gravel moving toward the head of the flume approximately describes an arc. Two giants are used for piping in when there is an abundant supply of water, the amount of water used varying from 600 to 700 in. The amount of gravel moved through the flume approximates 500 cu.yd. in 10 daylight hours; the value runs from 10 to 20c. per cubic yard.

The tailing piles are so placed that they serve as a wall against an overflow of creek water to the dredging ground. The waste water from the flume and the light mud that washes through the flume are disposed of through a ditch about four ft. wide cut into the bedrock at a grade of ½ in. to the rod and running parallel with the creek. When a piece of ground has been worked out, the flume boxes are disconnected and set up in another position on the unworked gravel from which the overburden has been removed, and the operation is repeated. The boxes composing the flume are built on sled runners so that a four-horse team may be hitched to it and the box hauled to any point desired for reassembling the sections. The giants are also moved to the proper positions for elevating and piping in the gravel.

FLUME CONSTRUCTION

The construction of flume boxes is simple. They are 12 ft. long, 4½ ft. wide and 1½ ft. deep. The sides and bottom are of 18x1½-in. flume lumber; the frames of 4x4-in. pieces for the sides and 4x6-in. for the bottoms. The frames are bolted and the sides nailed. Sled runners, to which the frames are bolted, run the full length of the boxes and are beveled or rounded at both ends so that the boxes, when disassembled, may be hauled either forward or back. The bottoms of two boxes when assembled make a close even joint; the sides are lap-jointed and so attached that when the full complement of boxes necessary for the desired length of flume are assembled and made fast the whole structure is sufficiently watertight and compact and is capable of withstanding great strain. The force of the water and gravel at the head of the flume, as it is piped in, is so great that it is necessary to line the box at the head of the flume with iron plates 6 ft. long, 2 ft. wide, ½ in. thick. The corners formed by the joining of the sides and bottom of the box are also protected with 3x6-in. angle iron ½ in. thick and 6 ft. long. The bottoms of the flume boxes are covered with blocks 11x11 in. or 18x18 in. square and 10 in. deep. The blocks are set in rows across the box, 2 in. apart; 2x2-in. wooden riffles are placed at the bottom of the box between the rows of blocks. The flume is set at a grade of 7 in. to the 12-ft. box.

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This type of flume may, of course, be extended to any desirable length, or shortened to meet the requirements of narrower strips of ground to be worked. It has been found desirable, however, to reduce the size of the riffle-blocks for flumes as short as this one, made up of 14 boxes. It is also believed to be better practice to use stronger material than wooden blocks. Lorenz brothers have decided upon an experimental installation of one box or more provided with angle-iron riffles. This was in course of construction at the time of my visit, though I was denied the opportunity to observe the practical application by the delay of the anticipated rain. The material to be used for these experimental riffles consists of 3x6-in angles, ½ in. thick and 4½ ft. long, fastened to 4x6-in. wooden pieces 1½ ft. long, and set in the bottom of the flume box, two inches apart. This will give a smooth and even surface for the flow of the water and the passage of the gravel and provide a solid iron corner against the attack of the gravel and water. The item of breakage will have to be taken into account and it may be necessary to substitute steel for iron.

So far as I am aware Lorenz brothers are the only hydraulic miners who in California have adopted the practice of elevating gravel with giants and building flumes in portable sections of the type described. They have installed a similiar hydraulic plant in Alaska. They are probably the first also to contemplate the use of angle iron for riffles, though steel plates and channel iron are in course of experiment by other operators. It is probable that the coming hydraulic season in California will introduce some valuable experimental installations and a number of improved details of practical hydraulic mining.

Two other items of practical detail were noted at the Lorenz mine. One is a pipe sleeve used for connecting two sections of pipe. The upper end, which receives the water, is provided with a steel ring, 2 in. wide and ⅜ in. thick, is covered with a rubber or canvas band about 4 in. wide and fitted inside the sleeve. When the full volume of water passes through the pipe and into the sleeve, the portion of the canvas band extending beyond the inner edge of the steel ring is forced back and forms a water-tight joint. The other device is not new, but is perhaps applied to better advantage than usual. It is the adoption of the flag principle to the gaging of the water in the supply reservoir. The block placed on the surface of the reservoir is connected to a wire that extends to the dredging ground where a flag is attached. The flag rising or lowering indicates the rise and fall of the volume of water in the reservoir, and in the practice employed at this mine of working two giants for piping in when the water is abundant and reducing to one giant when the water is low, the arrangement of the flag signal within close view is of great economic advantage, permitting the change to be made quickly.

Union Hill on Flat Ground

Union Hill placers, comprising about 1000 acres, are situated on a flat that slopes toward Trinity River to the south and Weaver Creek to east. A hill intervenes between the placers and the river, necessitating a tunnel 1300 ft. long through which the flume carries the water and tailing to the river. Water for washing the gravel is delivered through a ditch carrying 2700 in. of water from Grass Valley Creek. The intake is 5 miles east of the mine in a direct line, but the ditch is 12 miles long, owing to the hills that intervene. The penstock is siutated on a hill above the mine. Two pipe lines deliver the water to the mine. One is composed of 1400 ft. of 26-in. pipe connected to a double line of 15-in. pipe, and under a pressure of 450 ft. The low pressure, 250 ft., is composed of 1200 ft. of 30-in. pipe connected to a double line of 15-in. pipe. Four giants are used and about 4000 ft. of pipe for mining. Approximately 800,000 cu.yd. of gravel was removed through the flume last season.

The deposit is formed in an ancient river channel, and composed of three benches, 160 ft., 100 ft. and 90 ft. deep. The situation of the ground and the composition of the formation is such that the operation of the mine requires the stream from the giants to be so directed against the bank as to form a current which constantly carries the gravel across the flat bedrock toward the bedrock ditch leading to the flume. The bedrock ditch varies in width from 4 to 20 ft. and is formed by the wearing of the moving gravel on the bedrock.

Flume Laid in Tunnel

The tunnel through which the flume is laid is 8 ft. wide and 8 ft. from floor to roof, allowing 18 in. on each side for convenience of workmen in repairing the flume and putting in new blocks. The tunnel is about the same length as the flume, 1300 ft. The grade of flume for the first 700 ft. is 3 in. to the 12-ft. section and for the remaining 600 ft. the grade averages about 5 in. to the 12-ft. section. The proper grade would be 7 in. to the 12-ft. box, but the fall from bedrock of the channel deposit to the river is insufficient to permit this grade.

The flume is 5 ft. wide, 4 ft. 6 in. deep and composed of 108 boxes or sections, each 12 ft. long and permanently joined. The frames are made 1½x6-, 1½x4- and 4x5-in. pieces; the sides and bottoms of the boxes are of 1½ in. flume lumber. Riffle blocks are 12 in. deep and 11x11 to 18x18 in. surface, set on end in rows across the box 2 in. apart. Riffle sticks are 2x2 in. by 5 ft. long placed on the bottom of the box between the rows of blocks. The boxes are lined with 2-in. spruce plank, one plank 10 in. wide, the other 6 in. wide. These are renewed at intervals of about three years. Total lumber used in construction of one box, 500 ft., b.m., for frames, bottoms and sides, and 525 ft., b.m., of blocks. The cost for one box is, lumber, $16, blocks, $9 construction, $10; a total of $35, or approximately $4000 for the entire flume, including nails and extra labor required for handling and placing. The lumber is sawed in the vicinity of the mine and costs $32 per M. for siding and frame lumber and $17 per M. for blocks, b.m. laid down at the mine. The flume cost at the Lorenz mine is estimated at $20 per box or section, due not wholly to the smaller size of the Lorenz boxes, but practically to the fact that Lorenz brothers own and operate a saw mill and do their own construction work. The costs of lumber and construction under the same conditions would be approximately the same.

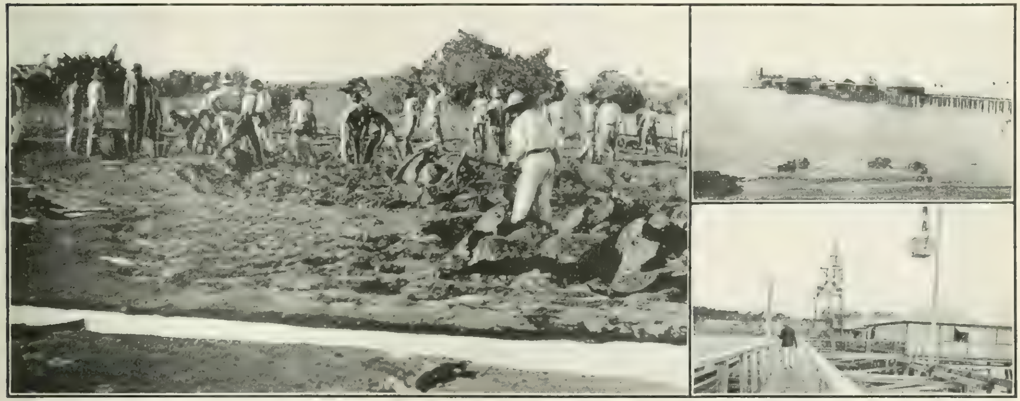
The cost of pipe is an important item in hydraulic mining in this region, due to necessary wagon haul of approximately 60 miles from Redding, the nearest railroad station. The cost stated by Mr. Shank is: 26-in. pipe, $2 per ft.; 15-in. pipe, $1.15 per ft., laid down at the mine. Mr. Lorenz segregated the price of the pipe and the freight. Cost at Sacramento: 26-in. pipe, 90c. per ft.; 15-in. pipe, 59c. per ft.; freight, Sacramento to the mine, including 169 miles to Redding by rail and 58 miles wagon haul to the mine, 2c. per lb. Total cost is the same as at Union Hill.

Channel Iron Used for Riffles

Mr. Shank has decided to experiment with channel iron as a substitute for wooden riffle blocks. Owing to the greater length of the Union Hill flume a greater width of surface between riffles than in the Lorenz flume is considered essential, so that 12x8-in. or 18x12-in. channels will be used for the experiment. The preference for channels over angles for the initial installation is based largely on economy of construction. The same wooden riffle blocks may be used for holding the channels as are now in use, as the channels are to be 5 ft. long extending across the width of the flume. Besides this, the channels may be reversed when the side and corner receiving the force of water and gravel become worn, upon the theory that the top surface of the channel iron will equal in wearing life the two sides and corners. Should the experiments warrant, the Union Hill and the Lorenz flumes will be fully equipped with channels or angles. The cost of full installation can not be well calculated at present; but in general terms the change has been considered an economic improvement at least worth the small cost of initial equipment of one or two boxes. These experiments will be well worth watching by hydraulic miners whose properties are situated like the Union Hill or the Lorenz. The geographical situation of the two mines, only three miles apart, and the essential differences in deposit and methods of operation will lend interest to the experiments.

Mining Trinidad Asphalt[*]

Trinidad asphalt from the lake or deposit near Brighton, Trinidad, B. W. I., has been mined on an increasing scale for 35 years. It is only in comparatively recent years, however, that the operation has been placed on a thoroughly efficient basis. To facilitate transport of the asphalt from the lake to the vessels in which it is shipped to the United States, Europe and South America, narrow-gage tracks are run out upon the lake on long ties which, notwithstanding the semi-solid condition of the asphalt, support the track without difficulty. The asphalt, which has a semi-conchoidal fracture, is flaked out of the deposit with mattocks and placed in skips holding about 500 lb., on the railways just mentioned. The asphalt weighs about 75 lb. per cu.ft. Cars, sometimes in trains of 8 or 10, are then hauled to a terminal at the edge of the lake, where they are placed on a cableway, about a mile long, supported by steel frames, and conveyed to steamers at the end of the Brighton pier. Although the asphalt readily flakes out of the lake, it quickly amalgamates in the steamer and upon arrival at its destination must be again "mined" out of the steamer's hold.



ASPHALT MINING ON TRINIDAD ISLAND

Natives digging asphalt from the lake bottom. The pier at Brighton and the cableway from the lake to the end of the pier

The composition of the crude asphalt is roughly as follows: Water 29%, soluble bitumen 39%, mineral matter 32%. The Trinidad deposit covers about 111 acres, and as far as exploration drills have been run they indicate that the depth is at least 135 ft. The material is absolutely uniform in all parts of the deposit. The reason for this is undoubtedly that the Trinidad lake is not an overflow of petroleum, in the sense of being an oil seep. It occurs in the bowl of a huge mud volcano. The petroleum is forced upward from the lower point of this bowl and is at or near this point mixed with extremely fine mineral matter in uniform proportion.

[*] From information furnished by the Barber Asphalt Co

The Mining Industry in Uruguay

By Rolf Marstrander*

The Republic of Uruguay has been studied but little by geologists and mining men. Only a few scattered descriptions and observations by travelers are at hand, and little systematic prospecting has been done. In the last few years, however, a change has taken place. The Instituto Nacional de Agronomia, created a few years ago, has a chair of geology occupied by an able man, and about two years ago the Instituto de Geologia y Perforaciones was created with the object of increasing the knowledge of the mineral wealth of the Republic.

Exploration by Drilling

The drilling department has nine drills consisting of diamond, percussion, combination and shot drills of varying capacities. Both this and the geological department of the institute have been working in various parts of the republic for about 1½ years. To date two bulletins[1] have been issued, and several others are in preparation and will be published within a short time.

Up to the present, metal mining has not been of importance in Uruguay. A few companies have been formed and have carried on work but, almost without exception, they have not been successful, due in great part to lack of capital. Another cause contributing to the meager development of the mining industry has been the insignificant amount of information available concerning the mineral resources and the small amount of prospecting work done. A short description of the most important mines follows:

The oldest mines, and the only ones worked continuously for any long period, are the gold mines at Cuñapirú, situated in the Department of Rivera, in the northern part of the republic. The first company started work there in 1869. Since that time the mines have changed hands many times, being operated by Uruguayan, French and English companies at various times. The last company (English) sold all its holdings in October, 1913, and at present only a small amount of prospecting work is being done by the owners.

From 1894 to 1913, the yearly production has averaged 11,400 tons of ore carrying 5.7 dwt. of gold per ton. The largest production was 26,000 tons, the highest yearly yield 9.2 dwt. per ton and the lowest was 2.4 dwt. The plant of these mines at Corrales comprises: Two rock breakers, 60 stamps, two tube mills, 12 amalgamators, two cones and six open cyanide tanks with a capacity of 30 tons each. An aërial tramway, about 11 km. long, connects the plant with the mines.

The ore occurs in quartz veins intersecting dioritic rocks. The mineralized ground extends over a vast region in this part of the country, but trained men and careful examination are necessary to detect the payable ore. Lack of water in some instances threw serious obstacles in the way of the work.

Other gold mines in this district are the Zapucay and Samuel Bloxen mines, both in the Department of Rivera, the latter is operating on a small scale at present.

At Soldado, in the Department of Minas, there exists another auriferous zone where gold and copper have been extracted from numerous pyritiferous and cupriferous zones. Many assays show an astonishing content of gold and copper, some yielding as high as 4 oz. 6 dwt. gold and 20% copper. These high-grade assays may be ascribed to samples taken from the zone of sulphide enrichment from which practically all the ore mined has been taken. The Spaniards are said to have been the first to work these veins. In 1854 a Uruguayan company started, but soon abandoned the mines. In 1909 another company resumed work on an estimate of 8% copper and 3.8 dwt. gold per ton as an average. A mill was erected but in 1912 the work was stopped, for lack of capital.

Beside the Soldado mine, only one copper mine has been worked in this country, namely, the Oriental mine in the Department of Maldonado. Considerable work has been done here on two copper veins, containing from 8 to 19% copper and having a maximum width of 2 m. The galleries and shafts are in good condition and comparatively well drained, the mine has not been regularly worked for 30 years.

In the department of Rivera, near the gold mines, there exists a large iron-manganese deposit, containing about 35% iron and 23% manganese. It is estimated that nearly 80 million tons can be taken out by opencut. The mine is owned by the Uruguay Manganese Co. A branch railway line is projected to the main line leading to Montevideo. Much development work has been done. Other deposits of iron-and-manganese ore exist at Carrasco, Montevideo, with 30 to 40% Mn; at Piedra del Gigante, Department of Minas, hematite and magnetite; at Santa Lucia in the same department, hematite; and at Cerro Mulero, Department of Treinta y Tres, magnetite.

At Las Conchillas, Department of Colonia, near La Plata estuary, talc of excellent quality has been mined for the last seven years. The total production has been 7000 tons, the greater part of which is shipped to Buenos Aires. The mineral is worked by opencut and is milled and treated at the mine.

Quarrying Industry Most Developed

The quarrying industry in Uruguay is at present far more important than metal mining as there are many beds of granite and marble of fine quality. Most of the granite quarries are situated along the south coast, especially in the Departments of Colonia and Maldonado, the most important being the Minuano quarry at Sauce, Department of Colonia, and the quarry at Piriapolis, in the department of Maldonado. The latter was greatly enlarged and improved in 1914. Modern Swedish stone-cutting machinery capable of producing 32,000 paving blocks per day has been installed.

The largest quantities and best qualities of limestone and marbles are found in the eastern departments in the crystalline -schist formation extending over large areas there. In spite of the large consumption of marble as building stone, both in Uruguay and in Argentina, all deposits are at present exclusively worked for the production of lime and for cement manufacture.

As to oil and coal, probabilities of their existence are present and the Instituto de Geologia y Perforaciones is carrying on investigations in the eastern and northeastern parts of the country; peat investigations are likewise to be started in a systematic way all over the republic.

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[1] Bull. No. 1, "The [illegible] of the [illegible] District;" Bull. No. 2, "The Mineral Resources of Uruguay."

The Cost of Cyaniding[*]

By Herbert A. Megraw

SYNOPSIS—The cost of cyanide treatment of an ore depends upon so many factors beyond control of the operator that no comparison of efficiencies can be founded upon it. Ore character, geography and plant equipment are among the principal points of difference. A table of cyaniding costs at some of the world's principal mills is appended.

The cost of cyaniding various ores is as different as the ores themselves or as their geographical location. The sum total of cyanide-treatment cost depends upon so many different factors that as a basis of comparison of plant efficiencies it is about as useless as any factor could possibly be.

Effect of Crushing and Grinding on Cost

Possibly the first factor upon which the cost of cyaniding depends is the hardness or toughness of the rock itself. Obviously a soft rock will be put in condition for cyanide treatment at a much lower figure than a hard, tough rock, and there will be a series of different costs for all the gradations between extreme amenability to mechanical reduction and extreme resistance to the same agency. The power will be different in each case, as will also the maintenance cost, expressed in terms of the cost of iron or steel consumed in the crushing operation.

The next factor of importance is the character of the ore itself—the character of its mineral composition, which affects the rate of dissolution of the metal in cyanide solutions, and therefore introduces a factor of cost difference which no ingenuity can avoid. There is also another factor depending upon the physical character of the ore, aside from its resistance to crushing. This is the kind of pulp formed after the ore is ground to the required fineness. Some ores produce a large quantity of colloid material, or slimes as they are usually called in cyanidation, while others reduce to a granular product to a great extent. It may easily be possible, and usually is quite true, that slimes and sands cost different amounts to treat, one class being in most cases considerably cheaper to handle than the other. If the two products are to be treated separately, a large preponderance of the more expensively handled material will make a higher total cost, while on the other hand if the material is all to be treated as sands or all as slimes, the cost of producing that uniform product may be high in some cases and low in others.

Cost of Transportation as a Factor

The geographical location of a plant has a great deal to do with cost, since transportation will not only influence the installation cost of a plant, and consequently its depreciation, but will also influence the cost of all its supplies and all its products. Transportation is a point that has to be given most careful attention, since it may easily make the difference between a profitable and an unprofitable operation.

Aside from the transportation influence, the geographical location of a plant has an influence upon cost in that the supply of labor is apt to be different, even in the same country, while in different countries and dealing with different nationalities the differences are so great as to be altogether incomparable. All of these matters have, however, been spoken of previously in this series of articles, and no useful purpose will be served in bringing them up again at this point. The cost of the detailed operations in cyanidation has also been discussed, so that since the total cost of cyanidation is simply the addition of all the detailed costs, all that remains to be done at this point is to discuss the costs in general and show in a broad way, if possible, upon what they depend.

In considering the cost of cyaniding, one usually considers all the mill operations, beginning with rock breaking, crushing, regrinding, and continuing with the operations necessary to complete the treatment, including concentration and amalgamation, if these are part of the milling system. It is, of course, perfectly clear that all of these items are not cyaniding proper, but since by "cyaniding" we usually mean the total milling operation in which the cyanide process is used, and since all the processes which precede and follow actual cyaniding are designed to be an assistance in the process, to promote its efficiency and to make it deliver a higher extraction or effect a reduction of cost, they must all be considered as vital parts of the system. Cost of cyaniding cannot be limited strictly to the dissolving of the metal in cyanide solution and its precipitation afterwards, but must include all the processes which have effect upon the actual dissolution of the ore.

Influence of Machinery Types

Among the practices which exercise a strong effect upon ore treatment are the methods of breaking, crushing and grinding. Usually jaw or gyratory type breakers are used for the first rock reduction, followed by stamps, rolls, chilean mills or perhaps some other form of intermediate crushing machines. Of all of these types, the stamp may be regarded as the most expensive on all ordinary ores, although on exceptionally tough ores it may be somewhat cheaper than other machines, due to the less destruction of iron per ton of ore milled. On ores of medium toughness rolls may be used with good effect, or a ball mill of any of the several types now in general use for the purpose may be used. These machines perform a reduction from coarse rock, which will pass a 1½- or 2-in. ring, down to a size appropriate for tube-mill feed, approximately a maximum size of 10 mesh, or perhaps up to ¼ in. Chilean mills, of either high speed or low speed, will also perform work of this class, and the slow-speed mill may be considered somewhat cheaper as to power consumed and wear and tear on the grinding parts, though its installation cost is somewhat higher since it does not have the large capacity of the high-speed mills.

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[*] This is the twentieth and last of a second series of articles by Mr. Megraw. Preceding articles of this series appeared in issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, 1913; Jan. 31, Mar. 7, Mar. 21, Apr. 25, May 23, June 20, July 25, Aug. 29, Sept. 12, Oct. 17, Oct. 31, Dec. 5, Dec. 26, 1914, and Feb. 13, 1915.

The cost of this intermediate crushing process, then, will depend altogether upon the nature of the ore itself. An extremely hard, tough ore will probably require the use of stamps to bring it satisfactorily to a size for regrinding, if regrinding is followed, while a medium or soft ore can be handled in some one of the cheaper machines, the machine most available depending upon the kind of ore to be reduced.

SEPARATE-TREATMENT PLANTS

Regrinding is not always followed. After the intermediate-crushing process cyaniding may be immediately undertaken without any further reduction of the ore size. In this case, it is usual to divide the pulp into two classes, to be called sands and slimes—sands to be leached in open tanks and slimes to be treated by agitation. Sometimes only leaching is resorted to, the slimes being discarded or saved for future treatment. In this case the reduction process is likely to be extremely cheap, since leaching is cheap and requires little labor and little installation, and consequently necessitates only a low maintenance cost. If slimes are to be treated too, the cost will be somewhat higher.

If the pulp, however, is to be treated as a total slime, then the cost is higher on account of the agitation required, and also because of the interest upon the more expensive installation made necessary by the conditions. Added to this, there is the cost of reducing the ore to a total slime; that is, taking the sand product from the intermediate crusher and reducing it to a fineness such that it may be all treated in agitation tanks. This usually means passing all of the material, or much the greater part of it, through a 200-mesh screen. The operation is usually performed in tube mills and is a factor which adds materially to the cost of the operation in total. Crushing and grinding costs have already been referred to in this series of articles, and reference to the data will show the comparative cost of the different methods of reduction.

Between the intermediate crushing and fine grinding operation there comes the process of classification, which means the separating of the oversize material requiring further grinding from the slime or portion which has already been reduced to the fineness sufficient for agitation methods. Classification may be carried out in several machines and by several methods, and each of them will have a different cost. Probably the principal apparatus used for classification is the Dorr classifier, while others which may be mentioned as efficient and satisfactory in many cases are the Akins, Esperanza, Ovoca and several other types of mechanical separators. Besides these there are the cone classifiers, which may be simple separating cones, or cones with the Caldecott diaphragm. All these machines are efficient under special conditions, and the cost of operating each of them will probably be different in any case. Study must always be made of the proper applications of any machine, and classification is no exception to this rule. The use of any particular means in any special case will provide a cost of operation which may be, or may not be, reduced by using some other machine, the finality depending upon the care with which the selection was originally made.

LEACHING AND AGITATION COSTS

If leaching is to be adopted, there is not much chance of a cost change except in the provision of material of proper fineness. Various degrees of fineness will cost various amounts for their production, so that the cost of leaching a material of any particular fineness will have to be worked out for each case. When agitation of slimes is considered, however, there are any number of different methods of doing it, all of which have a material effect upon the final cost. The various agitating devices, such as the Pachuca tank, the Hendryx agitator, the Patterson agitator, Dorr agitator and dozens of other devices which have been suggested for the purpose, all require different degrees of power and maintenance costs, and work with different efficiencies. Their total cost will differ materially. In agitation not only efficiency has to be taken into account, but power consumption, durability and the ability to operate for long continued periods of time without plugging up. If an agitator is liable to stoppage, it will have to be dug out every once in a while, and the cost of doing this work must be added to the cost of operation, which will be likely to run the cost figures up materially. The cost of agitating a sandy ore will differ very much from that required for agitating a pure colloid, so again the physical condition of the ore has a large effect upon the ultimate cost of treating it.

Proceeding from the agitation department, when slimes are treated there are other processes which have an appreciable effect upon the cost of the system in general. Pulp thickening, for instance, may be performed either in cones of the Callow type or plain cones, or in Dorr thickeners. The process used, if any, will have an effect upon the total cost. The filtering operation, the final one in the cyanide treatment of ore, will have great importance upon the ultimate cost. As has already been set forth in the chapter on filtering in this series of articles, each system has an entirely different cost factor, both for operation and for installation. The leaf filters of the vacuum type have a high operation cost and a high installation cost. The pressure filters of the leaf type may be considered somewhat more economical in both departments in many cases, although not in all. Again the plate-and-frame type of filter may be used, either in its original form or with the Merrill improvement, which materially reduces cost of operation. Depending upon the quantity handled, either of the systems may be used under proper circumstances. Another alternative is the counter-current decantation system as proposed and designed by Dorr, which avoids the use of any filter at all, accomplishing the washing result by successive decantation of low-value solution or water. This system is used in many cases, and assists in reducing the ultimate cost of the cyaniding operation.

ECONOMY OF PRECIPITATION METHODS

The method of precipitation will have some effect upon the ultimate cost also, since the zinc-dust method, as applied by Merrill, will have numerous advantages in many cases over the zinc-shaving method formerly widely used. Aluminum dust is also sometimes used as a precipitant, notably at the plant of the Nipissing Mining Co., Cobalt, Ont. All of these systems will have an effect upon the cost of cyaniding operations, and each will probably provide a minimum cost in different cases. In addition to the various methods of operation, it is of course obvious that the scale of operation will have a vital effect upon ultimate cost. In general it may be said that the greater the scale of operation, the lower the cost, although this does not always hold true since large operations may be carried on at isolated or remote locations, and under labor conditions which make the total cost excessive. Granted that other conditions remain the same, however, it may be said that the greater the scale of operation, the lower the total cost.

In comparing costs of cyaniding, or any other operation in the mining field, it must be fully and carefully and constantly borne in mind that the cost figures afford no basis for comparison of efficiency, economy or intelligence in plant operation. No two plants can be compared unless all conditions are absolutely identical, which never obtains in actual practice. While a notation of costs obtained in various mills may be enlightening as to the limits within which cyaniding can be performed under various conditions, the comparison of these costs among themselves must not be considered as representing efficiency.

Cost Figures at Different Mills

The accompanying table of the cost of operation at various cyanide plants will give a general idea of the limits within which the process is carried on. Those interested in the cyanide process will realize that these plants are of different size, working on different ores, located in different parts of the world, near and far from railroad communication, and in general working under every conceivable combination of circumstances. Naturally the costs are widely different. The first plant, the Tom Reed, of Arizona, is remote from a railroad, in a dry and rugged country, and therefore its costs are comparatively high. The next plant mentioned, Stratton's Independence, of Cripple Creek, Col., is working on a large scale in a camp amply supplied with railroad and other communications, using a cheap method of crushing and concentration, ably managed, and working on a gold ore, which is of course cheaper to treat than silver, due to the difference in the volume of metal extracted. Its costs are noticeably low. Most of the Tonopah mills are mentioned, and it will be seen that there is no great difference between their costs when it is considered that the higher costs are at the older mills and that some of the figures given include administration costs.

As has been said, it costs much more to treat a silver ore than it does a gold ore. Silver does not occur native, but in complex minerals, and the volume is very much greater than is the case where gold is treated. The Pittsburgh Silver Peak mill has a low cost, because it works a medium-grade gold ore on a comparatively large scale and by a simple process; that is, leaching the sand and treating the slime in Merrill filter presses. The Homestake treats for a low cost on account of its enormous working scale. The Wasp No. 2 treats cheaply because of the simplicity of the process, which is simply roll crushing to coarse mesh and leaching. It also operates on a good scale—500 tons per day. The G. C. & C. costs are introduced simply to show the approximate cost of leaching accumulated tailings by a simple process. In this case there is no crushing or grinding to be accounted for, and the whole operation is conducted on a temporary basis.

At the Dome and Hollinger mills in the Porcupine District, the costs are based on large-scale treatment of medium-grade gold ore in a cold country. It may be mentioned here that the costs in a cold country are somewhat higher, due to the necessity of heating the mill in winter time during the severe weather. At the Nipissing mill, Cobalt, a highly complex ore is treated by a specialized system with which all cyaniding engineers are at the present time undoubtedly familiar.

Among the Mexican mills, a great difference in cost will be noticed. At the Dolores, for example, costs are high, due to the isolated locality of the plant, which is several days by trail from the nearest railroad station. El Rayo is also isolated, and therefore its costs are also high.

At the Central American plants there is also a great difference in cost, a good deal of this difference depending upon the character and quality of the labor used. In the Orient, costs are low, due to the exceeding cheapness of the native labor. On the Rand the costs are low, since upon most of the ore separate treatment is employed, regrinding for total sliming being a rarity.

COST OF CYANIDING

United States and Canada

Plant	Cost per Ton Milled
Tom Reed	$3.376
Stratton's Independence	1.310*
Camp Bird	1.830
Liberty Bell	1.500
Goldfield Con	1.610
Montana Tonopah	3.121*
Nevada Hills	2.830
Tonopah Belmont	2.960
Tonopah Extension	3.290*
West End Consolidated	3.620*
Tonopah Mining Co (Desert Mill)	2.670
Pittsburgh Silver Peak	1.010
Homestake	0.897
Wasp No 2	0.630
North Star	0.979
Black Oak	1.729
Consolidated Mercur	1.270*
G. C. & C (tailings leaching, Eureka, Utah)	0.890*
Motherlode (Sheep Creek, B. C.)	**1.400**
Dome	**2.110**
Hollinger	1.490
Porcupine Crown	1.640
Nipissing	2.952

Mexico

	Cost per Ton Milled
Creston Colorada	$1.690
Dolores	6.000
El Rayo	3.220
Dos Estrellas	1.250
El Oro Mining & Ry Co	1.100
Esperanza (El Oro)	**1.610**
Mexican Mines of El Oro	1.190
La Blanca	1.725
Santa Gertrudis	2.440†
Guanajuato Reduction & Mines	1.350
El Tigre	3.380

Central America

Abangarez Gold Fields of Costa Rica	$3,640
Aguacate	1.310
Montezuma Mines of Costa Rica	2.350*
New York and Honduras Rosario	3.460*
Lone Star (Nicaragua)	0.990
Siempre Viva (Nicaragua)	**0.920**
Butters Divisadero (Salvador)	**1.690**

The Orient

Oriental Consolidated (Chosen) Three different mills	$1.630 1.870 3.180
Mysore	**0.829**
Nundydroog	**0.771**

Transvaal

Aurora West United	$0.960
Meyer & Charlton	1.090
New Goch	0.940
Roodepoort	0.870
Van Ryn	0.850
Knights Central	0.940
Main Reef West	0.996
Simmer & Jack Prop	0.737

*Includes general expense †Includes shipping and selling

The figures given are compiled from various published sources—technical journals, books, company reports, etc., and are for periods of six months or a year during years varying from 1912 to 1914. The latest reports have been used whenever there has been any choice. No attempt has been made to include all plants, nor most of them, but simply to present enough types to show the general limits within which the work is carried on.

Mineral Production of Canada*

The preliminary report on the mineral production of Canada in 1914 shows a total value of $128,475,499, which is a decrease of $17,159,313, or 11.8%, from 1913. This is the first decrease shown in a number of years, and is the smallest total reported since 1911. The first table shows the details of this production.

By provinces Ontario again has the largest output with a value of $52,147,973, or 40.6% of the total, practically the same proportion as in the previous year. British Columbia is second with a value of $24,202,924, or 18.8%; Nova Scotia is third with $17,514,786, or 13.6%; Alberta fourth with $12,773,669, or 9.9%; Quebec fifth with $12,259,637, or 9.5%; the Yukon sixth with $5,402,062, or 4.2%; Manitoba seventh with $2,428,902, or 1.9%; New Brunswick eighth with $1,034,706 and Saskatchewan ninth with $710,840, each less than 1%. A decreased production is shown in each province with the exception of Manitoba and in this case the increase is due chiefly to the operation of the new cement mill near Winnipeg by the Canada Cement Co. and the inclusion of a more complete record of the production of sands and gravels.

MINERAL PRODUCTION OF CANADA

	1913		1914	
	Quantity	Value	Quantity	Value
Copper, lb	76,976,925	$11,753,606	75,738,386	$10,301,935
Gold, oz..........	802,973	16,598,923	770,374	15,925,044
Pig iron, tons	1,128,967	16,540,012	783,164	10,002,856
Lead, lb	37,662,703	1,754,705	36,337,765	1,627,568
Nickel, lb	49,676,772	14,903,032	45,517,937	13,655,381
Silver, oz.....	31,845,803	19,040,924	27,544,231	15,097,269
Other metallic products		1,313,732		1,123,919
Total....		$81,904,934		$67,733,972
Less pig iron credited to imported ores, tons	1,055,459	15,543,583	687,420	8,863,944
Total metallic		$66,361,351		$58,870,028
Asbestos and asbestic, tons	161,086	$3,849,925	117,573	$2,909,806
Coal, tons	15,012,178	37,334,940	13,594,984	33,433,108
Gypsum, tons...........	636,376	1,447,739	510,663	1,137,157
Natural gas, M ft	26,477,838	3,309,381	21,047,028	3,511,302
Petroleum, bbl	228,080	406,439	214,805	343,124
Pyrites, tons.	158,566	521,181	224,958	735,514
Salt, tons	100,791	491,280	107,038	493,648
Cement, bbls	8,658,805	11,019,418	7,172,480	9,187,924
Clay products		9,504,314		7,090,898
Lime, bu...	7,558,484	1,609,398	6,245,189	1,247,517
Stone...		5,504,639	. ..	5,593,485
Miscellaneous non-metallic...		4,274,807	. .	3,921,988
Total non-metallic		$79,273,461		$69,605,471
Grand total...........	....	$145,634,812	....	$128,475,499

The quantity of ores treated by smelters and refiners in Canada in 1914 was: Nickel-copper, 917,053; silver-cobalt, 5661; lead, 71,064; copper-gold, 1,612,197; total, 2,649,935 short tons, a decrease of 387,456 tons from 1913. The first products were 12,238 tons blister copper, 6291 tons copper matte, 46,396 tons nickel-copper matte and 101 tons cobalt material. The metallic contents are given in the accompany table.

SMELTER PRODUCTION IN CANADA

	Refined	In Matte, Etc	Total
Gold, oz.......	11,088	170,818	181,906
Silver, oz. ..	11,096,861	873,400	11,970,261
Lead, lb ..	36,443,706		36,443,706
Copper, lb		59,237,016	59,237,016
Copper sulphate, lb	152,060		152,060
Nickel, lb		45,517,937	45,517,937
Nickel oxide, lb	391,312		391,312
Cobalt oxide, lb....	895,789		895,789
White arsenic, lb	3,474,322		3,474,322

Gold

The total production of gold, in placer and mill bullion and in smelter products in 1914, is estimated at 770,374 fine oz. valued at $15,925,044, showing a decrease of $673,879 or about 4%. Of the total production in 1914, about $5,695,508 was derived from placer and alluvial mining; $6,050,690 in bullion from milling ores, and $4,228,846 from matte, blister copper and other smelter products, etc. The production in Nova Scotia and Quebec is small compared with the other provinces but shows an increase of over 25% in 1914. The Ontario production, $5,546,356, shows an increase of over a million dollars due to the extension of milling facilities in the Porcupine field.

No records have been received with respect to gold production in the Beaver Lake district of Saskatchewan or of recoveries from the river bars near Edmonton, Alberta, although activity has been reported in both localities.

The production in British Columbia was $5,177,343, of which $524,000 is credited to placer workings as estimated by the Provincial Mineralogist, and $4,653,343 to smelter products and bullion from milling ores. The Yukon production shows a falling off of $721,384, the total in 1914 being $5,125,396 including a small value in mill bullion.

Silver

The falling off in price of silver amounting to 4c. on the average price for the year, the cessation of price quotations and the difficulties of marketing the metal immediately following the declaration of war restricted operations in the Cobalt camp, causing a lower production than might have been expected under normal conditions.

The total Canadian production in 1914 was 27,544,231 oz., valued at $15,097,269, a decrease of 4,301,572 oz., or 13.5% in quantity, and of $3,943,655, or 20.7% in total value. Of the total production 24,215,926 oz., or 88% is credited to Ontario. The production from the silver camps is reported as 9,614,069 oz. in bullion shipped, and 14,544,524 oz. (after deducting 5% for smelter losses) contained in ore and concentrates shipped from Cobalt district. There is also included in the total a small quantity of silver contained in gold bullion shipped.

The Ontario production in 1913 was 28,411,261 oz. showing a falling off for the province of 4,003,805 oz., or about 14.1 per cent.

In addition to the bullion shipments from the Cobalt camp, 9,052,993 oz. were produced in other silver refineries in the province, making a total of 18,667,062 oz. or 67.7% of the Ontario production recovered within the province in the form of bullion. The production in British Columbia, representing refined silver and silver contained in smelter products and estimated recoveries from ores exported, was in 1914 about 3,212,111 oz. There was a small production in copper ores from Quebec, and in gold and copper from the Yukon.

Copper and Lead

The copper situation in 1914 was marked by an increased production in Ontario and Quebec as against a falling off in British Columbia and the Yukon, leaving the net result as a very slight decrease.

The copper contained in matte, blister copper, etc., produced in Canadian smelters together with the estimated recoveries or amounts paid for in ores exported amounted in 1914 to 75,738,386 lb. There was a falling off of only 1.6%, but, owing to the lower price, a larger percentage decrease in total value.

The production in Quebec from pyrite ores was 4,201,497 pounds.

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*Abstract of the Annual Report of John McLeish, Chief of Division of Mineral Resources and Statistics, Department of Mines of Canada, Ottawa.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine, although there is a small amount of copper contained in the silver ores shipped from Cobalt, some of which is paid for. The production in 1914 is reported as 28,948,211 lb., an increase of 3,062,282 lb. over 1913. The Mond Nickel Co. contributed a much larger percentage of the total production during 1914 than in 1913. The British Columbia production was 41,221,628 lb., a falling off of 4,569,951 lb. The Pueblo mine was again the principal copper producer in the Yukon.

The smelter production of lead from Canadian ores in 1914 was 36,337,365 lb., nearly all of it from British Columbia ores, recovered at the Trail smelter.

Nickel

The declaration of war resulted in the almost immediate closing down of a considerable portion of the mining and smelting operations of the Canadian Copper Co. in the Sudbury district, and although they were partially resumed before the close of the year the company's output was greatly reduced. The Mond Nickel Co. on the other hand, having increased the capacity of its smelter at Coniston, nearly doubled its output. Ores from the Alexo nickel mine north of Cobalt were also reduced in this smelter. Ten separate properties were worked by these companies.

PRODUCTION OF NICKEL IN CANADA

(In Short Tons)

	1911	1912	1913	1914
Ore mined	612,511	737,584	784,697	1,000,364
Ore smelted	610,834	725,065	823,403	947,053
Bessemer matte produced	32,607	41,925	47,150	46,396
Copper content of matte	8,966	11,116	12,938	14,448
Nickel content of matte	17,049	22,421	24,838	22,759
Spot value of matte	$4,945,592	$6,303,102	$7,076,945	$7,189,031

The nickel-copper ore is reduced in smelters and converters to a bessemer matte containing from 77 to 82% of the combined metals and shipped in that form to Great Britain and the United States for refining; the product of the Canadian Copper Co. going to New Jersey and that of the Mond Nickel Co. to Wales. A portion of the matte produced by the Canadian Copper Co. is used for the direct production of Monel metal, an alloy of nickel and copper, without the intermediate refining of either metal. There is also a small recovery of nickel in the form of oxide from Cobalt District ores. Details of the production and working are shown in the accompanying table.

Iron Ore and Iron

The iron-ore shipments from mines in Canada during 1914 are reported as 244,854 short tons. These shipments included 199,292 tons of hematite and roasted siderite and 45,562 tons of magnetite and concentrates. Exports of iron ore from Canada during 1914 were recorded by the Customs Department as 135,451 tons. Imports of iron ore in 1914 were 1,447,408 tons, valued at $2,387,358.

The total production of pig iron in Canadian blast furnaces in 1914 was 783,164 short tons, as compared with 1,128,967 tons in 1913. A large portion of this production is used directly in the manufacture of steel and the values are in part estimated. Of the total production in 1914, 9380 tons were made with charcoal and 773,784 tons with coke. The classification of the production, according to the purpose for which it was intended, was as follows: Bessemer 230,817, basic 346,553, foundry and malleable 205,794.

The ore charged to blast furnaces included 182,961 tons of Canadian ore, 1,324,326 tons of imported ore, and 33,583 tons of mill cinder, etc. The amount of coke used during the year was 921,171 tons, comprising 330,269 tons from Canadian coal, and 590,902 tons of imported coke or coke made from imported coal. The quantity of charcoal fuel used was 920,045 bu. and of limestone flux 117,636 tons.

Nova Scotia reported 227,052 tons made and Ontario 556,112 tons.

There was also a production during 1914 in electric furnaces of 7521 tons of ferro alloys (ferrosilicon and ferrophosphorus) compared with 8075 tons in 1913. This production is chiefly 50% ferrosilicon.

Coal and Coke

The production of marketable coal is shown in the accompanying table. Exports of coal for the year were 1,423,126 tons. Imports were 4,435,070 tons anthracite and 10,286,047 tons bituminous.

The total output of oven coke during 1914 was 1,015,253 short tons made from 1,533,365 tons of coal, of which 1,030,053 tons were mined in Canada, and 503,312 tons were imported. The total quantity of coke sold or used by the producers during the year was 1,019,082 tons. The output by provinces in 1914 was: Nova Scotia 345,880 tons; Ontario 377,514 tons; Alberta 28,541 tons, and British Columbia 263,318 tons. The production from Ontario was entirely from imported coal.

COAL PRODUCTION IN CANADA

(In Short Tons)

	1912	1913	1914
Nova Scotia	7,783,888	7,980,073	7,338,790
British Columbia	3,208,997	2,714,420	2,238,339
Alberta	3,240,577	4,014,755	3,667,816
Saskatchewan	225,342	212,897	232,541
New Brunswick	44,780	70,311	104,055
Yukon	9,245	19,722	13,443
Total	14,512,829	15,012,178	13,594,984
Coke made	1,411,219	1,517,133	1,015,253

Byproducts from coke ovens during the year included 8572 tons of ammonium sulphate; 5,714,172 gal. of tar and 3,201,097 thousand feet of gas.

Miscellaneous

The asbestos production in 1914 was obtained from the districts of Black Lake, Thetford, Robertsonville and Danville in the Province of Quebec.

The total output in 1914 was 107,668 tons, a falling off of 24,896 tons, or 18.7%. The sales and shipments of asbestos during 1914 were 96,542 tons. Stocks on hand on Dec. 31, 1914, were 31,171 tons.

The production of petroleum was chiefly from Ontario, the western fields not having reached the stage of commercial production. The total production in 1914 was 228,080 bbl., or 7,518,168 gal. The total production of natural gas was 21,017 million feet, about two-thirds from Ontario and nearly one-third from Alberta.

The year 1914 witnessed a large falling off in the production of nearly all materials of construction. This situation while possibly aggravated by the war was due primarily to conditions which had already begun to show their effects during the latter part of 1913.

The total quantity of portland cement, including slag cement and natural portland, made in 1914 was 8,727,269 bbl. of 350 lb. each, a decrease of 2%. The total quantity of Canadian portland cement sold or used during 1914 was 7,172,480 bbl. The average value at works was $1.28 per barrel.

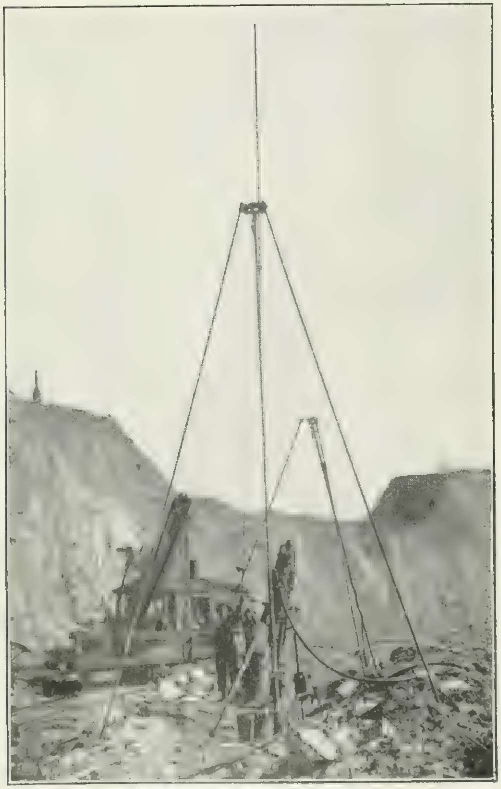
Details of Practical Mining

Tripod for Handling Long Drill-Steel

By Le B. Reifsneider*

The accompanying illustration represents a device we have found useful in handling long pieces of steel when drilling vertical holes up to 35 ft. in depth, using tripod drills.

The device consists of the parts of an old tripod so badly worn as to be no longer safe as a drill mounting.



Old Drill Tripod Rigged with Extension Legs

The usual short pipe legs are removed and replaced with lengths of 1½-in. pipe, the latter being threaded and having a coupling on the lower end for convenience in adding short lengths of pipe when it is desired to increase the height of the rig. An eye-bolt is put into the opening in the saddle and secured there by a washer and nut, and a single block with a ¾-in. manila line rove through it is hooked into the eye-bolt. The line is two and a half times the length of the tripod legs, and at one end a simple straight hook of ½-in. round iron is fastened.

In use the tripod is first laid out on the ground, the front legs are spread to a width that will make a stable base, usually about one-half the height although sometimes less, and all bolts are drawn up and tightened except the nut on the through bolt which holds the rear leg. The block is then hooked into the eye-bolt, the rope rove and the tripod raised and moved over the hole where the machine is drilling, so that the hook on the rope falls approximately over the center of the hole.

In removing a piece of steel from the hole it is first pulled up as far as it can be conveniently handled with the dolly bars, one man then lets go the dolly bar and takes three turns of the hook end of the rope around the steel close to the collar of the hole, fastening the hook back over the rope above the turns on the steel. He then pulls the rope taut and takes several turns around the rear leg of the tripod on which the drill is mounted. As soon as he has done this, the other man lets go the dolly bar and aids the man at the rope to pull the steel up until the bit swings clear of the collar. After this the steel is lowered by paying out the turns of the rope on the leg of the drill tripod. The steel is always handled between the two front legs of the rig, since this gives greater stability.

The illustration shows the regular drill crew of two men raising a piece of steel 35 ft. long, using a tripod 22 ft. high. The rig is used for all steel over 20 ft. in length.

Beside the saving of time and labor in handling the steel this is also a valuable safety device, since by using the drill-tripod leg as a snubbing post the steel is always under control and can be handled safely on a narrow ledge in a high wind.

*

First-Aid Kit

The following is the first-aid kit specified by the Massachusetts factory law:

One 2-oz. bottle of aromatic spirits of ammonia (to be renewed every three months).

One 2-oz. bottle of 1% boric-acid solution.

One 2-oz. bottle of alcoholic iodine.

Two 3-oz. tubes of 3% bicarbonate of soda in petrolatum.

One 3-in. by 10-yd. roll of gauze bandage.

One 2-in. by 10-yd. roll of gauze bandage.

Two 1-in. by 10-yd. roll of gauze bandage.

One medicine glass.

Three drinking cups (paper), to be used once only.

One teaspoon.

One eye dropper.

One pair 1½-in. scissors.

One dozen assorted safety pins.

One 1-oz. jar of green soap, to cleanse hands.

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*Mine superintendent, Spanish-American Iron Co., Daiquiri, Oriente, Cuba.

One basin enameled or nonrustable metal.

One-half pint of grain alcohol.

Six paraffin envelopes, each containing 6x36 in. of sterilized gauze, dressings for wounds, burns, etc.

One yard of 24-in. canton flannel, to make triangular slings.

One 1-in. by 5-yd. spool of adhesive plaster.

One rubber tourniquet, 24x½ in., or of webbing about 24x1-in., to control hemorrhage.

Two splints, 30x4x$\frac{3}{16}$-in., whitewood, and one wire-gauze splint, about 30x4 in., for fractures.

The National Founders' Association has adopted the following for its standard package:

One tourniquet.
One pair of nickel-plated scissors.
One pair of nickel-plated tweezers.
One triangular sling.
One wire-gauze splint.
Twelve assorted safety pins.
One 2-oz. bottle of castor oil.
Two 3-oz. tubes of burn ointment.
One 2-oz. 3% alcoholic iodine.
One 2-oz. bottle of white-wine vinegar.
One 2-oz. bottle of 4% aqueous boric acid.
One 2-oz. bottle of aromatic spirits of ammonia.
One 2-oz. bottle of Jamaica ginger (or substitute).
One piece of flannel, 24x36 inches.
One roll of absorbent cotton (1.5 ounces).
One 3-in. by 10-yd. roll of gauze bandage.
One 2-in. by 10-yd. roll of gauze bandage.
One 1-in. by 5-yd. spool of adhesive plaster.
Six packages of 6x36-in. of sterile gauze.
One teaspoon.
One metal cup.
Two medicine droppers.
Three paper drinking cups.
First-aid record cards.

This is the outfit to be packed in the jar described in the Journal of Jan. 30, 1915.

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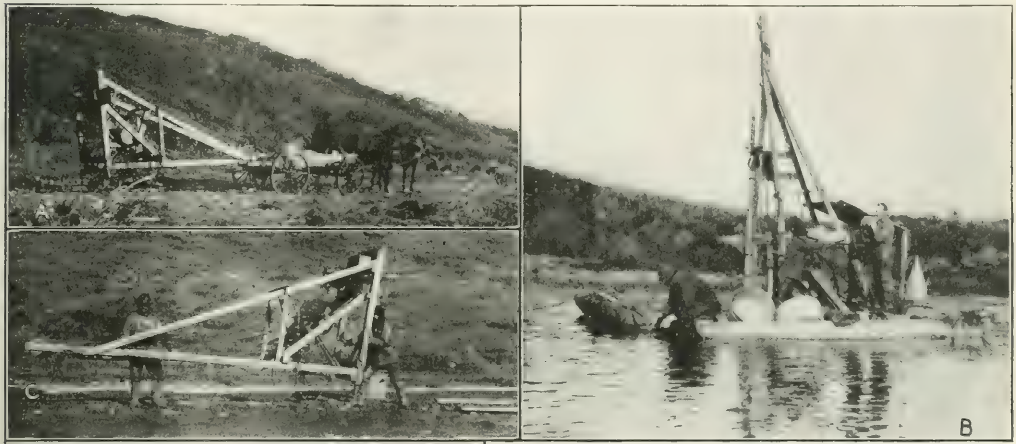
Union Portable Gasoline Churn Drill

The Union Construction Co. of San Francisco manufactures a light portable power drill, especially adapted to placer testing and prospecting. This drill is much lighter and more easily handled than the older types of power drills used for such work. Two types of the Union drill are offered; type A is provided with a wooden frame and built to use 4-in. casing; type B is of all-steel construction, built to use 5-in. casing. The shipping weight of type B, including 50 ft. of casing and all tools, is approximately two tons.



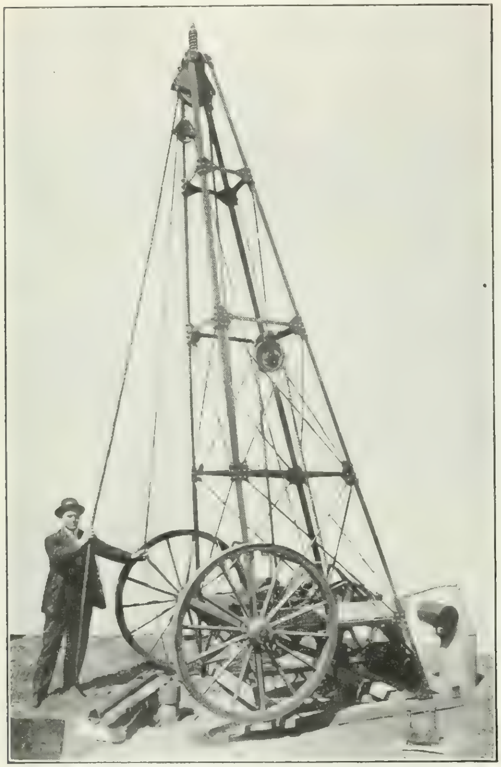
Union Drills in Transport and in Use in Alaska

A—Hauled by wagon on a five-mile move. B—Operating from a scow. C—Moving by hand. D—Packed 48 miles over a trail

The drill is intended for operation by two men, a driller and a panner, and is moved about by tipping to a horizontal position on its two-wheeled axle, and hauling by hand or by horses. The frame is built of structural steel sectionalized for transportation. All gears and main bearings are of steel. Sheaves are bronze bushed, and the four legs of the frame are well braced with tie rods. Steel channels are used for carrying the spudding gear.

These drills are operated by means of a 4-hp. Cushman gasoline engine, of the four-cycle type, having a speed range of from 350 to 900 r.p.m. The drill has no walking-beam, but is fitted with a slip-shoe friction in the spudding gear. This gives the bit an unimpeded fall. The ordinary speed is 42 strokes per min. and the length of the stroke is adjustable from 24 in. to 36 in. The standard bit weighs 185 lb.; the heaviest single piece of the frame weighs 90 lb. and the heaviest piece of machinery weighs 135 lb. The engine is heavy for its horsepower and has a low piston speed; its life and durability are correspondingly increased.

When drilling, the operator stands in front of the drill next to the drive pipe and has four levers in reach to control all actions of the machine. When in operation, the machine stands on a broad base, and when ready to move, the two-wheel axle is put in place. The pivoting point is such that two men tip the frame to a horizontal position. It is easily replaced in an upright position and made ready for drilling. The wheels and axle are then detached and removed. For soft ground the wheels are provided with extra-wide tires.



Type B Machine Making Ready for Drilling

The drill may also be equipped with a centrifugal pump for shaft sinking under special conditions. For this work the drill line-drum is used for hoisting.

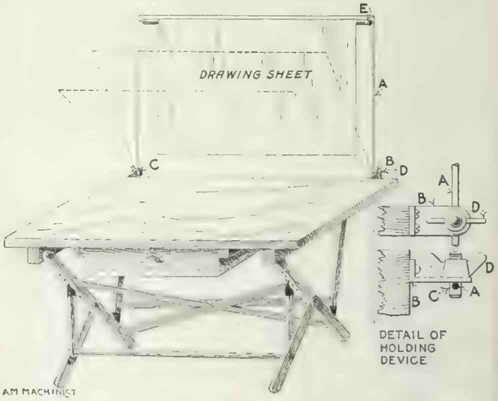
Stoping at Park City

Writing in the February "Bulletin of the American Institute of Mining Engineers," James Humes describes Park City mining methods (presumably those at the Silver King Coalition especially) as follows:

Most frequently the ore dips down from the fissures (that is, the north-dipping fissures); and if our drift in the fissure has cut the ore we work down on it as far as we can by shoveling the rock out. If it persists in going down, we rig up one of our many small hoists, of which we have over a dozen, ranging in size from a Holman stretcher-bar to a double-cylinder 35-hp. These little hoists enable us to raise our regular mine cars. If the angle is too steep for a direct pull, we simply fasten the end of the hoisting rope to a post at the top of the inclined winze, and pass it through a 7-in. pulley hooked into the car. This method gives the engine a double purchase; and even with our little double-cylinder 5x6-in. engines we are seldom unable to manage our 18-cu.ft. cars. If the deposit is too thin, we take up enough of the bottom to admit the car. Often our temporary inclines will meet with a face of barren rock. In such cases we do not cut through the waste but turn our rails to the right or left, as the case may be, and follow the ore. Should the ore continue down on the dip for a considerable distance, we run small drifts right and left from our main incline, in which we use a small special car, dumping its contents into a hopper that connects with the car on the main incline. Should there be a sufficient thickness of ore at the point where we wish to run one of these sublevels, we simply put down a track switch on the main incline, the points of which we throw with a lever on the level that is connected with the points by means of a long rod, crank and short rod, and in this way we are able to load the mine cars that are hauled to the ore bins on the surface.

Copyholder for Draftsman

Writing in the *American Machinist,* John E. Cahill describes his invention intended to aid the draftsman in copying and combining drawing and maps. The device is made for attachment to a drawing-board. It consists of the rods *A*, fastened to the table with the angle irons *B*. A socket *C* holds the rods in any desired position, being locked with the thumb-screws *D*. A shade roller *E* is fastened to the two vertical rods, a wire being attached to hold the upper ends of the rods rigid. The attachment may be placed in any desired position or dropped behind the table should it not be in use. When the draftsman is working on the drawing board, drawings for reference are placed on the roller, thus locating the drawing in a convenient position for use. The device would seem to hold out promise of usefulness to the mining engineer required to combine data from a number of old maps into a new map, and for similar work.



Shade-Roller Attachment for Drawing Board

Details of Milling and Smelting

Size of Products from Square and Round Hole Screens

By H. A. Roesler*

In practice, screens larger than 1 mm. usually consist of round perforations in plates. In laboratory work the hand screens are made of wire cloth, the openings of course being square. It often becomes necessary to know what size of square opening is equivalent to a specific size of round opening or *vice versa*. The following tests were made to show this relation, a set of hand screens with round perforations being checked against a set of accurately measured wire-cloth screens.

A sample was first screened through the perforated plates and the cumulative curve plotted as shown in Fig. 1. It was then screened through the wire-cloth screens and, from the cumulative curve, the size with round holes, equivalent to the percentage obtained with the wire cloth, noted. The ratio between the space of the wire-cloth screen and this size is the relation sought.

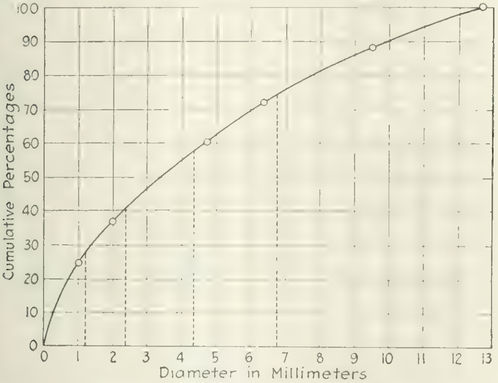


Fig. 1. Cumulative Curve of Screen Test No. 1, Using Round-Hole Screens. Dotted Vertical Lines Show Points Where Wire-Cloth Percentages Cut the Curve

SAMPLE SIZED THROUGH ROUND- AND SQUARE-HOLE SCREENS

	Percentage of Sizes			
Size of Round Holes	Test No. 1	Test No. 2	Test No. 3	Test No. 4
On 9.53 mm..	11.9	0.7	9.5	1.5
9.53 mm. to 6.35 mm..	15.9	1.1	15.8	2.9
6.35 mm. to 4.76 mm	11.8	1.8	10.8	3.0
4.76 mm. to 2.00 mm..	23.0	42.4	19.6	31.4
2.00 mm. to 1.00 mm..	12.2	27.9	12.0	29.8
Through 1.00 mm......	25.2	26.1	32.3	31.4

	Percentage of Sizes			
Space of Wire Cloth	Test No. 1	Test No. 2	Test No. 3	Test No. 4
On 5.41 mm.. ..	25.1	1.5	23.1	4.5
5.41 mm. to 3.48 mm..	17.7	3.6	16.3	4.5
3.48 mm. to 1.88 mm...	16.6	33.7	14.4	26.8
1.88 mm. to 0.91 mm..	12.9	29.7	13.1	28.4
Through 0.91 mm	27.7	31.5	33.1	35.8

EQUIVALENTS OF ROUND AND SQUARE HOLES

	Equivalent Size of Round Holes			
Space of Wire Cloth	Test No. 1	Test No. 2	Test No. 3	Test No. 4
5.41 mm....	6.78 mm	6.80 mm	6.68 mm.	6.35 mm.
3.48 mm	4.31 mm	4.29 mm	4.36 mm.	4.42 mm.
1.88 mm..............	2.34 mm.	2.33 mm.	2.26 mm.	2.18 mm.
0.91 mm.	1.17 mm	1.18 mm	1.05 mm	1.15 mm

	Ratio of Space of Wire Cloth to Equivalent Size Round Hole				
Space of Wire Cloth	Test No. 1	Test No. 2	Test No. 3	Test No. 4	Average for Each Screen
5.41 mm	1.25	1.26	1.24	1.17	1.23
3.48 mm	1.25	1.23	1.25	1.27	1.25
1.88 mm	1.25	1.24	1.20	1.16	1.21
0.91 mm	1.29	1.30	1.15	1.26	1.25
Average each test	1.26	1.26	1.21	1.21	1.23

DESCRIPTION OF SAMPLES

Test No. 1	Limestone crushed through ½ in
Test No. 2.	Zinc concentrates from jigs, through ½ in
Test No. 3	Limestone crushed through ½ in
Test No. 4	Zinc concentrate from jigs, through ½ in

The average of all tests on all screens shows the ratio of space of wire cloth to equivalent size of round hole to be 1:1.23. In other words, if one screens material through wire cloth having a space of 1 mm., it is equivalent to screening it through round perforations of 1.23 mm. diameter.

It should be noted that this factor is very nearly the average of the diagonal of a square opening and its side. The ratio shown here may not be constant for all minerals, due to their difference in shape when crushed.

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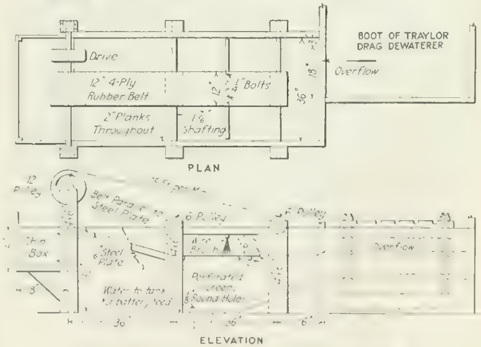
*Mill superintendent, Vinegar Hill Zinc Co., Platteville, Wis.

Trethewey Chip Collector

By G. H. Moyer*

The accompanying drawing shows a device in use at the Trethewey mill for collecting chips and rubbish which get into the mill water and, unless removed, tend to clog up the pipes and valves. The jigs and concentrators discharge into a Traylor drag dewaterer, the overflow from which, after having the chips removed, is sent to a storage tank to be used in the batteries.



The Trethewey Chip Collector

The accompanying sketch of the collector is self-explanatory and shows the different parts in detail. Attention is called to the small perforations in the screen, by the use of which practically all the chips and wood pulp are removed. This enables the operator to use the jig water over again without fear of blocked valves, etc. The device has now been in operation for nine months and has proved entirely satisfactory. The screen has not choked up since its installation. Furthermore, it needs practically no attention.

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*Mill superintendent, Trethewey Silver-Cobalt Mine, Ltd., Cobalt, Ont

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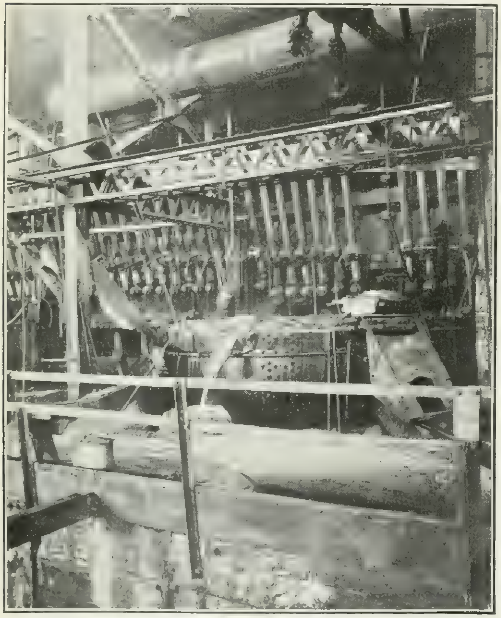
Tapping Shield at Anaconda

The accompanying engraving shows a part of one of the Mathewson blast furnaces at Anaconda, Mont. There has always been so much to say about these big furnaces, when writing about the Washoe works, that some of the interesting details have been passed with scarcely any mention. The shields to protect tappers when stopping the matte are shown at the two tapholes of the settler. One of the shields is shown in position, ready for tapping; the other shield is in the elevated position in which it is ordinarily suspended when it is desired to work at the taphole. The shield is hinged at the top to brackets on the settler, and at the bottom a guy wire, connecting with a counterweight through small overhead pulleys, makes it easy to lower or raise the shield. When lowered in position for stopping the taphole, the tapper may rest the dolly bar on the angle iron at the bottom of the shield opening. The plate constituting the front of the shield is at some distance from the settler at the top so as to permit the escape of fumes. The great advantage of the shield attached to the settler is that it is always at hand when the taphole is to be stopped and hence there is no hasty scurrying around to find a loose shield at the last minute; this happens at some plants and as the matte ladle begins to overflow, the tapper becomes nervous and perhaps "misses the hole," with a resultant spill of matte entailing additional labor in cleaning up. The attached shield reduces the chances of the tapper failing to stop the hole and, also, the liability of his getting burned. At some other works the advantages of an attached shield is also appreciated, and some tappers prefer a nearly vertical shield to the shield shown, which has been in use at Anaconda for 10 or more years.



TAPPING FLOOR AT ANACONDA, MONT.

Since the above photograph was taken, a vertical steel plate has been erected on the side of the settlers opposite the spout, thereby protecting those who may be passing or standing in the runway from spout explosions.

Another feature of the furnace practice at Anaconda is the use of a clay insulating shield; this is plainly shown in the accompanying engraving over the settler slag spout. It is used instead of coke or wood for the purpose of preventing the slag from chilling and stopping the flow. The clay shield is also applied to the furnace spout and under favorable conditions works satisfactorily, though at times a little coke or wood is required to assure free running. At other smelting works not using the easily chilled high-lime slag made at Anaconda, it has been found feasible to use the clay shield for long periods with no fuel whatever.

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Improved Lead Recovery at Herculaneum, Mo.

As the result of the campaign of reconstruction which the St. Joseph Lead Co. has had in progress for several years at Herculaneum, Mo., the lead recovery at that plant has shown a steady and consistent improvement until now it is reported to be over 96%—a gain of more than 5% over the conditions which existed four years ago. According to the annual report of the company, 1% of lead recovered is worth about $4800 per month when lead is at 3.75c. per lb. The importance of this improved recovery is therefore apparent. The better recovery has been obtained by improved work in every department of the plant, but it has been divided roughly as follows: Roasting, 1½%; furnace tops, 1½%; slag loss, ½%; flue, ¼%; baghouse, 1½%. In the increased efficiency resulting from the campaign of reconstruction the plant shows its most important gain in the increased recovery.

⁂

Rules for Thickness and Weight of Lead Pipes

The thickness of lead pipe required to withstand a given pressure may be calculated by the following formula (*Power*, Mar. 9, 1915):

$$T = \frac{0.433 \times H \times R}{2745}$$

in which

T = Thickness of pipe in fractions of an inch;
H = Head of pressure in feet;
R = Radius of pipe in inches;

from which we get

$$T = 0.0001578 \times H \times R$$

For lead a factor of safety of 10 is required, hence the last rule becomes $T = 0.001578 \times H \times R$ or, if we take D = the diameter of pipe in inches, instead of radius R, we get

$$T = 0.000789 \times H + R$$

The formula for the weight of lead pipes is

$$W = 3.86\ (D^2 - d^2); \text{ or } 3.86\ (D + d) \times (D - d)$$

in which

W = Weight of pipe per lineal foot in pounds;
D = External diameter of pipe in inches;
d = Internal diameter of pipe in inches;
3.86 = A constant.

The Cost of Doing Things

Development Costs Per Foot

Average development costs at the Montgomery mine at Candor, N. C., for a period of six months are shown in the accompanying table. The drifts were the usual 4 ft. 6 in. by 6 ft. 6 in., and the shaft was 8x11 ft. outside the timbers. The country rock was a hard, tight diabase, sometimes slaty, and with frequent joint planes which gave the gases a chance to run off into the country and spoil the break. Air drills were used.

UWARRA MINING COMPANY MINING COSTS, SIX MONTHS 1912

Underground Costs per Foot

			Labor		Supplies						
		Breaking	Mucking	Hoisting Compressed Air Pumping	Powder	Caps	Fuse	Candles	Timber	Fuel Estimated	Total
150 lev.	Mont. So. Drift...	$2.07	$0.30	$0.40	$0.334	$0.023	$0.045	$0.043		$1.40	$4.62
	Mont. No. Drift.	1.296	0.865	1.754	0.615	0.043	0.104	0.06		1.40	6.14
	Mont. Rise-2..	0.979	0.347	0.480	0.204	0.015	0.038	0.026	0.24	1.20	3.53
225 lev.	Mont. No. Drift....	1.35	0.804	1.828	0.65	0.036	0.093	0.061		1.90	6.72
	Mont. Rise-2..	3.364	0.897	1.29	0.913	0.04	0.117	0.098	0.24	1.40	8.36
	Mont. Rise-3	2.237	0.705	0.788	0.52	0.037	0.092	0.057	0.24	1.40	6.08
	Mont. Rise-4	2.513	1.11	0.957	0.698	0.047	0.117	0.070		1.20	6.71
	Mont. S. Rise-1	2.00	0.27	0.22	0.48	0.03	0.07	0.04		1.40	4.51
	Iola-No. X-Cut.	2.56	1.28	0.91	0.632	0.034	0.093	0.073		1.90	7.48
	Iola-So. Rise-1...	2.405	0.65	1.20	0.63	0.054	0.095	0.071	0.24	1.40	6.75
	Iola. So. 150'-Sub-	1.394	0.329	0.947	0.31	0.024	0.057	0.043	0.24	1.25	4.59
300 lev.	Main, East X-cut	2.456	0.78	1.35	1.174	0.129	0.082	0.068		2.40	8.44
	Iola So. Drift..	2.22	0.60	0.968	0.782	0.039	0.111	0.052		2.40	7.17
	Main-West-X-cut	2.70	0.96	1.513	1.54	0.187	0.081	0.078		2.40	9.47
	Mont. No. Drift.	3.03	0.583	1.317	1.24	0.062	0.163	0.073		2.40	8.85
	Mont. So. Drift...	3.16	0.71	1.25	1.198	0.061	0.159	0.078		2.40	9.02
Main Shaft, No. 2		14.46	9.23	2.75	2.76	0.37	0.130	0.38	2.47	1.75	37.30

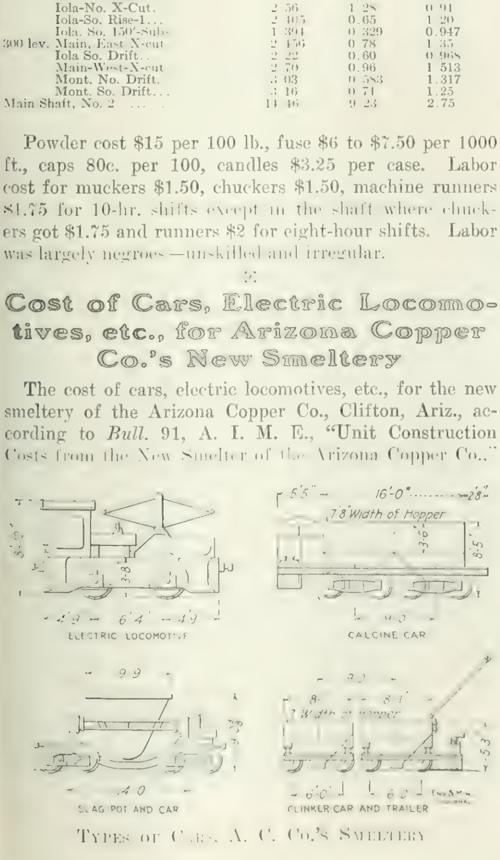
Powder cost $15 per 100 lb., fuse $6 to $7.50 per 1000 ft., caps 80c. per 100, candles $3.25 per case. Labor cost for muckers $1.50, chuckers $1.50, machine runners $1.75 for 10-hr. shifts except in the shaft where chuckers got $1.75 and runners $2 for eight-hour shifts. Labor was largely negroes—unskilled and irregular.

Cost of Cars, Electric Locomotives, etc., for Arizona Copper Co.'s New Smeltery

The cost of cars, electric locomotives, etc., for the new smeltery of the Arizona Copper Co., Clifton, Ariz., according to *Bull.* 91, A. I. M. E., "Unit Construction Costs from the New Smelter of the Arizona Copper Co.," by E. Horton Jones, was $35,204.30. Of this amount, $385.38 ($381.02 for labor) was for alterations to calcine cars. These cars, with their pantographs on top, were too high to operate successfully beneath the roasters. To overcome this difficulty, the tracks beneath were lowered 1 ft. and the cab end of the car was cut down 18 in. in height. The pantograph was then placed on the cab end of the car. Much difficulty was also experienced with the pantographs themselves, especially when the cars were on short curves and taking switches. This cost covers all the labor and material incident to overcoming these difficulties. The table covers the cost of equipment, together with labor for unloading, trying out, removing air brakes from the slag cars which came in on their own wheels, installing extra controlers on slag cars, and a large amount of repair work in addition to alterations to calcine cars. The accompanying diagrams are sketches of the electric locomotive, calcine car, slag pot and car, and clinker car and trailer. Illustrations of these cars on the tracks at Clifton are shown on p. 923, of the JOURNAL for Nov. 21, 1911.

COSTS, A. C. CO.'S SMELTERY CARS AND LOCOMOTIVES

	Factory Cost	Freight	Total
Three 18-ton calcine cars, weight of each, including electrical equipment, 33,200 lb. from Kilbourne & Jacobs Mfg. Co.	$7,200	$1,394.22	$8,594.22
Four 225-cu.ft. capacity electrically operated slag cars, from M. H. Treadwell Co. Cars are side-dumped by 15-hp. motors, can also be dumped by hand. Weight of one car, 57,000 lb...... ..	11,620	513.48	12,133.48
Two 18-ton electric locomotives from Westinghouse Mfg. Co. Drawbar pull 8000 lb. Each locomotive has two 84-hp. motors. Weight of each locomotive is 43,950 lb.	8,500	1,380.03	9,880.03
One clinker larry car, 12½ tons capacity, 10-hp. motor, weight 11,000 lb.	1,450	176.00	1,626.00
Two trailer cars, 165 cu.ft. or 25,000 lb. capacity, weight of each car 5000 lb.	680	160.00	840.00
Two 15 hp., 220-volt drum type controllers for electric locomotives to dump slag cars			165.64
One pair Schoen rolled-steel wheels with axles for slag cars			115.66
Miscellaneous material			662.60
Total cost			$34,017.63
Labor cost			801.29
Alterations to calcine cars			385.38
Total cost of cars, locomotives, etc.			$35,204.30



ELECTRIC LOCOMOTIVE

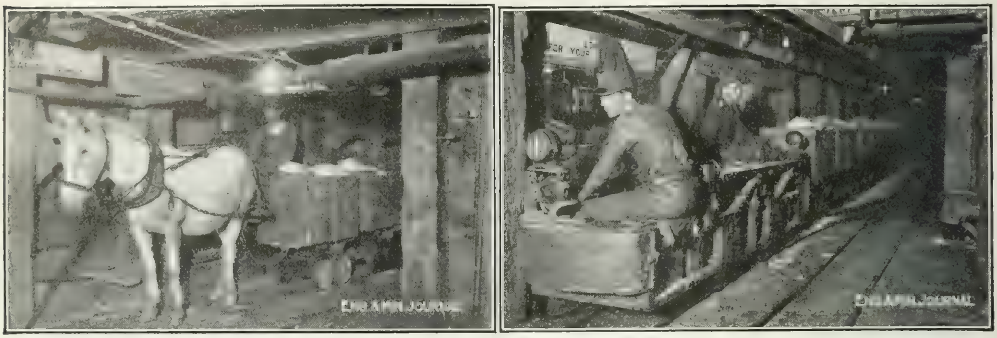
CALCINE CAR

SLAG POT AND CAR

CLINKER CAR AND TRAILER

TYPES OF CARS, A. C. CO.'S SMELTERY

Photographs from the Field



UNDERGROUND TRANSPORTATION AT BUTTE

The old system uses horses or mules. Modern electric locomotives are also installed.

ALASKA-GASTINEAU MINING CO.'S MILL, THANE, ALASKA

Erecting the steelwork of the 6000-ton mill unit, a portion of which is now in operation. Crushers and rolls prepare the ore for concentration

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VIEWS FROM THE ALASKAN RAILROAD SURVEYS

(1) Survey camp in Broad Pass, (2) Innoko River, (3) Looking up the Skwentna River, (4) Looking down the east fork of the Chulitna River; (5) View along the Susitna River, (6) Survey camp on the Susitna River; (7) Pack train crossing the Happy River.

The Master Crook

By Berton Braley

Jim Bowker is in jail this day
An' like to stay awhile,
Fer gettin' in a cuttin' fray
An' slashin' round in style,
Who was it made Jim draw that knife
An' laughed his sense to scorn,
So he forgot his kids an' wife?
Go ask John Barleycorn.

Bill Welsh fell down a chute last night
An' he won't work no more.
He's lyin' home all still an' white
That was so live, before.
What made his eyes so blear an' dim,
Why was it that he fell
Leavin' his folks to mourn for him?
John Barleycorn kin tell.

Red Smith he makes a heap of dough
Contrackin' in a raise,
An' yet his wife an' kiddies go
Half-ragged all their days,
Their cabin's ugly, rough an' bare
They're thin an' pale, forlorn,
Why ain't they got enough to wear?
Go ask John Barleycorn.

John Barleycorn he seems your friend,
A pleasant pal to meet,
An' at the first the hours you spend
With him are mighty sweet,
But give him time an' he will make
The strongest man his slave,
His winnin' ways are all a fake,
John Barleycorn's a knave.

The wise boys never fool with John,
For long ago they've found,
He kills more men than miner's con
Or dangers underground;
They've seen the woe an' horror borne
Upon his poisoned breath,
An' so they shun John Barleycorn,
Whose other name is Death.

Written expressly for "The Engineering and Mining Journal."

Canadian Mining Institute Meeting

SPECIAL CORRESPONDENCE

SYNOPSIS—A successful meeting, although the war made some inroads on attendance.

The Seventeenth Annual Convention of the Canadian Mining Institute was held at the King Edward Hotel, Toronto, Mar. 3 to 5, and despite a smaller attendance than usual, especially from the outlying districts, proved highly successful. The papers read excited more than ordinary interest and resulted in several animated and well-maintained discussions. In the absence of President G. G. S. Lindsey, at present in England, the chair was taken by Vice-President A. A. Cole, of Cobalt.

Hon. G. Howard Ferguson, Ontario Minister of Mines, in welcoming the convention on behalf of the Provincial government, in allusion to his recent appointment said he hoped to demonstrate at a later period that he was a good student of the branch of industry with which he had become identified. In view of the burdens entailed by the war it was incumbent upon them to see that production was well maintained, and mining men should realize their responsibility in this respect. A. J. Young extended a hearty welcome on behalf of the Toronto branch.

Mr. Cole in the course of a brief address spoke of the disturbance in conditions caused by the war, which had resulted in a diminished attendance. As nearly as could be ascertained about 10% of the members had enlisted and some of them were now on the fighting line.

The first business taken up was the consideration of the proposed amendments to the by-laws governing the election of councillors. Hitherto the 20 councillors have been chosen by the members at large, half of the number retiring each year. It was contended that under this system Ontario and Quebec furnished nearly all of the councillors while the remaining provinces had few representatives. The amendment, which was introduced by Clifford E. Smith and seconded by A. G. Burrows, provided that the election should be by provinces, each province having a representation in proportion to its membership, and that for this purpose British Columbia should include the Yukon; Alberta, Saskatchewan and Manitoba should be grouped as one province; the Maritime Provinces also forming a unit. The proposition was warmly debated, the principal opposition coming from the Cobalt Branch on the ground that as the present was an abnormal year on account of the absence of such a large proportion of the membership, the consideration of the question should be postponed until next year. A resolution to that effect was moved by A. A. Cole, seconded by Norman Fisher. As showing the necessity for a change it was stated by Prof. H. E. T. Haultain, of Toronto, that out of 50 men chosen to the Council during the last five years, only eight represented provinces outside of Ontario and Quebec. The discussion was enlivened by the interchange of sharp but good-humored personalities between Professor Haultain and Mr. Cole, which created much amusement. The resolution to postpone consideration was lost and the amendments carried by a vote of 18 to 21.

John McLeish, chief of the Division of Mineral Resources and Statistics, presented a preliminary report of the mineral production of Canada during 1914.

T. W. Gibson, Deputy Minister of Mines for Ontario, in presenting the report of the mineral production of the province for 1914 stated that the principal decreases were in silver, nickel and pig iron. In his opinion the maximum production of Cobalt had been reached and it might be expected to show a gradual diminution of production. A falling off in the output of nickel and pig iron was due to the war, and the lessened activity in the building trade had curtailed the production of structural materials. On the other hand the development of the Porcupine mines had resulted in a substantial increase in the output of gold.

Theo. C. Denis, Superintendent of Mines for Quebec, presented the preliminary statement of mineral production in that province for 1914 showing a decrease. He said that the main decrease was in asbestos, for which Germany had been an important customer, but shipments to the United States were now increasing and the demand for magnetite was also likely to be augmented.

D. B. Dowling, Ottawa, read a paper on the structural geology of the Alberta oil fields. He said that six or seven companies were boring on the Turner Valley anticline. In addition to the original find and No. 2 well, several of these had showings of oil, but the operations in the broken country of the foothills had not been successful and the prospect of finding oil in that direction was not favorable. On one of the wider anticlines northwest of the original discovery some oil had been found, and also some on the Milk River.

Professor Haultain read a paper on "The Stimulation of Prospecting," pointing out that the decline in production must continue unless new discoveries were made, for which it was necessary to train and encourage prospectors. The old-time prospector has gone and must be replaced. There are many young men who are fitted for the work, but they should be encouraged and properly trained for it. Invention has been organized instead of being left, as formerly, to individual initiative, and prospecting ought similarly to be organized by the government and the corporations. A long and interesting discussion followed during which various suggestions as to how prospecting should be encouraged were advanced. G. R. Rogers, of Gowganda, and W. M. Goodwin, of Kingston, advocated the subsidizing of prospectors by the government, the latter stating that in Australia smelting plants had been established in mineral districts, so that prospectors' ore could be tested practically free of expense. T. W. Gibson said he had looked into the matter but had been unable to ascertain that any new or important fields had been brought to light in Australia by state-aided prospecting.

Professor Guess, Toronto, thought valuable data on the subject could be obtained from the state of Colorado. J. J. Harpel, Montreal, advocated the addition of books on primary mining to the school libraries. Arthur B. Clabon, Vancouver, said that the coöperation of business men in an effort to stimulate prospecting should be obtained, as the mining industry was worth so much to commercial interests.

Several speakers urged that prospectors should be regarded as partners and given a percentage on the value of their discoveries. It was decided to present a com mittee to consider the question and report a definite plan of action to be adopted by the Institute.

In the evening E. T. Corkill, of Copper Cliff, Ont., read a paper on "Safety Engineering at the Canadian Copper Co.'s Works and Mines," illustrated by moving pictures showing safety work at the plant of the New Jersey Zinc Company.

D. H. Browne, of New York, gave a suggestive paper on "Things We Might Have Done," showing the benefits frequently gained by the lessons learned through failures.

A resolution offered on Thursday by Dr. F. D. Adams, Montreal, and seconded by T. W. Gibson voicing the thanks of the Institute to the members who have enlisted was adopted.

Dr. F. D. Adams dealt with the "Conservation of Mineral Resources." He said that while there was but little waste in metallic mining there was a great deal in the extraction of coal. Until recently in Nova Scotia there was as much coal wasted as there was taken out, but this waste has now ceased under a strict system of government inspection. In the new coal areas in the West, however, wasteful processes are still maintained, as the lessees are allowed to operate as they please. By the substitution of gas producers for steam engines a great amount of energy could be saved. Another important saving could be accomplished by the adoption of byproduct coke ovens in place of the bee-hive ovens, which allowed the tar, sulphate of ammonia and other valuable constituents of the coal to go to waste.

Charles Fergie, Sydney, N. S., pointed out that in estimating the coal reserves large allowances must be made for deposits in inaccessible regions and seams which cannot be economically worked. The government should appoint an official to see that all mines are carefully laid out and systematically worked. James McEvoy, Toronto, said conservation should be judiciously applied, otherwise important industries might be injured, as had been the case with the Alaska coal-mining industry. Working a mine in accordance with a plan drawn up in advance might do in Nova Scotia, but was not suited to the Western coal areas, which were characterized by continual changes of dip.

Walter A. Schmidt, Los Angeles, Calif., gave a most interesting paper on the Cottrell process for controlling fumes and extracting the metallic and chemical values of smoke and dust, copiously illustrated by lantern slides and moving pictures showing the plants where the process had been introduced. This was followed by a practical demonstration with a model apparatus conveying a clear idea of the working of the system.

"The Smelting of Titaniferous Ores in the Blast Furnace" was dealt with by Bradley Stoughton, of New York, who sought to show that the prejudice existing against these ores was unfounded. Experience had shown than ores containing from 5 to 20% of titanium oxide could be successfully smelted. Ore has been used in England containing as high as 36% of titanium oxide. Canada had large deposits of titaniferous ore and if it were treated mixed with other ores in as large a proportion as could be done without interfering with smelting it would greatly increase the available ore reserves of the country. F. A. Jordan, of Sellwood, Ont., and other speakers, thought it would be a matter of difficulty to prevail upon blast-furnace operators to use titaniferous ores.

E. B. Thornhill, Cobalt, read a paper on the "Recovery of Mercury from Residues of Amalgamated Cobalt Ores" describing the process used for that purpose by the Buffalo Mining Co., by which the mercury was recovered in a pure condition and free from arsenic.

The annual dinner was held in the evening, the speakers at which included Hon. G. Howard Ferguson, Major Tolmie, M. P. P., Bradley Stoughton, of New York, Col. Hay, Haileybury, Ont.; D. H. Browne, New York, and Dr. Thompson, M. P., of the Yukon.

On Friday officers for the ensuing year were elected as follows: President, G. G. S. Lindsey (by acclamation); vice-presidents, Thomas Cantley, Sydney, N. S., and A. A. Cole, Cobalt, Ont.

Councillors: Prof. M. B. Baker, Kingston, Ont.; Prof. J. W. Bell, Montreal; Prof. R. W. Brock, Vancouver; Theo. C. Denis, Quebec; D. A. Dunlop, Toronto; M. B. R. Gordon, Cobalt; G. C. Mackenzie, Ottawa; D. H. McDougall, Sydney, N. S.; J. T. Stirling, Edmonton, Alta.; A. J. Young, Toronto.

O. B. Perry, New York, dealt with "Recent Developments in the Gold-Dredging Industry of the Yukon." J. A. Van Mater, New York, presented a paper on "The Zinc Industry in America." In answer to a question as to the reason for the high price of zinc dust, which is a byproduct from the manufacture of spelter, he explained that it paid the manufacturers better to return it to the retort than to market it in the form of zinc dust. Belgium produced zinc dust as a special product, not as a byproduct. "The Origin of the Wabana Iron Ore" was the subject of a paper by Albert O. Hayes, Ottawa. J. B. Tyrrell, Toronto, gave a paper on "Gold on the North Saskatchewan River." He estimated that during the past half century this region has yielded gold to the value of half a million dollars. The gold-producing area extends from the Rocky Mountain House to Prince Albert, a distance of 650 miles, the gold being found associated with coarse gravel. Attempts to find a paystreak on bedrock have proved failures and geological conditions are not favorable to its existence. Associated with the gold is a small amount of platinum.

E. L. Bruce, of Ottawa, described "A New Gold Area in Northern Saskatchewan and Manitoba," in which valuable finds were made in 1913. This region stretching from Beaver Lake, Sask., into Manitoba for 100 miles east and west has a width of about 30 miles, and the rocks are similar to those of northern Ontario. He regarded it as a favorable field for the prospector.

The meeting then adjourned until next year.

Chronology of Mining for February, 1915

Feb. 1—Bristol mine, Crystal Falls, Mich., resumed operations.

Feb. 6—Serious cave in inclined shaft, Gagnon mine, Butte, resulted in death of four men and slight injuries to two.—Calumet & Hecla and its subsidiaries resumed work on full-time basis.

Feb. 12—Calumet & Hecla announced resumption of dividends.—Harry Robinson, vice-president, new Mine Workers' Union, and an I. W. W. agitator, shot and killed Anaconda guard.

Feb. 15—Annual meeting of American Institute of Mining Engineers in New York.

Feb. 18—First 1500-ton unit of Alaska-Gastineau mill at Juneau started.

Feb. 20—Man killed while unloading timber at Wilcox mine, Cuyuna Range.

Feb. 23—Five miners arrested for high-grading in the Cripple Creek district, this being the beginning of a new crusade against this practice.

Feb. 24—Two men injured by fall of rock at Armour No. 2 mine, Cuyuna Range.

Feb. 26—One man killed by cave-in at Kennedy mine, Cuyuna Range.

Work of the Sixty-Third Congress

Secretary Lane, of the Interior Department, in an interview on Mar. 5, expressed himself as pleased with the record made by the Sixty-Third Congress on legislation affecting the work of the Interior Department and the public affairs under its administration.

"No single Congress in a decade," said the Secretary, "has passed and considered so much constructive legislation for the development of the West, the encouragement of pioneers and settlers, and the economical administration of the many interests handled by this department.

"Probably the biggest item in the list is the legislation for the building of the Alaskan railway, for which $2,500,000 is now available, and the opening and leasing of Alaskan coal lands.

"The temporary oil-leasing bill for the relief of the oil situation, the authorization of establishment of 10 mine-experiment bureaus and 15 additional mine-rescue stations, the appropriations for extension of the work of the Bureau of Education in rural and industrial sections, are all progressive measures. In its every act in relation to the public domain and the work of this Department, the Congress just adjourned has evinced a desire to further the interests and encourage the efforts of the man or woman anxious to aid in the country's development, and has frowned upon the speculative and exploiting class.

"Real progress has been made toward true conservation of our natural resources. Although the leasing bills for opening up the coal, oil, phosphate and potash lands and water-power sites to development failed in the Senate because of obstructionistic tactics, the favorable action by the House upon these measures and the passage of the law opening the surface of phosphate and potash lands to homesteading, and providing that the mineral deposits in these lands shall remain withdrawn until further action by Congress, is highly significant of the purpose of Congress to complete this program at an early date."

Among other measures of importance relating to the public domain and the affairs of the Interior Department which have been enacted by the Sixty-Third Congress, Secretary Lane mentioned the following: Authorization of a new building for the Interior Department, estimated to cost $2,500,000, of which $1,500,000 is appropriated this year. This new building, to be erected at F and Eighteenth streets, Washington, will contain quarters for all the bureaus of the Department except the Patent Office, the Bureau of Education and the Pension Bureau. An appropriation of $500,000 for the construction of new laboratories for the Bureau of Mines at Pittsburgh. The appropriation of $35,000 to permit Dr. Rittman to continue his research and experimental work with petroleum and natural gas. The creation of a Board of Review in land cases, in the office of the Secretary of the Interior. The act authorizing the President to provide a method for opening lands restored from reservation of withdrawal. The validating of locations of deposits of phosphate rock heretofore made in good faith under the placer-mining laws.

The Old U. S. Assay Office

The U. S. Assay Office in Wall Street, New York, has a certain interest to the mining and metallurgical fraternity, since it is estimated that about $1,500,000,000 has been put in circulation from here. The old building has long been one of the landmarks of the city. It was erected in 1823, of gray sandstone, and, as can be seen from the accompanying illustration, is a fine specimen of Ionic architecture.

It was originally the home of the United States Bank in the Andrew Jackson régime, but when that institution was liquidated it was transferred to the Bank of the State of New York. In 1854 the building was sold to the United States government and has since been used as Assay Office.

According to the New York *Tribune,* its front rooms were abandoned in 1910, when the walls next to the Sub-Treasury began to bulge, and it has been found impracticable to use the facade in the construction of the new $607,000 fireproof building to be put up. This will have the largest vaults in the country, costing $327,000.

THE OLD U. S. ASSAY OFFICE, NEW YORK
(By courtesy of the New York "Tribune")

Commenting further on this, the *Tribune* says:

> Robert W. De Forest, president of the Metropolitan Museum of Art, is to be the new owner of the facade of the old Assay Office. The gift of this historic bit of architecture from the government to Mr. De Forest was announced Feb. 24 by Commander Alfred B. Fry, chief engineer of the Treasury Department in this city.
>
> Although Mr. De Forest could not be seen—he is now in the West Indies—it is understood that the facade will be taken down and each stone numbered carefully. Then it is probable that it will form the front of a new building to be erected by the museum to house Americana. This plan will be carried out if sufficient funds are obtained. It is expected that a collection of Colonial furniture from Mrs. Russell Sage will form the nucleus of the exhibit.
>
> Bids for the removal of the Assay Office will close on Mar. 16, and shortly after the wreckers will go to work. Within a few months the erection of a new building will be begun.

Correspondence and Discussion

Synthetic Crude Oil

I have read with interest the account of the work of Dr. Walter O. Snelling, in the JOURNAL of Feb. 20, 1915, in producing "synthetic crude oil" from various hydrocarbon mixtures. It is not only well known that distillation of heavy hydrocarbons under pressure causes a breaking up and rearrangement of their molecular structure, but also that it is the basis of many patents for making gasoline from heavy oil. The work of Snelling is comparable to Burton's process for producing gasoline from gas and fuel oils by distillation and condensation under pressures, whereby hydrocarbons consisting mainly of the paraffin series are produced as well as a small percentage of fixed gas.

As stated by Dr. Snelling the relation of the volume of oil to the capacity of the still has much to do with the characteristics of the products ultimately obtained. In short it may be safely said that crude petroleum distilled in the ordinary manner will yield larger percentages of gasoline as the volume of oil charged is cut down, which has been explained as due to a larger area of metallic contact surface, a point which has been taken advantage of in recent designs of pressure stills for manufacturing gasoline.

Although complete tests of the products worked with and obtained by Doctor Snelling are not given, the results as described are essentially those of the process well known to refiners as "cracking," and in what the innovation consists is not manifest.

THOMAS T. GRAY.

Elizabeth, N. J., Feb. 20, 1915.

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Value of the Bawdwin Ore

In the JOURNAL of Jan. 23, 1915, p. 180, I find the ores of the Bawdwin mine in Burma valued on some basis that some of the readers do not understand. The statement is:

"Shipments of average-grade zinc-lead ore, without any attempt at hand-picking, namely, of a grade of 30% Zn, 26% Pb and 23 oz. Ag, showed a profit of from £2 to £2 10s. per ton of ore, when the combined metals had a value of £39, the average prices of the preceding four years."

What we do not understand is how the value of £39 is arrived at. Taking zinc at 6c., lead at 1½c. and silver at 60c. and the ton at 2240 lb., I make the value of the ore: Zn, $40.32; Pb, $26.21; Ag, $13.80, or a total of $80.32, or about £16 instead of £39. Perhaps you can explain this?

NEOOCH

San Francisco, Feb. 10, 1915.

[The expression "combined metals" with reference to the Bawdwin ores should have been more fully explained, as in the early reports of the Burma Corporation, Ltd. In making estimates of the value of the ores, it was necessary to assume a value of certain of its ingredients. The London prices of the four years, 1910-13, with certain deductions for the future course of the metals, were taken. Copper was taken at £63 10s. per ton, silver at 26d. per oz. and lead and zinc, combined, at £39 per ton. The expression "combined metals" refers only to the assumed market price of lead and zinc. The company report states that while "the prices of zinc and lead do not always fluctuate together, the metals occur in this ore in such proportion that for present purposes they may be considered as one."

We approve the principle adopted by the Bawdwin engineers, which is by no means original with them. To our own knowledge, the value of ore in the Joplin district of Missouri, which yields both galena and blende, has been computed in that way during many years. This is the best way in which to figure mixed ores, and often it is the only way. For example, how else would anybody figure the nickel-copper ore of Sudbury, Ont.?—EDITOR.]

⁂

The Location of the Iron Industry

It has sometimes been a matter of speculation and discussion that the accepted policy in the iron industry of the United States has been and is to haul the iron ore to the fuel rather than the fuel to the ore. The rule is generally received with little questioning and in locating new blast furnaces, it is the fuel supply rather than the ore supply which is the final deciding point. The one notable exception among recent plants was intended as compromise and there are some observers who have always considered that plant an economic mistake. It is only in a few districts, as in Alabama, where the close neighborhood of ore and fuel makes discussion over the selection of a furnace site unnecessary and precludes all considerations of transportation questions.

As in many such cases, the established practice is the outcome of early conditions and gradual growth, rather than of deliberation. In the beginning of the iron industry of this country in New Jersey and eastern Pennsylvania, local ore deposits determined the location of iron works. These were on a small scale and everywhere used charcoal, which could readily be supplied from the adjoining forests. Thus the hills of Morris and Sussex counties in New Jersey and the Lehigh and Schuylkill valleys in Pennsylvania were dotted with small forges and furnaces which used ore from neighboring mines and charcoal from neighboring kilns. The increasing cost of charcoal and the growing demand for iron brought about the use of mineral fuel, the use of larger furnaces and the gradual supersession of the old forges by the quicker and larger methods of the blast furnaces and the puddling furnaces. The ore supply was still largely from neighboring deposits, but the location was more generally fixed by the fuel supply. The furnaces of the Lehigh and Schuylkill valleys drew from the adjoining anthracite mines, New Jersey ores being hauled to them by canal. The ores of central and western Pennsylvania and eastern Ohio were drawn to the Pittsburgh district, the Mahoning and Shenango valleys by the abundant coal of the Pittsburgh seam; and when the superiority of coke over raw coal as furnace fuel was established, the industry was further anchored by the discovery of the admirable coking coal of the Connellsville field. As the iron industry grew, its demands were met by the coke and anthracite furnaces, the chief charcoal iron districts remaining being the Berkshire district in eastern New York, Connecticut and Massachusetts, the Hanging Rock and Jackson County districts in Ohio and the Bellefonte-Tyrone district in central Pennsylvania. The South was not considered, for the South was then purely an agricultural region, and later when it began to be an iron-making country, it presented problems of an entirely different character.

So it happened that when the known Eastern ores gradually became scarce and more costly and the Lake Superior ores began to come in their place, the iron industry was already established around certain centers too firmly to be easily moved. The first Lake ores mined were carried to Pittsburgh and the Shenango Valley to be tested there. Later, when the extent and value of the Lake Superior deposits began to be realized, attention was given chiefly to improving the means of transporting them to the furnaces already built. From time to time plans were made for building furnaces in the Lake Superior country, but none of them so far has been successful. The only blast furnaces now active in the region are those at Marquette and St. Ignace and a few charcoal furnaces in the heavily wooded northern section of the lower Peninsula. The Steel Corporation, it is true, has begun to build a larger plant at Duluth; but it may be questioned whether it will really succeed any better than some other of its recent enterprises. It must be remembered also that the population of the Lake Superior country at that time was almost entirely a pioneer and mining population and moderate in number, so that the establishment of iron works there would have required the transfer of many skilled laborers for whom the country was not ready. Thus all the conditions at that time combined to keep the iron manufacture in the Central West, where it was already an established industry. Such improvements as were made from time to time were in the mining and more especially in transportation, gradually cutting down the cost of placing ore at the furnaces—a work which has been well performed.

Thus the conditions existing when our iron industry was comparatively small combined to give it a direction and policy which remained with its growth. That the general policy thus enforced is economically sound seems to be generally admitted, and the decision would hardly have been different had the whole industry been built up from the beginning. There is not space here to enter into elaborate calculations, but brief consideration will show that the established policy is upon the whole the judicious one. There is no probability that it will be changed in any important degree until new conditions arise with regard to ore supply, and this is not likely to be the case for many years to come. The one experiment which has now been undertaken in the opposite direction will, we believe, serve still further to confirm our belief.

ROBERT OLDS.

Philadelphia, Penn., Feb. 16, 1915

The Nickel Situation

Misther Editor,

'Tis a funny thing, the way cuss-words creep into a language an' get to be rayspictable: an' how other words start rayspictable an' get to be worse than cuss-words in other nayshuns.

Siveral hundred years ago the Germans, intirely ign'rant av the fact that the Chinees knew all about the metal which is first cousin to cobalt, tried to smelt copper out av some av its ores. They had bad luck; havin' to use an extry amount av fuel; an' whin they got raysults the product was off-color an' not marketable as pure copper. So they cussed it out an' called it *kupfer-nickel*. Jist look up the dirrivashun yoursilf. Whin a Swede diskivered that it was a new kind av a metal, the opprobryus name stuck.

Whin the Germans found out the saycrit, they began to immytate the Chinee alloy av copper, zinc an' nickel; calmly appropriatin' it as their own invinshun under the name av German silver. Nickel is now perfectly rayspictable, in spite av a few excited Canadyans; an' can be used in thousands av ways without comin' in contact with the word German.

I wud vinture to state without fear av contradicshun, that there is not wan man, woman or child in the whole United States but what uses somethin' ivery day with more or less nickel in it. An' we're all neutral, at that; or ought to be. Tell the Canadyans not to worry about nickles. I use plinty av thim, an' can use all their mines produce. A nickel by anny other name wud be as fleet, an' waste its substance on a trolley fare. Ivery American child is born with a silver spoon in his mouth; an' whin they save enough coupons they can get a dozen av American-silver spoons built on an 18% nickel base. They get on the ice with a pair av nickel-steel skates; an' manny's the felly that starts on a skate with a nickel drink. Whin they have tin, 'tis time for a copper.

BILL McGINTY.

New York, Feb. 27, 1915.

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Herbert Clark Hoover

In publishing the article by Will Irwin, the well-known writer, about Herbert Clark Hoover in the JOURNAL of Jan. 30, the editor of the JOURNAL surmised that there were probably numerous errors in Mr. Irwin's report, but thought the latter sufficiently interesting to be printed anyhow. The editor's surmise was correct. Mr. Hoover's career is wonderful enough without having to add romantic and incorrect details. He was not expert of the North China Government. There is no North China Government. He was not prospecting when the Boxers broke out. His worldly fortunes had nothing to do with the alleged government. He did not join the correspondents. He did not help in reconstruction of railways.

At the time of the Boxer troubles he was in the employ of the Bewick, Moreing & Co. at a very good salary. The story of the coal concession can be found in the court records of Great Britain.

Mr. Hoover is such a remarkable man that somebody ought to get an authentic account of his life and activities. He is certainly the most remarkable mining engineer, from a financial standpoint, that has yet appeared.

San Francisco, Feb. 12, 1915. W. H.

Editorials

The Situation in Spelter

Since our last review the price for spelter advanced to figures previously unrecorded. Spot spelter for sale exists anywhere in but trifling tonnages and commands prices measured only by the exigencies of the buyers. Spelter for prompt and near-by delivery is almost as scarce and almost as dear. Spelter for the months of April and May is more plentiful, but previous to this week was obtainable only at moderate concessions. With spelter for June and later deliveries it was a different story. This meant that smelters had sold much of what they expected to make up to the end of May, but not so much beyond that date, although there was no doubt that many sales running forward to August had been made.

What was the situation of the market is rendered clear by a little reflection. The mainspring of the advance was the buying from abroad to supply the deficiency resulting from the isolation of the smelters in Germany and Belgium, and in the north of France. American consumers woke up, too late, and found that early supplies had been practically exhausted by the foreign buying. Those consumers who had entered into contracts to deliver brass, galvanized goods, etc., and had not previously provided for the necessary spelter, were caught short and were obliged to pay almost any price demanded. They came into competition with the contractors for war material, among whom price was more or less a matter of indifference, and the ugly situation was made worse by the pudding-sticks of reckless speculators.

Now as to the position of the smelters: Even before the beginning of January they found themselves receiving increased supplies of ore. When the great advance in spelter obtained real headway every zinc miner in North America exerted every effort to produce all he could, and supplies to the smelters increased rapidly. The smelter taking in ore sold spelter against it as rapidly as he could, and in the main his sales were made at the lower levels of the rising market. As ore supplies increased beyond the immediate smelting capacity the smelters found themselves obliged to sell further and further ahead, or else run the risk of carrying a large supply of high-priced ore in the face of the collapse that was bound to come sooner or later. Therefore in order to protect himself the smelter was not only willing to sell deliveries beyond the customary two-months and three-months contracts at large discounts, but was anxious to do so. Indeed, his solvency might depend upon his ability to do so.

The misunderstanding of these conditions led to some strange vagaries. In the Joplin district, for example, the mine operators have been holding mass meetings to protest against the action of the smelters in refusing to pay what they, the miners, would like to get for their ore. Because some belated consumer is understood to have paid 11c. for a carload of spelter out of warehouse in New York, it has been reasoned that the St. Louis price ought to be 11c. minus 0.15c.; and that the entire Joplin production ought to sell per ton of ore at about eight times the St. Louis price for 100 lb. of spelter. A good many of the fancy prices named for spelter have been based on bids which in reality have been for quantities and deliveries that nobody could supply, a fact well known to the bidder, who could, for purposes of his own, bid almost any price with impunity.

The effect of all this upon the uninformed public was to make it think that the highest price mentioned in any newspaper, responsible or irresponsible, was the true price for spelter and anything else a malevolence. Upon the demand of the Joplin operators the Attorney-General of Missouri started an investigation to find out why the smelters would not pay more for ore, to pry into the cherished myth of a zinc-smelters' trust, etc. The simple fact, was, of course, that the price paid on the forced purchase of a few carloads of spelter did not represent the basis on which an output of 35,000 to 40,000 tons a month was being marketed, or could be marketed; and smelters were not going to buy ores on any basis higher than that upon which they could sell spelter.

The Joplin ore market, being an open market, the smelters were able to meet the situation by refusing to purchase ores except at a price which they figured would be reasonably safe. The smelters taking in ore on sliding-scale contracts, on the other hand, a system that obtains especially with respect to the Rocky Mountain ores, were not such free agents. They were obliged contractually to take in ore right along, whether or not they could sell the spelter against it. The situation was so distinctly adverse to the smelters that the concern taking the Butte & Superior ore notified the mining company on Mar. 1 that thereafter it would refuse to accept any more than the minimum stipulated in the contract, which would have had the effect of greatly curtailing the Butte & Superior production had not that company been able to make smelting arrangements elsewhere for the surplus. In fact, arrangements were promptly made with the American Zinc, Lead & Smelting Co. for the treatment of the surplus Butte & Superior ore at Caney and Dearing, which smelteries had previously been idle. While the details of this arrangement have not been made public, it may be assumed with certainty that the mining company has guaranteed the smelting company against loss, or that the smelting company is going to handle the ore on toll for the mining company, which must subsequently sell its spelter as best it can.

So much for the purely technical position of the ore and spelter markets. Considering the situation broadly, the factors that we pointed out in our last previous review developed rapidly. About all of the active smelting capacity of the United States is now in use, the idle furnaces consisting only of a few here and there which are cold for necessary repairs. In Kansas and Oklahoma everything is running. A good deal of the moribund capacity, including that at Caney, Dearing, and Altoona, is being put into use. There is even a contemplation of putting the old plant at Pittsburg, Kan., rated as inactive, in operation again. Work on the two big plants building is being rushed as rapidly as possible, and one by one their furnaces are going into commission.

There is a plethora of ore supply. Not only have the big American mining companies increased their outputs to the maximum possible, but a large tonnage of Broken Hill ore is on the way hither. The last was a development that was bound to come. A basic cause for the recent situation was the inability to smelt the Broken Hill ore in Germany and supply Great Britain with spelter from there. As soon as the price for spelter rose above a certain figure, it was manifest that all restrictions of unfavorable geography, unfavorable metallurgical practice, etc., would be nullified and that Australian ore would come here so long as we had capacity to take it; and as was pointed out in a recent article, our total smelting capacity is largely, possibly as much as 50%, in excess of the use of it in 1914.

On the other hand, the consumption of spelter for industrial purposes is suffering severe contraction. Reports from the galvanizing districts of Great Britain and the United States agree respecting this. Increasing production and decreasing consumption are bringing about the cure of the distressful situation that has lately existed, and still exists. On the whole it is fortunate that the collapse in spelter which occurred this week was so drastic. If the slump goes further and the squeeze in this industry be ended very soon, as it will be according to the present outlook, we may be saved from the troubles that always follow a long period of inflation.

Tendencies in the Location of the Iron Industry

In our discussion columns is to be found an able presentation of the factors usually given as determinative in the selection of a location for a new steel plant, but from which, in part, we differ.

The reasons generally assigned for the location of the iron industry have dealt chiefly with the question of whether the ore, of which about two tons are required per ton of iron, should be brought to the coal, of which about one and one-half tons are required, or *vice versa.* The coal is frequently coked before shipment and the weight of coke required is only about one ton per ton of iron against nearly twice as much for the ore; but many plants have been located much closer to the coal than the ore, nevertheless. This fact has not unnaturally troubled many who have attempted to work out the underlying causes.

It may be freely admitted that the location of iron-manufacturing centers is a matter of freight charges; but not, as is commonly assumed, of freight on raw material only. Obviously there must be included freight on the finished product to the point of consumption. If we were to consider the establishment of an iron works in a country entirely without such works, knew that each person would consume a given weight of iron per year, and knew also the tonnage of the proposed works, we should know how much population was required to consume the product and from the density of the population in the country we could calculate the average distance the product would have to be hauled to reach the consumer, and the freight for this haul added to the freight on the raw materials would constitute the total freight charge on the product. It is this which should be kept a minimum. It would clearly be an accident if the point which gave the lowest combined value for the three were at either the ore mines or the coal mines.

The correct location would obviously be the equilibrium point of the three forces acting through the coal mines and the ore mines and the center of population. We could, without much trouble, make a model which would illustrate the action almost perfectly. We need only to put a peg at the center of population for a given district and one each at the ore mines and coal mines, fasten together at one end three pieces of rubber cord of equal length, whose lengths were proportional to the rate of freight per mile of the quantity of material equivalent to a ton of finished product, and attach the free ends to the corresponding pegs; the junction point would be the equilibrium point and would indicate the proper location of the plant. The strength of the forces acting is profoundly affected by the means of transportation available (whether water or rail) and the location of the equilibrium point is obviously influenced to correspond. The sum of the tensions in all three strings measures the disadvantage under which the district must labor.

We can see this law demonstrated in the growth of our iron-producing centers. At the time of the Civil War, Pittsburgh was nearly the center of population of the country, and it made, for the next 20 years, the vast bulk of the steel produced, although there was a considerable center in eastern Pennsylvania and New Jersey, in which the fuel, the ore and the consuming population, were all close together and the sum of the tensions was small.

As the West became settled, the center of population traveled west, first to Ohio, then to Indiana, and then to Illinois, where it is now; simultaneously the Chicago district developed as an iron center although its freight on ore is but little less than that to Cleveland and Buffalo while its freight on coal is very much higher; but it is the center of a great consuming district and its freight on finished product is low enough to make the sum of the string tensions small. Later still, Colorado became an iron-producing center, in spite of many disadvantages, because of its location near the center of a consuming district which is far removed from any other source of supply. The sum of its string tensions was high but that of any other iron-producing district is higher in its territory. The present construction of a steel plant in Duluth is a further example: The freight on both coal and ore assembled there has been very low for many years; but until the population of the Northwest became large enough to support railroads whose tonnage of steel consumption runs into six or seven figures, it did not pay to build a steel plant there. The freight on the finished product to points of consumption would have been too high.

At Birmingham, the conditions are similar but more marked. The ore and coal are in closer proximity than anywhere else in the known world, the tension in these two strings is almost nothing but the freight to outside consuming centers was so great as to more than counterbalance the advantage; the tension in the single string was more than that of all three at other iron-producing centers and the district made much pig iron but very little money until a local consuming center was built up.

In the future, the attraction of the center of population will be increased even over what it is now; because the gas, which is a byproduct in the production of coke, is of vast value for public heating and lighting and the power which can be produced with surplus gas from the furnace will be increasingly valuable for public utility purposes.

These products are consumed in steel mills in greater quantity than they are produced by its coke ovens and furnaces, so such works are not to be considered as sources of supply for these products and their location will not be so strongly affected; but the merchant furnace will have gas and power for sale and will more and more be so located that it can dispose of them to good advantage without building long pipe or transmission lines; that is, near centers of population.

That is, in the future, as we grow more efficient there should be an intimate connection between the iron blast-furnace plant and the public utility, and especially the public utility serving large centers of population.

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Anaconda Adopts Flotation

We have previously hinted that the newly developing art of copper hydrometallurgy might not become so important, or rather of so general application, as was expected, for the reason that a superior substitute in many cases was probably forthcoming. We had reference to the substitution of the froth-flotation process of mineral concentration in many cases where hydrometallurgical extraction had been contemplated. Among these was Anaconda.

It has lately been officially announced by the Anaconda company that its elaborate program of slime concentration and leaching of tailings, which was published less than one year ago, is to be abandoned for the major part, flotation being substituted. The new round-table plant, that model of ingenuity and excellent engineering design, is to be dismantled. The sulphuric-acid plant and the first unit of the leaching plant, both of which are nearly completed, will be carried on, but will be used only for the treatment of the great accumulation of old tailings below the mill. The finishing treatment of the current make of tailings will be flotation.

The reason for this swift and radical change of policy was simply that is was demonstrated that the flotation process would make more money for the company. It will be recollected that in an article in the JOURNAL last May, wherein the plans of the Anaconda were described, it was mentioned that flotation experiments were to be inaugurated, and even then there was thought to be a possibility that the flotation process might be superior for a certain part of the treatment. The results of the experiments went far beyond what the Anaconda staff then thought they would. That the change of plan was so completely, boldly, and swiftly made indicates conclusively that the Anaconda staff rides no hobbies and is not fettered by prejudices or preconceived ideas.

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In referring to the starting of milling in the Juneau district by the Alaska Gold Mines Co., it was inadvertently stated, last week, that stamps began dropping in the first 1500-ton unit of the mill on Feb. 18. This inadvertence—referring to stamps instead of rolls—will probably be apparent at once to readers of the JOURNAL, as reference has frequently been made to the fact that the Alaska-Gastineau mill would be a roll-crushing mill in contradistinction to the Alaska-Juneau's stamp mill. Both of these mills are under excellent technical direction and will offer an interesting opportunity of comparing the two types of equipment for the milling of gold ore on a large scale.

BY THE WAY

We hereby quote, in part: "Every man accepted by ——— was a murderer. He would have no weaklings. No one can tell how many victims his associates had before they went into his alliance; but it is sure that novices in man-killing were not desired, nor any one who had not been proved of nerve. ——— soon had so many men that he set up a rendezvous at points on all the trails leading out from ——— to such mines as were producing any gold. One robbery followed another, until the band threw off all restraint and ran the towns as they liked, paying for what they took when they felt like it, and laughing at the protests of the minority of the population, which was placed in the hard strait of being in that country and unable to get out without being robbed." No, gentle reader, this is not an account of Zapata or any other bandit leader in Mexico. The text is taken from Emerson Hough's "The Story of the Outlaw" and portrays the exploits of one Henry Plummer in Montana and Idaho about 50 years ago. It is but a sample of many tales of violence and pillage. Measured by the standards of some of the pioneers of our Western civilization, Francisco Villa is elegible for admission to the infant class of a Baptist Sunday School; while Zapata may be likened to the mischievous boy who catches flies on the back of the church pew.

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General Obregon of the "Constitutionalista" army of Mexico (1915 Carranza Model, self-starting, internal-combustion type) has been quoted as naively remarking: "Every day opportunities are presented to me for splendid business deals, which I have rejected with indignation for to accept them would be like surrendering into my enemies' hands. If I were to remain in this city two months, perhaps I should in the end be overcome and cease to be honest. I am human and, therefore, capable of being corrupted, but so far I have succeeded in clinging firmly to my principles." This is very much like the story of the army sergeant in the Filipinas who was visited for several days in succession by an astute Chinese gambler who desired to operate without molestation. Each day the celestial would lay on the sergeant's desk-table a pile of money, daily augmented, gazing silently but inquiringly at his vis-a-vis. Recurrently a silent yet eloquent gesture of the saber arm would indicate the scornful spurning of the offered bribe. Finally, however, when the bait reached the interesting sum of $10,000, the gesture was transferred to the right boot and made kinetically effective; while the silence was broken with "git the —— — out of here, you ———, you're gettin' too ——— near my price." If the Mexican patriots would only fill Boss Tweed's standard specifications for an honest man (i.e., "one who will stay bought"), perhaps someone could arouse popular interest in a movement to buy up these manager dogs of Mexican politics.

PERSONALS

S. S. Fowler of British Columbia was a recent visitor in New York.

J. R. Finlay is going to Nevada to attend to some professional work.

John L. Malm of the Malm-Wolf Co. of Denver, has gone to Chicago on professional business.

H. E. Tuttle, formerly with the Edgar Zinc Co., is now with the Fink Furnace Co. at Chicago, Ill.

F. G. Lasier, of Detroit, Mich., is at the National Hotel, Cripple Creek, Colo., during the month of March.

E. G. Spilsbury has gone to Montana, where he expects to be engaged until about the end of March upon professional work.

Wilkinson, Currie & Amigo have opened offices as mining engineers in the First National Bank Building, Goldfield, Nevada.

W. Earl Greenough, manager of the Marsh Mining Co., Wallace, Idaho, has been in New York for the last two weeks on business.

Prof. Roswell H. Johnson of the firm of Johnson & Huntley, geologists, is in Washington in connection with the Osage hearing.

Edward K. Judd, for some years past instructor in the Columbia School of Mines, New York, has been promoted to assistant professor of mining.

C. B. E. Douglas has resigned his position as engineer for the Amparo Mining Co. at Etzatlan, Jalisco, Mexico, and has gone to England to enter the British Army as a volunteer.

H. W. Kitson, formerly superintendent of the British Columbia Copper Co., Ltd., operations at Princess Camp, B. C., has accepted charge of the sampling department of the Arizona Copper Co. at Morenci, Arizona.

Doctor Vogelsang, general manager of the Mansfeld copper mines, and Herr Francke, his metallurgical aid, were called to the colors, and both are at the front near San Quentin, France. In the meanwhile the mines and works are being run by their staff.

A. E. Bendelari, who has been manager for the Underwriters' Land Co., of Joplin, Mo., has resigned his position to become general manager of mines with the Picher Lead Co. Under Mr. Bendelari's management development work will be pushed on five different properties, shafts will be sunk and mills erected.

Dr. Pierre de P. Ricketts announces that hereafter he will be identified with Ricketts & Co., mining, metallurgical and chemical engineers, with offices and laboratories in the Eighty Maiden Lane Building, New York. The firm will undertake examinations of mines and properties; advice as to development and operation; determination of method of ore treatment; assays and analyses of all materials and products.

O. M. Bilharz has resigned from the consolidated St. Joe and Doe Run lead companies, where he occupied the position of general technical manager. When he took the superintendency of the Doe Run Lead Co., 21 years ago, it was operating its single mine at the town of Doe Run and was producing about 4000 tons of lead yearly from a 500-ton mill. Under his management, the Flat River mines were opened, the new mill recently finished at Rivermines of 4000 tons daily capacity and the output of the Doe Run Co. has grown to over 40,000 tons of lead per annum. He also designed and built the Leadwood plant of the St. Joe Lead Co., a 2000-ton unit.

Dr. John H. Banks, formerly of the firm of Ricketts & Banks, announces that he is now located at 61 Broadway, New York, where he will continue the mining, metallurgical and chemical work in which he has been continuously engaged for the past 30 years. Attention will be directed especially to the examination and development of mines and mineral properties, to the problems of ore treatment, and to the testing and improvement of metallurgical processes. Facilities for test treatments of ore on a practical scale continue as heretofore, and newly equipped laboratories enable him to undertake investigations based upon the most recent advances in metallurgical and milling practice.

Captain William H. Johnston, who has been in charge of the mines of the Oliver Iron Mining Co. on the Marquette iron range since that company was organized, has tendered his resignation and will be succeeded by Captain Frank E. Keese, who has been his assistant since 1905. Captain Johnston is well advanced in years and will have his name placed on the company's pension roll. He entered the employ of the old Lake Superior Iron Co. almost 40 years ago, starting in at the bottom and ending as general manager. When that company was taken over by the Oliver he was made manager of all the mines of the new company on the Marquette range. He has always taken an active interest in the mining affairs of the Lake Superior district and is one of the prominent members of the Lake Superior Mining Institute, serving as president during 1914.

Captain Keese started his mining career on the Mesabi range in the early days, being stationed at the Genoa mines for some time. Later he was transferred to the Marquette range, where he was placed in charge of the Moore mine at Palmer. When operations were suspended there he went to Ishpeming to become assistant to Captain Johnston in charge of the underground operations.

OBITUARY

Dr. James Geikie, the noted geologist and president of the Royal Society of Edinburgh, died at Edinburgh, Scotland, Mar. 2, aged 76 years. He was born in Edinburgh, and was emeritus professor of Geology and Mineralogy at the University of Edinburgh, and dean of the Faculty of Science at that institution. Prof. Geikie, after his graduation from Edinburgh University, entered Her Majesty's Geological Survey in 1861. In 1869 he was appointed district surveyor, and in 1882 was the occupant of the Murchison Chair of Geology at the university. Prof. Geikie had been awarded the Brisbane Medal of the Royal Society of Edinburgh, the Murchison Medal of the London Geological Society, and the Gold Medal of the Royal Scottish Geographical Society. He was one of the founders and past president of the Royal Scottish Geographical Society, and honorary editor of the "Scottish Geographical Magazine." Prof. Geikie wrote extensively on geological topics, his first book being "The Great Ice Age," published in 1874, and his last, "The Antiquity of Man in Europe," published last year.

John Gray, who died at his winter home in Los Angeles, Calif., Mar. 3, was one of the best known and most successful mining operators in the Black Hills district of South Dakota. Born in Lancashire, England, Feb. 28, 1846, he came to the United States when 22 years of age, locating at Scranton, Penn. Later he removed to Rock Springs, Wyo., following coal mining, and in the seventies was a resident of Cheyenne. Becoming friendly with "Wild Bill' Hickok he joined the latter's wagon train and journeyed to the Black Hills, then the mecca of thousands of gold seekers, in the spring of 1876. He was fortunate in securing valuable placer property on Deadwood Gulch, owning and working No. 3 above discovery, from which he realized a small fortune. With the working out of his claim he again followed the lure of the new diggings and joined the rush to the Cœur d'Alene district in Idaho, remained a few years and returned to the Black Hills permanently to remain. The greatest achievement of his life was the equipment and operation of Wasp No. 2 mine, at Flatiron, where handsome profits are earned on the mining and milling of a $2 gold ore. He was the largest individual holder in this enterprise, owning one-fifth of the capital stock. He was a director at the time of his death, a year ago he resigned the general managership, which he had held for years, on account of his failing health. A man of remarkable force of character, aggressiveness and untiring energy, at all time liberal in the support of new enterprises, his death will be sincerely mourned in the community in which he resided. Interment will be made in Deadwood, beside his wife, who died in 1897.

SOCIETIES

Mining & Metallurgical Society of America—The presentation of the annual gold medal of the society to Robert Hallowell Richards will take place at the Chemists' Club, 52 East 41st St., New York, on Thursday evening, March 18. There will be a formal reception at 6:30, followed by a dinner. Tickets may be obtained from F. F. Sharpless, 52 Broadway, New York.

American Institute of Electrical Engineers—A meeting was to be held in the Engineering Societies Building, New York, March 12. This was a joint meeting with the New York Section of the American Electrochemical Society, and two papers were to be presented as follows: "Fixation of Atmospheric Nitrogen," by Leland L. Summers, and "The Cyanamide Process," by Frank E. Washburn.

Editorial Correspondence

SAN FRANCISCO—Mar. 3

The Mining, Irrigation and Power Ditch of the San Francisco-Oakland Terminal Power Co. was sold at public auction at Placerville, Feb. 23, to satisfy a court judgment on the foreclosure of a mortgage for $47,972 and costs. The property consists of 30 miles of main trunk canals and about 100 miles of laterals, chiefly in Eldorado County. The intake is located on American River. The laterals of the main trunk extend to Coloma and Eldorado. While the bulk of the water is procured from American River, reserve supplies are maintained at Silver, Echo and Medley Lakes. The main canal was built in the early '70s, chiefly for the purpose of hydraulic mining and was used extensively for this purpose until 1887 when the anti-débris law went into effect. The situation of the hydraulic mines and the indisposition of the owners of such mines caused the cessation of hydraulic mining in the region covered by this ditch system. Subsequently, the canals were used for other mining and power purposes, and in recent years have carried water for irrigation of fruit orchards in Eldorado County. The system has cost a large amount, estimated from $1,000,000 to $3,000,000. It is still valuable property, but has been shifted about in ownership so often and made so little use of that it will require improvement and direct economical management to make it a paying system. It was formerly owned by the Eldorado Water & Deep Gravel Mining Co. and sold later to C. N. Beal who afterwards transferred it to the Sierra Nevada Water Supply Co. This company held it but a short time and transferred it to the San Francisco-Oakland Terminal Power Co. The Placer Gold Mining Co. succeeded the Eldorado Water & Deep Gravel Mining Co. and was plaintiff in a recent suit at court against the power company.

Rules For Inspection of California mines are being formulated by a committee selected by the California Metal Producers' Association and the safety department of the State Industrial Accident Commission. The committee is composed of H. M. Wolflin, mining engineer of the Industrial Accident Commission, N. S. Kelsey, manager of the Argonaut mine, Arthur Foote, superintendent of the North Star mine, A. F. Anderson of Los Angeles, manager of the Needles smeltery (George W. Meltcalfe, manager Mammoth Copper Co., alternate), James Giambruno of the Amador County Miners' Union, J. C. Williams of the Nevada County Miners' Union, and E. M. Arandall representing the miners in the Randsburg region. The committee included the mining laws now on the California statute books in the rules so far adopted. The rules are prefaced with a summary of the Workmen's Compensation and Safety Act and a definition of the class of mines to which the rules are applicable. The following provisions were made: For reports to be made by superintendents to the office of the inspector and for reporting accidents by employees to employers; keeping first-aid materials at the mines; preparation of mine maps showing safety precautions; lighting and candles, safety pillars, skips and cages, artificial-breathing apparatus; prohibiting use of intoxicating liquors; storage of inflammable materials at the surface, in addition to the rules for storage and use of explosives provided by law; hoisting rules, boiler inspection, guard rules, sanitation, dry closets, drinking water, change houses, ventilation; shaft protection, ladders and ladder ways, safety gates, timbering, installation of electrical machinery. After being completed to the satisfaction of the committee, copies of these rules will be sent to operators and miners and others interested in mining for discussion and criticism. Then a public hearing will be held by the commission and the rules as amended will be submitted for approval. After such approval, under the provisions of the Workmen's Compensation Law, these rules may be enforced in like manner as the statutes would be enforced.

DENVER—Mar. 4

That Shipment of Rich Ore from the Cresson mine, of which so much has been heard in the past few weeks, finally got back to the Copeland sampler where it was first sampled and purchased. It is now being mixed with low-grade ores in such proportion as to bring the gold content below 50 oz. per ton, which grade the Golden Cycle company will accept for cyanide treatment in the Colorado City mill. In these days it is quite a job to market bonanza ore. A 68-ton lot of Cresson "reduced" high-grade ore was shipped recently and while this ran 65 oz. it is understood that settlement was made and that the lot netted about $80,000. Souvenir reproductions of the $468,637.29 check paid by the Copeland Sampling Co. to the Cresson Gold Mining & Milling Co. were given each of the business men from Denver, Colorado Springs and Pueblo in last week's special visit to the Cripple Creek district.

All the metal-mining property of the Golden Cycle Mining Co. has been sold for $1,500,000 to the Vindicator Consolidated Gold Mining Co. The purchasing company declined to consider the acquisition of other holdings of the Golden Cycle company, consisting mainly of the cyanide plant at Colorado City and large areas of coal land near Colorado Springs. It is surmised that the coal and mill properties will be retained and operated by the present holders of the option from the Golden Cycle company as such action will give them virtual control of the milling of custom ores shipped from the Cripple Creek district, the same interests already controlling the United States Reduction & Refining plant at Colorado Springs.

BUTTE—Mar. 4

The Pending Litigation between the Anaconda company and the Pilot-Butte has taken on a new phase by the Pilot-Butte filing an application Feb. 25 to dismiss the latest order to show cause in the case in which the Anaconda company claims ownership of veins on which the Pilot-Butte had been working. The original order to show cause why a permanent injunction should not issue was obtained Oct. 8, 1913, and the case was heard by Judge Lynch last June and taken under advisement. On Feb. 23, 1915, another injunction was asked in the same case. It was supported by affidavits to the effect that the Pilot-Butte has recently been mining in the disputed ground, which was supposed to be protected by the temporary injunction of 1913. On this showing the Judge issued an order to show cause on Mar. 15 why the Pilot-Butte company should not be enjoined permanently. In the application for dismissal made Feb. 25, it is set out that the order of October, 1913, described the vein from which the Pilot-Butte was restrained from taking ore and that if any ore is taken now, the proper proceedings will be to have the officers cited for contempt. It is claimed that the Anaconda's present proceedings is an effort to increase in scope the area in dispute and is otherwise simply a repetition of the former application.

Labor Union Affairs—After last summer's labor troubles had subsided, the Miners' Union presented the City of Butte with a claim for $138,291 damages for the destruction of the Miners' Union hall, loss of books and other items. When the city refused to make payment the matter was taken into court. Judge Lynch took action on a motion to strike several vital paragraphs from the complaint of the union by lopping off $47,800 from the bill presented. Thus an amount of $90,491 still stands against the City of Butte which, the complaint states, made no effort to prevent the mob from destroying the hall and therefore became responsible and liable for the damages as asked.

The ruling of the Supreme Court handed down Feb. 28 in the cases of Muckie McDonald, Joe Bradley and W. Winchester, former officers of the Butte Mine Workers' Union, now in the state prison for kidnapping, clears up the case of Burt Riley, former president of the Butte Miners' Union No. 1 who is charged with kidnapping William Leduc and who accordingly will be tried in Bozeman before a Gallatin County jury. The case promises to be a hard-fought one and holds much interest for the miners of the district, as Riley was a central figure in the circumstances which led up to the June rioting. The Supreme Court's decision was on the contention of Muckie and his staff that kidnapping was a misdemeanor instead of a felony and that therefore they were unlawfully detained in the penitentiary. This the Supreme Court denied.

SALT LAKE CITY—Mar. 4

Drain Tunnel for Tintic—There has been some talk recently of driving a tunnel which will drain the south end of the Tintic district. The plans call for a tunnel five miles long to be driven west from Goshen valley, starting at an elevation of 5000 ft. Such a tunnel, it is estimated, would cost in the neighborhood of $1,000,000. The promoters are L. A. Martin & Co. brokers of this city. In addition to unwatering and draining certain mines in the Silver City section, and providing transportation and outlet for ores at a point where mills could be built, and there are railroad facilities and short haul to the smelteries, etc., it is thought revenues could also be derived from electric power plants and irrigation. Such a tunnel would undoubtedly drain the porphyry area, but would be above the water level of the most important mines of the district in the central and northern part of the camp which are in the limestone. If the tunnel started at an elevation of 5000 ft. and had a grade of 10 to 20 ft. to the mile the elevation of the tunnel near the face would be about 5075 ft. The water level at Eureka, as shown by the Gemini, Centennial-Eureka, Chief, etc., is at approximately 4800 ft. elevation (4793 to 4807 ft.), so that the water level of the mines in this section would be 200 to 300 ft. below the drain tunnel. Possible benefit to this part of the camp, if branches were extended from the tunnel, would consist in enabling pumping to the proposed tunnel level, instead of raising water to the surface. The 5000-ft. contour runs along the base of the range and a lower elevation for the tunnel-site could not be obtained without driving a much longer tunnel, in which case a few hundred feet only could be gained, the elevation of Utah Lake being 4515 feet.

SEATTLE—Mar. 1

Gold Output of the Iditarod District last year has proved somewhat of a disappointment to those who anticipated a total gold production of about $3,000,000. The latest available figures which are about correct place the entire production of the field at $2,059,200 and is but little greater than the season of 1913, despite the fact that weather conditions were excellent for opencut mining throughout the district. The main reason ascribed to the falling off in the expected output is that the two dredges were compelled by unfortunate circumstances to close down much earlier than was expected. The Yukon Gold Co.'s dredge on Flat Creek operated fully three weeks longer in 1913 than in 1914, but the dredge of Riley & Marston on Otter creek was compelled to close down much earlier than was expected, owing to serious accidents in the machinery.

Activity Over New Strike made on the Stewart River is evidenced by the filing of 25 applications for claims at the Dawson gold office. The discovery was made originally by Carl Loeffler on Brewer Creek, which flows into the Stewart a few miles below Barker.

NEWPORT, ORE.—Mar. 1

The Lease on Lakes Abert and Summer, of Lake County, given by the state land board has been ratified by the Legislature. The lease runs for 40 years and Mr. Moore and his associates have notified the Land Board that work will be commenced at once and that the improvement and development will cost $7,000,000. It is said that $2,000,000 will be spent on a pipe line running from the lakes to the Columbia River a distance of 270 miles and that $5,000,000 will be spent in manufacturing plants at the end of the pipe line on the Columbia. This is the greatest development project Oregon has seen and the mineral salts of these lakes will be manufactured into a number of products. The work will employ many men. By the terms of the lease Mr. Moore guarantees the state a minimum annual royalty of $25,000.

MARSHFIELD, ORE.—Mar. 1

Financial Conditions are not improving in this section; if anything they are getting worse except the price of supplies is being reduced some and this benefits the laboring class. Some of the mills running have had to delay their pay-day.

A Rich Gold Strike is reported to have been made on the head waters of Lobster Creek, Curry County, about eight miles to the north and west of Agness on the Rogue river which is opposite the mouth of the Illinois River. The report is unconfirmed so far, as that section is under several feet of snow.

HOUGHTON—Mar. 9

Kaolin and Manganese, in Ontonagon and Keewenaw counties respectively, have been reported in the local press in the Copper Country recently. An investigation of these reports reveals that the kaolin deposit referred to is probably a deposit of ordinary clay along the banks of the Ontonagon River near Rockland, Mich. An attempt was made to have the deposit developed several years ago, but little was accomplished. The manganese deposit is at Manganese Lake, near Copper Harbor, and attracted some attention in 1900 and 1901. The property was not developed to a producing basis and is considered of doubtful value.

Such Insistent Demand for immediate shipment of copper at this season of the year has never been equaled in the history of the producing industry in the Lake Superior copper country. As a rule, all of the smelters here begin to accumulate stocks of refined copper in March and keep piling it in the yards until navigation opens, thus to take advantage of a cheaper water freight rate. But the smelters are shipping daily to New York. Two hundred thousand pounds left in one shipment from the Calumet & Hecla works yesterday, following a shipment of 300,000 lb. the day before. Report has it that this company is selling direct to the French government.

Production for February from the mines of the Lake Superior district ran well over 15,000,000 lb. and it was a short month. Every producing mine now is working under conditions which prevailed just previous to the Western Federation of Miner's strike and the percentage of copper per ton of rock is, as a general average, a little higher than it was at that time. This is due to the material betterment generally in the underground openings at several of the mines, notably Baltic of the Copper Range Consolidated, Mohawk, and Quincy. The conglomerate lode of the Calumet & Hecla is also showing a little better than its average of recent years, but this is offset by the increased tonnage without any increase in contents of the rock from the Osceola lode of the Calumet & Hecla. At the Mohawk mine the efficiency of labor has played a wonderful part in the general improvement in the quality of rock coming from the newer openings.

AUSTIN—Mar. 3

Oil Strike—What is probably the most significant oil strike that has been made in Texas for several years has been made near the town of Thrall, 35 miles northeast of Austin. At a depth of 1400 ft. a gushing flow of oil was struck in a well that was being bored by a local company, headed by Dr. W. F. Wallace. The flow from the well was approximately 500 bbl. per day. There is much activity in the sale of leases, some of the owners receiving as high as $100 per acre bonus.

That the scene of this oil strike is nearly 200 miles from any of the existing producing oil fields is believed to indicate that a new producing territory is about to be opened. Already more than a dozen well-drilling rigs have been shipped to the new scene of operations.

BISBEE—Mar. 5

Calumet & Arizona has acquired between 75 and 80% of the stock of the New Cornelia Copper Co., at Ajo, Ariz., 44 miles from Gila Bend, to which main-line connection it contemplates building a railroad this spring. The Cornelia was at one time held under option by the General Development Co., and $20,000 was spent on the property under direction of J. Parke Channing. Later it was leased to its former manager who shipped several hundred tons of 4% copper ore to the C. & A. smeltery at Douglas. The C. & A. secured an option and have developed to date, by drilling, 40,000,000 tons of ore, averaging 1½% copper. The capping of this deposit is said to yield to a leaching process developed by the C. & A. engineers. Calumet shareholders of the C. & A. are not altogether pleased with the New Cornelia absorption scheme, claiming it will shut off dividends for three or four years. They believe that financing of a big low-grade property like Cornelia would better be done by a bond issue There is talk of organized opposition to the scheme at Calumet.

TORONTO—Feb. 27

Government Control of the Nickel Industry was the most important subject considered at the annual meeting of the Ontario Associated Boards of Trade, held Feb 25, at which over one hundred representatives of the principal cities and towns were present. After a thorough discussion, which showed considerable difference of opinion, a resolution was adopted by a small majority approving the proposed appointment of a commission of investigation by the provincial government, and declaring it to be in the interest of Canada and the British Empire that the refining of all nickel, copper and matte should be done in Canada under Government control

EDMONTON—Feb. 27

Discovery of Gold was made recently in the Herb Lake district north of Le Pas, Manitoba, a short distance from the new railway line from Le Pas to Fort Nelson on Hudson Bay. A second find 100 miles farther on was made at Wintering Lake, also adjacent to the railway. Eight nuggets of well rounded placer were brought in to the Pas. Following their arrival, J. P. Gordon, assistant chief engineer of the Hudson Bay railway, left immediately on a special train to investigate

Bar Diggings on North Saskatchewan River have been regulated by an order-in-council Persons are now allowed to operate a strip of land 100 ft. wide along high-water mark of the river and extending thence into the river to its lowest water level, on payment of fee of $1 to the mining recorder, who will issue certificate.

The Mining News

ALASKA

ALASKA COPPER CORPORATION plans to do but little work during coming summer. Capital has been raised for development work on larger scale but it is impossible to freight machinery and supplies to mine before next winter. Expect to do much work during summer of 1916. Company shipped ore assaying 55% copper to Tacoma smeltery several years ago. A. B. Iles is manager.

REX CREEK, tributary to Chititu Creek, which is itself tributary to Nizina River in Copper River district, is scene of considerable activity. Two sets of laymen are working on J. S. Taylor property. Powell & Cooper, on upper lay, have 25 ft. of tunnel in pay and Woodward, on lower lay, has obtained pans running from 4c. to $1 from bottom of shaft. Price & Manley have taken option on Brooks ground in Edison group and have 7 men working in pay. Plan to use Keystone drill for prospecting. Lumbeck & Basset have good prospects on No. 11, second tier bench, and Anderson & Hanson are taking out winter dump on No. 8 bench, first tier, left limit.

RAMSAY-RUTHERFORD (Valdez)—In preparation for extensive work next summer 50 tons of supplies have been freighted over snow to Ramsay-Rutherford mine, seven miles from Valdez.

HEMPLE COPPER CO. (Landlock)—Company owns claims on Copper Mt. on Landlocked Bay and has driven 2000 ft. of tunnel. Recently let contract to Gus Lundstrom to drive additional 100 ft.

VALDEZ CREEK PLACER MINES (Chitina)—W. T. Soule and N. P. Sias will shortly leave from Cordova for the mines to start preparations for next summer's work. Company has already expended about $100,000 in development work and will ship in a Keystone drill, Ingersoll-Rand air compressor and drills. Air compressor will be driven by 58-hp. Pelton water wheel. Hydraulicking will start in May. Cleanup is expected to reach $200,000. George W. Sias, president of the company, will shortly leave Boston for the North.

ARIZONA

Gila County

MIAMI COPPER CO. (Miami)—Rate of production increased considerably above 50% mark.

OLD DOMINION (Globe)—Forced to close down after futile struggle to handle huge volume of water pouring into upper levels of mine caused by unprecedented rainfall during past two months. Normal flow of about 4,000,000 gal. per day increased by this reason to 10,000,000. If water can be kept below 14th level can ship in limited way from Kingdon shaft.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Ledge opened up on the 2150-ft. level 21 ft. wide, milling ore. Orebody on this level is 150 ft. long, which is longer than found on the upper levels. Supply of pebbles for Hardinge mills now obtained from Natomas Consolidated dredge tailing dumps owing to inability to get pebbles from Denmark.

DEFENDER (Pine Grove)—Development resumed above 350-ft. level. Three veins have been disclosed in drifts west from shaft, some of the ore being high grade. When sufficient ore has been extracted and blocked out, mill will be put in operation.

Inyo County

SALINE VALLEY SALT CO. (Owenyo)—W. E. Chapman engaged in salt production at Hutchison, Kansas, has been inspecting this property which is equipped with 13-mile bucket-tram and refining works. About 1000 tons of salt have been sold since first of year. Present production about 30,000 tons per year.

Kern County

LONG TOM DISTRICT is attracting attention from preparations being made for reopening the Long Tom mine and other properties near Kern River. The Hudson property, commonly known as [illegible], will be developed. Stamp mill is being installed.

JOSEPHINE T. G. (Randsburg)—Mill run in the Red Dog mill of 33 tons yielded [illegible].

PHOENIX (Randsburg)—Mine to be equipped with 10-stamp mill, concentrating tables, and cyanide plant.

ELLA (Loraine)—Preparations made for driving development tunnel 150 ft. vertically below the shaft house.

CACTUS CONSOLIDATED MINING CO.—This company, reorganization of Cactus Copper Co., Duluth, Minn., has just purchased property of Mammoth Consolidated Mining Co.

BIG BLUE (Kernville)—Attempt to reopen mine resulted in discovery that fire which started in mine last August is still alive. Smoke issued from old openings and mine was again closed. No information available as to method proposed to extinguish fire.

[illegible] MINING CO. [illegible] granted by California Corporation Commissioner to sell stock. This is first permit issued by [illegible] Company will sell 100,000 shares at [illegible] per share. Property developed by 1000 ft. of underground work [illegible] of high-grade ore have been [illegible] of ore on dump ready for shipment. Electrical power [illegible].

Mariposa County

RUTH PIERCE (Hornitos)—A 105-hp. electric motor has been installed as substitute for gasoline power. Extensive improvements have been made preparatory to resuming regular operations. H. W. Morris is president.

Nevada County

ELSIE A. (Nevada City)—Development of this property at Round Mountain is contemplated by T. J. Nolan and C. P. Loughbridge.

GASTON (Washington)—Reported that 10-stamp mill will be increased to 20 stamps. Property is operated through a 2000-ft. tunnel. E. T. Moore is manager.

EL ORO (Lake City)—Two compartment shaft sunk to depth of 78 ft. with hand windlass. Preparations for installing power hoist and sinking suspended until roads are improved. Shaft being sunk to tap the blue-gravel channel disclosed by prospecting with a boring machine.

EMPIRE (Grass Valley)—New 5000-hp. hoist installed and other improvements made. Old shaft timbers removed and iron and steel substituted for depth of 150 ft. This improvement will continue below 150-ft. point. Shaft will be increased to double compartment. Deepening shaft to 7500 ft. is contemplated. New 60-stamp mill nearing completion.

Placer County

MAYFLOWER GRAVEL MINING CO. (Forest Hill)—Suits aggregating $17,000 have been brought for damages alleged to have been caused by tailings flowing into irrigation and power ditches.

San Diego County

OWENS (Julian)—Ore will be transported to San Diego by auto truck to be shipped by water to Selby.

Siskiyou County

HAPPY CAMP DISTRICT has three hydraulic mines operating and a new quartz mine recently opened up and preparing for the installation of a stamp mill. The quartz mine was recently purchased by Mr. Anderson of W. E. Wright. Siskiyou hydraulic mine is operating three giants under supervision of Mr. Paine. Reeves-Davis mine completed repairs of the ditch which was damaged by early storms.

NIGGER BOY (Hornbrook)—Mill will be started immediately, gasoline power having been substituted for water.

Trinity County

PLACER MINING CO. (Carrville)—Largest self-shooter in Trinity County being installed at this property on north fork of Coffee Creek.

TRINITY COUNTY HYDRAULIC MINING CO. (Weaverville)—Company in 1914 handled 875,000 cu.yd. of gravel. T. W. Shanks is superintendent.

Tuolumne County

EXPERIMENTAL GULCH (Columbia)—Tunnel now in 2500 ft. will be advanced 250 ft. which it is believed will be sufficient to drain the old works and make possible working the mine at that point.

Trinity County

GOLDEN JUBILEE (Carrville)—Reported that mine will resume operation as soon as weather will permit. Property has been idle for several years.

COLORADO

Chaffee County

MARY MURPHY (Romley)—Report covering past year's operations. Average daily mine output past year was 180 tons of which 30 tons, varying in value from $12 to $50 per ton, was shipped crude to smelteries, remaining 150 tons being put through company's mill. Ore came from vertical depth of 2200 ft. Net returns were $474,000.

Clear Creek County

NEW ERA (Idaho Springs)—Benjamin F. Hall has remodelled mill and is prepared to treat custom ores.

ANNEX MILL (Idaho Springs)—Twenty additional stamps started this week, making total of 40 operating.

MIXELL MILL (Idaho Springs)—Being remodeled for treating zinc ores from Seaton and Foxhall properties. Horn slimer will be installed.

ONEIDA-STAGG (Idaho Springs)—Installing new filter plant, and building compressor house 26x50 ft. Will install motor-driven air compressor. Improvements completed in about 60 days.

Gilpin County

POZO GILPIN (Idaho Springs)—Engineers' Lease has sunk 100-ft. lift in winze from Newhouse tunnel and has opened, in a drift from bottom, 10 in. streak of high-grade gold ore.

Lake County

WOLFTONE (Leadville)—To provide better ventilation, 150 ft. crosscut being driven on 1st level to connect with Castle View shaft. Another body of smithsonite has been disclosed.

JENNIE JUNE (Leadville)—In outlying East Tennessee Park district near Tennessee Pass on the Denver & Rio Grande R.R., now controlled by new leasing company composed of Denver men who will prosecute development.

WESTERN ZINC OXIDE CO. (Leadville)—Newly incorporated concern of local men has taken over smeltery erected just west of city of Leadville last year and will immediately start plant again to produce high-grade white oxide from the camp's non-sulphide ores.

Ouray County

CAMP BIRD, LTD. (Ouray)—Report for last quarter 1914 shows 8882 tons dry ore milled, bullion value $246,916 yielding net mining profit $139,056. No expenditures for construction. No additions to ore reserves.

San Juan County

IOWA-TIGER (Silverton)—Winze in ground controlled by Melville Lease has reached depth of 150 ft. Level will be driven on vein from bottom of winze and new stoping ground will be opened.

San Miguel County

PRIMOS CHEMICAL COMPANY (Vanadium) — Company now has 65 men at mine and 40 at its mill. Five teams hauling ore from mine to mill. Considerable development is under way and company plans increase in production. A new property being opened up just below Sawpit.

Summit County

WASHINGTON (Breckenridge)—Lessees Theobald and Minchen drifting from bottom of winze sunk from Cornish tunnel, opened 16-in. vein of gold-bearing lead-carbonate alongside good streak of zinc ore.

Teller County

BLUE BIRD (Altman)—Lessees under recent contracts have begun shipments from nearly all the upper levels. On 5th level, the Zell lease has 3-ft. showing of $30 ore.

C. K. & N. (Anaconda)—Development by lessees Richardson Bros. on 500-ft. level in territory that formerly produced heavily has disclosed large shoot of 2-oz. gold ore.

SOUTH BURNS (Victor)—New power plant by Acacia Mining Co. to replace one destroyed by fire is completed. Chief development underground will be in 1100-ft. level.

ZENOBIA (Victor)—Ore from dump is now being worked by George Worth with satisfactory results. Product is being shipped to Portland mill. Estimated that about 40,000 tons of ore in dump can be treated at a profit.

TRAIL TUNNEL (Cripple Creek)—Kishman Leasing Co. has installed new washing plant to take care of increased output. Development in Upper Trail Tunnel is being carried on by Eastman & Company.

MARY McKINNEY (Anaconda)—New compressor has been ordered. As soon as it is installed company will resume sinking of main shaft. New equipment will provide for development to depth of 2000 ft., which is 900 ft. deeper than present lowest level.

ACACIA MINING CO. (Cripple Creek)—Wrockcliffe property, recently secured under lease by Frank Doherty, has been systematically developed with favorable results. A vein of ore has been opened 3 to 4 ft. wide and a value ranging from $20 to $30 per ton.

UNITED GOLD MINES CO. (Cripple Creek)—This company reports following productions of ore during 1914: WILD HORSE, 401 tons worth $3907; W. P. H., 2183 tons, $51,585; DEADWOOD, 1528 tons, $13,868; DAMON, 401 tons, $4279; MAY B., 440 tons, $7673; LONDONDERRY, 13 tons, $62. Wild Horse mill treated 10,704 tons, gross value $36,134.

IDAHO

FORT HALL (Pocatello)—It is reported that T. A. Ferguson, of Butte, has taken bond and lease on this property, and a cyanide plant will be installed in the near future.

THE AMERICAN PLACER MINING CO. (Pierce City)—Company owns 100 acres of placer-ground, and has purchased dredge. Will begin active operations on property early in March. J. M. Porter is manager.

MONITOR (Cœur d'Alene District)—Mine to be developed under supervision of Otis Hill of Spokane, managing director in Montana-Idaho Copper Co., organized several months ago to take over Monitor and adjacent properties.

MICHIGAN

Copper

KEWEENAW COPPER (Calumet)—After cutting large sump, to catch water coming from above the seventh level, has resumed shaft sinking.

INDIANA COPPER (Houghton)—Unable to find bottom extension of its No. 2 diamond drill hole by crosscutting and other search in deepest openings, now crosscutting at sixth level and will open a chamber at its approximate position at that depth in search of it.

NORTH KEARSARGE (Kearsarge)—Inexplicable boiler explosion at No. 3 plant put that shaft out of commission, miners were transferred immediately to No. 1 and rock hoisting was maintained at regular schedule. No. 3 is now in condition to resume operations at any time.

WOLVERINE (Kearsarge)—Average daily tonnage of rock stamped since [illegible] operations were attained, following the labor strike of 1913-1914, is about the same as average daily tonnage for five years previous to the strike. This corrects erroneous report in "Journal" of Feb. 20, 191[illegible].

WINONA (Houghton)—Company has about 600,000 lb. of refined copper in storage at Quincy smelter, Hancock, Mich., waiting for opportunity to sell at higher prices. Company passing through period of inactivity at small loss because lessees are working the property and keeping it in prime condition under supervision of company's regular superintendent.

QUINCY (Houghton)—New drilling record made in Quincy No. 2 shaft last Friday with new [illegible] drilling machine. Record established by Captain Thomas [illegible] who drilled 113 ft. of hole in one eight-hour stope drilling, in copper rock. It was necessary to take down and set up machine in new positions four times in the shift.

Iron

NEWPORT (Ironwood)—All employees at this mine again working full time since Mar. 1. Force has been increased to 900 men.

COLBY (Bessemer)—Corrigan, McKinney & Co. have taken on a few hands here getting the property in shape for a resumption of mining.

CAMBRIA (Negaunee)—Working force at this mine, which had been employed only three days a week since last August, is now on full time.

ASHLAND (Ironwood)—Hoisting of ore was resumed here on Mar. 1, after suspension of several months. While mine was idle extensive repairs were made to No. 3 and No. 9 shafts. Steel sets were put in place of the wood. No. 9 is now steel-timbered from surface to the 17th level.

MINNESOTA

Cuyuna Range

WILCOX (Woodrow)—Canadian-Cuyuna Ore Co. is constructing a number of houses for miners.

ARMOUR NO. 1 (Crosby)—Over 100 men will be put to work at once stripping western end of deposit, adjoining Pennington pit.

INLAND STEEL CO. (Crosby)—This company, operating Thompson, Armour No. 1 and Armour No. 2 mines, will install its own laboratory for doing work heretofore done by independent assayers.

HILL CREST (Ironton)—Cuyuna Range Power Co. is installing substation to distribute power for stripping operations. Mining company will use 300-hp. motor direct connected to 10-in. sand sucker and 250-hp. motor direct connected to 3500-gal. clear-water pump to supply giant nozzle. Four 6-in. pipes are now being driven through overburden to anchor sand sucker. This operation, patterned after hydraulicking scheme used at Rowe mine, will not be as large, having but one unit while Rowe has two giant nozzles. Water will be secured from Black Hoof Lake nearby.

Mesabi County

CROSBY (Nashwauk)—Preparations being made to resume operations. New washing plant is contemplated.

HAWKINS (Nashwauk)—A 60x60-ft. addition will be made to concentrator to cost $50,000. The addition will contain six tables for separating merchantable ore from low-grade.

IROQUOIS (Mountain Iron)—Rogers-Brown Ore Co. has canceled its lease on this mine and most of machinery has already been dismantled and shipped to one of the company's Michigan mines.

CROSBY (Nashwauk)—Cleveland-Cliffs Iron Co. will begin erection of concentrator here as soon as frost leaves the ground. Hoped to have plant running before the ore season is far advanced.

QUINN-HARRISON (Nashwauk)—This mine will ship 500,000 tons this year. Contract recently made calls for shipment of 500,000 tons per year over a term of years. Steel for washing plant has begun to arrive and construction is under way.

MISSOURI-KANSAS-OKLAHOMA

PICHER LEAD CO. (Joplin) has been carrying on an extensive drilling prospecting campaign in northeast Oklahoma field, for past year has opened up some rich orebodies and will now undertake development and construction. O. S. Picher is president.

CAVE SPRING LEAD & ZINC CO. (Galena)—Company is operating the Kramer lease at the present time and is equipping the old mills. Kramer company when it ceased operation a few years ago removed machinery but mill was left standing. A modern 250-ton mill will be completed within the next few weeks.

QUICK ACTION MINING CO. (Galena, Kan.)—Company has purchased Durston property, consisting of 250-ton mill and 40 acres of Luscomb and McElroy land south of Galena. Mine will be unwatered and workmen will be put to work repairing mill. Company expects to have mine in operation within two or three weeks. D. C. Wise, Supt.

MONTANA

Beaverhead County

KEATING GOLD MINING CO. (Radersburg)—Construction of railroad to connect Keating gold mine with Northern Pacific road will begin June 15. Road will be 42-in. gage and will run 14 mi. to a point 2¼ mi. north of Toston. At this point large ore bins will be erected. Will afford rail transportation for Keating, Ohio-Keating and other mining properties nearby. During January, Keating sent 3346 tons of ore to Washoe smeltery. When road is completed output will be increased to 250 tons per day.

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—New leaching plant to treat 2000 tons tailing per day will start in April. Sulphuric acid plant, capacity 100 tons per day, for furnishing acid for leaching and flotation processes also nearly completed.

Sanders County

DISCOVERY OF COPPER ORE—Henry Thomas, while drilling a well at his ranch across Flathead River, near Dixon, encountered copper ore at depth of 40 ft. Specimens of [illegible] show high per cent of copper. Discovery has attracted large number of people to locality and about 80 acres of ground have been located.

Silver Bow County

ALICE MINE (Butte)—Mine owned by Anaconda, long idle since [illegible], to be reopened for its zinc ore [illegible].

BUTTE-BALLAKLAVA (Butte)—Work [illegible] two-compartment shaft [illegible].

GREEN COPPER (Butte)—Mine wreckers [illegible] and [illegible] Green Copper shaft in ground [illegible] Anaconda company, Mar. 3. Seven shots were fired. Threats to put working shafts out of commission have been made and companies have been keeping close watch.

BUTTE-DULUTH (Butte)—Option on this property to Anaconda lapsed. Said to be on account of price and not physical condition. Has been optioned for 60 days to new interests not disclosed. John W. Neukam, Duluth, attorney for North Butte Co., elected director of Butte-Duluth, considered significant.

NEVADA

Esmeralda County

JUMBO EXTENSION MINING CO. (Goldfield) made defendant in Federal district court in two suits brought by Booth Reorganized Mining Co., an Arizona corporation, George Wingfield, president. Booth claims the Jumbo Extension vein by right of apex and equity suit asks an accounting on 15,000 tons of ore valued at $60 per ton alleged wrongfully extracted. Restraining order issued pursuant to petition, with hearing set for March.

GOLDFIELD MERGER DEEP MINES LITIGATION (Goldfield)—Word has been received from San Francisco that hearing on the application for permanent receiver for the Goldfield Deep Mines and Goldfield Merger Mines has been continued to Apr. 10, by stipulation between attorneys for the litigants and arrangement with judge of the federal district court at Seattle. Hearing was originally set for Feb. 8, but was continued to Mar. 1 upon application of the complainant, who desired a continuance in order to file an amended complaint.

GOLDFIELD CONSOLIDATED MINES CO. (Goldfield)—Estimated production of this company for February, tons mined, 29,864; gross extraction, $340,000; net realization, $172,000.

Nye County

TONOPAH PRODUCTION for week ended Feb. 27 was 10,367 tons, estimated gross milling value $212,566, as follows: Belmont, 3764 tons; Tonopah Mining, 2650; Tonopah Extension, 1638; West End, 1115; Jim Butler, 1050; Tonopah Merger, 150.

NEW MEXICO

Grant County

BONNIE MINING CO. (Lordsburg)—Company has encountered "blind-vein" in sinking new shaft averaging better than any on property. Width now 3 ft. and value $36 per ton, copper, gold and silver. Work progressing at rate of 5 ft. per day on new shaft.

85 MINING CO. (Lordsburg)—Arizona & New Mexico R.R. has filed intention to build spur from Oil Siding, its line, to 85 mine, which is employing 200 men and shipping regularly to El Paso and Douglas. Second largest producing copper mine in state.

Taos County

BUFFALO-NEW MEXICO MINES CO. (Red River)—Carload mining machinery received at Jaroso and will be sent to property at Red River. Will sink 250 ft. when machinery is installed. Entire district becoming active.

NEW YORK

St. Lawrence County

NORTHERN ORE CO. (Edwards)—New zinc concentrating and separating plant started, replacing mill destroyed by fire last June. New building steel and terra cotta, 102 ft. long, 52 ft. wide, 31 ft. to eaves.

SOUTH DAKOTA

Lawrence County

TROJAN (Trojan)—Enlargements in mill include erection of 40x16-ft. tank equipped with Dorr thickener, to house which superstructure was enlarged; building was also enlarged to give additional space around chilean mills. Work on company hotel suspended until spring.

LEAD (Lawrence)—Annual report of Homestake company shows 1,587,774 tons of ore milled during 1914, average value $3.879 per ton. Total for year $6,160,160.59. Shows increase in tonnage of 46,813 tons and decrease in value of $0.135 per ton over the previous year, $2,210,208 paid in dividends. Total of 17,809 feet of drifting done and two of shafts deepened 150 feet each. Recovery by amalgamation and cyanidation 94% of the assay value of the ore.

UTAH

Juab County

TINTIC ORE SHIPMENTS for week ended Feb. 26 amounted to 90 cars compared to 50 cars week preceding. February output amounting to 297 cars was below normal owing to heavy snowstorms.

GEMINI (Eureka)—Operations to be resumed with force of 60 men, to be increased later. J. C. McChrystal is manager.

YANKEE (Eureka)—Several buildings were knocked over by heavy snowstorms; equipment has been transferred, and operations resumed. There has been little loss.

EUREKA HILL (Eureka)—Seven feet of high-grade silver-lead ore has been opened in the Robinson tunnel by a lessee. In all 20 lessees are at work, most of them operating through the Bullion-Beck shaft.

KNIGHT-CHRISTENSEN MILL (Silver City)—Plant able to operate only 8 to 10 hr. daily on account of water shortage. Supply comes from Dragon Con. Condition to be remedied by lowering pumps from [illegible] to 1000-ft. level of mine.

LOWER MAMMOTH (Mammoth)—Development is being done on 1000 and 1800-ft. levels. Raise from 1800 is developing large body of ore carrying from 10 to 15% zinc. Lessees are mining zinc ore on 1500 and 1800 and lead-silver and copper ore on other levels.

CHIEF CONSOLIDATED (Eureka)—Gold ore carrying one to two ounces being mined from [illegible] level. Some gold ore has been opened on the 600 level also. Attention is being given to ore of this character on account of low prices of silver and lead. Some zinc ore will probably be mined.

DRAGON CONSOLIDATED (Silver City)—Development work, which has been handled through the Iron Blossom, will be resumed through the Dragon shaft. Drifting will be done on the 800, where bunches of lead ore have been cut. This company furnishes water for Knight mill.

Iron County

COAL CREEK COAL & COKE (Cedar City)—Articles of incorporation for this company were filed with secretary of state, Feb. 24. Capitalization is $1,000,000, divided into 10,000 shares. Company will undertake development of coal fields in Iron County.

Salt Lake County

UTAH COPPER (Salt Lake)—Company is operating two-thirds capacity in its mines and mills.

BINGHAM MINES (Bingham)—Company is shipping daily 100 tons lead-copper ore from the Dalton & Lark and 50 tons of copper ore from Commercial. Dalton & Lark ore is being shipped through the Mascotte tunnel.

COLUMBUS EXTENSION (Alta)—Suit to quiet title to three claims filed against the Cardiff Mining & Milling Co., plaintiff alleging that defendent has filed on claims overlapping the Rubberneck, Gilt Edge and Scorpion lodes, owned by Columbus Extension.

Summit County

PARK CITY ORE SHIPMENTS for week ended Feb. 22 amounted to 4,221,950 lb., by four shippers.

THOR (Park City)—Following recent change in control, offices have been removed from Salt Lake to Provo.

THREE KINGS (Park City)—Shaft is down 325 ft.; there has been a change in the formation, present bottom being in black limestone.

DALY WEST (Park City)—New 200-ton mill, limbered up in December, has produced 600 tons of concentrates. Considerable shipping ore also has been mined.

THOMPSON-QUINCY (Park City)—Meeting has been called for Apr. 3, for changing name to New Quincy Mining Co., with capitalization remaining same, but stock to become assessable.

SNAKE CREEK TUNNEL (Park City)—Work was resumed Feb. 20. Heavy flow of water at breast has not decreased, and drift will be started to tap the fissure at another point and thus relieve flow at face, when driving will be started again. Flow of water at portal is about 7500 gal. per minute.

SILVER KING CONSOLIDATED (Park City)—Connections have been made between 1700 level of this property and 1350 of the Silver King Coalition, thus improving ventilation and adding to safety at both. Silver King Consolidated has been sending its ore down the mountain in bobsleds.

Tooele County

GETHIN-LEROY (Wendover)—Work has been resumed at this property in Silver Island district.

WASHINGTON

Okanogan County

GOLDEN ZONE (Oroville)—Is running 1400-ft. tunnel. Present mill will be enlarged.

GOLDEN KING MINING CO. (Oroville)—Mill will be installed, work to be started next month. Milling ore runs from $6 to $8 a ton from a vein 4 ft. to 10 ft. wide.

Stevens County

TEN MINES IN THE CHEWELAH DISTRICT, which either have never shipped any ore or have been closed down for more than a year, will commence shipping this spring. The Hecla, which came into prominence last year, will install new equipment, all of which is on the ground at the present time. The Blue Star has commenced work on a new double shaft which it expects to sink to the 800-ft. level.

UNITED COPPER MINING CO. (Chewelah)—Will install flotation plant of sufficient capacity to handle output of 150-ton concentrating plant. This will be first flotation process introduced on a commercial scale in Chewelah district.

WISCONSIN

PENI (Mifflin)—Wm. Holtz and others have purchased the Peni mine.

WILSON (Potosi)—Mining operations have been resumed at Preston Point Mine.

VINEGAR HILL ZINC COMPANY (Mifflin)—Company has leased the Bainbridge land, embracing the Senator mine.

LOOMIS (Platteville)—C. D. Harding and H. B. Mann have purchased mine and equipment formerly known as Little Jack.

BLACK HAWK (Platteville)—Company has made a valuable discovery of dry bone, jack and lead in old workings on Spink land three miles south of Platteville.

CANADA

Ontario

TECK HUGHES (Kirkland Lake)—The option held by the Nipissing on this mine has been dropped.

ORE CHIMNEY (near Kaladar, Frontenac Co.)—Shaft down to 261-ft. level and 700 ft. of underground work done. A 20-stamp mill being installed.

CASEY COBALT—Exploration work on the East Casey, 1800 ft. from main shaft, disclosed 6-in. vein of milling ore. Another promising vein has been cut at 134 feet.

CANADIAN COPPER CO. (Copper Cliff)—Announced that Crean Hill and No. 2 mines will be reopened and all of the blast furnaces at smeltery started. This means the company will run full time. Frood mine will not be reopened, as company practically abandoned that pit last summer for Creighton where superior material was found.

MEXICO

Hidalgo

SANTA GERTRUDIS CO., LTD. (Pachuca)—Report for last quarter 1914 shows 64,429 dry tons produced, bullion value £77,669 yielding net mining profit £33,099. Crushing rate at mill reduced to 40% of capacity due to scarcity of supplies account of suspension of traffic via Vera Cruz. Operations at mine not hampered by local unrest.

The Market Report

METAL MARKETS

NEW YORK—Mar. 10

Copper and lead have been distinctly firmer. Tin rose to high figures because of the scarcity of supplies. The inflated spelter market collapsed.

Copper, Tin, Lead and Zinc

Copper—Some moderate business was done in the early part of the week with consumers at prices netting about 14.35c., cash, New York. The latter part of the week there was an increased demand and sales were made at 14½@14¾, regular terms, with 14¾ firmly established at the close. A fairly large business is reported to have been consummated. Certain agencies are entirely sold out for early deliveries, and for what they can supply later are asking prices above the present market.

Copper sheets show no change in the base price, which is 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15¼@15¾c. per lb., carload lots at mill.

Visible stocks of copper in Europe Feb. 28 are reported as follows: Great Britain, 16,316; afloat from Chile, 2275; afloat from Australia, 5125; total, 23,716 long tons. No stock reported at Rotterdam.

Copper exports for the week ended Feb. 27 are reported by the Department of Commerce at 10,171,000 lb., the larger items being 5,100,000 lb. to France, 2,961,000 lb. to Italy and 1,622,000 lb. to England. Imports for the week were 2,664,000 lb. metal and 840,000 lb. in ore and matte; 3,504,000 lb. in all, chiefly from Chile.

A cablegram from the U. S. consul-general at Christiania, Norway, says that embargo has been placed on all copper and brass plates, bars, bolts, spikes, nails, pipes, and foundry pieces.

Tin—There was something of a panic over the scarcity of supplies because of the shipping situation, but the business done either on the advance or the subsequent decline was relatively inconsequential. As one authority remarked "It was more of a movement on paper than anything else. Orders to buy 100 tons would put the price up to 50c. while orders to sell the same quantity would put it down to 40 cents."

Lead—Business with domestic consumers continued rather slack, but there was a good demand from abroad. The A. S. & R. Co. advanced its price to 3.95c., New York, on Mar. 5. Sales for export were made later at an advance over the A. S. & R. Co. quotation.

Spelter—While fancy prices were still being paid for spot and March spelter, the business represented thereby amounted to relatively trifling quantities. The inability of producers to place the tonnages that they had to sell against their intake of ore became more pronounced. Alarming news was received respecting the extent to which the high level of price was restricting consumption, especially among the galvanizers. This led producers to believe that they had been riding the whirlwind a little too long, and beginning on Mar. 4, strenuous efforts were made to place tonnages for any deliveries from April onward. This idea occurred to many sellers at the same time, and all kinds of efforts were made in the attempt to find a market. The unsoundness and danger of the previously existing situation were fully recognized, and no bones were made about offering spelter at 1@1½c. below previous quotations. In the latter part of the week April-May and May-June spelter was offered in large lots at 8c. with intimations of better terms to any one who wanted to do business. Even with such cuts buyers could not be found, and it is still too early to prophesy where the market is going to come into relative equilibrium. The scarcity of spelter for prompt delivery is genuine, but on the deliveries beyond March, the producers loosened up and stood not upon the order of their going. The disappearance of active demand, and the forthcoming production of old plants that are being started up were contributory factors.

Zinc sheets are again higher and are quoted today at $13.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The demand is very good, especially for early delivery.

On Mar. 3, in New York, 2000 shares of Edgar Zinc Co. were sold at auction at $75 per share.

Exports from Baltimore for the week included 288,030 lb. spelter and 133,680 lb. zinc dross to Great Britain.

Other Metals

Aluminum continues quiet, on a moderate but steady business. Quotations are unchanged at 19@19¼c. per lb. for No. 1 ingots, New York. **Antimony** has again advanced sharply, supplies being short. There has been no large business, and quotations are rather nominal, at 21@22c. per lb. for ordinary brands. For Cookson's 25@27c. per lb. is asked—**Nickel** is unchanged, ordinary forms being 40@45c. per lb. according to size and terms of order. Electrolytic, 3c. higher. **Quicksilver** has been strong and some excitement developed in the market. As high as $75@80 has been reported for small orders; but today's quotation for large lots is $65 per

DAILY PRICES OF METALS IN NEW YORK

Mar.	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: New York, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
4	4.8075	49⅝	14.30 @14.40	44½	3.90 @3.95	3.80 @3.85	*8.17½ @8.67½	*8.00 @8.50
5	4.8100	49¾	14.30 @14.40	48	3.95	3.80 @3.85	*8.17½ @8.67½	*8.00 @8.50
6	4.8088	49⅞	14.40 @14.50	48	3.95	3.85 @3.90	*8.17½ @8.67½	*8.00 @8.50
8	4.8075	50⅛	14.45 @14.55	48	3.95 @4.00	3.87½ @3.92½	*7.67½ @8.17½	*7.50 @8.00
9	4.8050	50	14.45 @14.55	46½	3.95 @4.00	3.87½ @3.92½	*7.67½ @8.17½	*7.50 @8.00
10	4.8025	51	14.55 @14.60	45	3.95 @4.00	3.87½ @3.92½	*7.67½ @8.17½	*7.50 @8.00

* Nominal

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Feb.-Mar.	Silver	Copper: Spot, £ per Ton	Copper: Spot, Cts. per Lb.	Copper: 3 Mos.	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
4	23¾	63⅛	13.71	63⅞		184½	162	20 3/16	4.39	43¾	9.51
5	23 3/16	63½	13.80	64		184	162½	20 5/16	4.41	44½	9.67
6	23¼										
8	23⅛	63⅞	13.88	64½		190	166	20 11/16	4.49	44½	9.67
9	23 9/16	64⅜	13.99	64¾		190	165½	20 13/16	4.52	44½	9.67
10	24 1/16	64⅜	13.99	64¾		188	164½	20⅞	4.54	44½	9.67

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17⅓c.; £15 = 3.26c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

flask. San Francisco, $60@63 for domestic business. London price is £12 15s. per flask, with £12 10s. quoted from second hands.

Minor Metals—Current sales of **Bismuth** have been at $2.75 per lb., New York. **Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.—**Cadmium** is quoted in London at 6s.—$1.44—per lb.—**Tellurium** is reported sold at 80s.—$19.20—per lb. in London.

Gold, Silver and Platinum

Gold—Among the arrivals of gold at New York during the week was $750,000 from Denmark.

Silver—Owing to a concurrent demand from the Continent and India on a market not very well supplied with silver, the price in London has had a sharp advance the past week. The fact that no steamers are sailing for England this week carrying bullion has also, no doubt, an influence on the London price.

Iridium—Prices are still high and irregular. The metal is scarce and quotations vary according to the needs of purchasers.

Platinum—The market is quiet and sales for the most part are small. There is still a considerable variation in prices and we continue to quote $38@42 per oz. for refined platinum, and $44@49 per oz. for hard metal.

Our Russian correspondent writes under date of Feb. 5 that the improvement of the market, mentioned in the previous report, still continues. At Ekaterinburg considerable business in small lots is to be noted for the last fortnight. The dealers and speculators voluntarily buy small portions at 8 rubles per zolotnik—$30.08 per oz. The export of platinum is entirely stopped. After the war a great revival of the platinum business is expected. At Petrograd the nominal price is 31,000 rubles per pood—$30.38 per oz.—for crude metal, 83% platinum.

Zinc and Lead Ore Markets

JOPLIN, MO.—Mar. 6

Blende, high price $76, assay base 60% zinc, low lead $73@70; high lead, $70@65; metal base suspended; calamine, base 40% zinc $42@40, low lead; average, all grades of zinc, $67.53 per ton. Lead, high price $49.85; base $47 per ton of 80% metal content; average, all grades of lead, $47.40 per ton.

SHIPMENTS WEEK ENDED MAR. 6

	Blende	Calamine	Lead	Values
Totals this week..	7,752,510	855,220	1,124,600	$317,260
Totals this year...	99,071,820	9,696,170	14,671,040	$3,493,420

Blende value, the week, $272,840; 10 weeks, $2,972,270.

Calamine value, the week, $17,780; 10 weeks, $175,620.

Lead value, the week, $26,640, 10 weeks, $345,530.

PLATTEVILLE, WIS.—March 6

The base price paid this week for 60% zinc ore was $72 per ton. The base price offered for 80% lead ore was $48 per ton. No sales of lead ore reported.

SHIPMENTS WEEK ENDED MAR. 6

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,076,120	.	126,800
Year .	35,250,720	470,000	3,559,900

Shipped during week to separating plants, 3,873,060 lb. zinc ore.

Iron Trade Review

NEW YORK—March 10

Improvement in the iron and steel trades is still in order, though the increase in new business is slow. The proportion of mill capacity employed is gradually growing.

Export business is growing, notwithstanding the drawbacks of high ocean freight rates and scarcity of vessels. Bars and wire are most in demand, also steel blooms and billets.

The demand for structural steel is gradually improving, and more new contracts are coming forward. Bridge material is more in demand as the season advances.

Pig Iron Production in February again increased. The reports of the furnaces, as collected and published by the "Iron Age," show that on March 1 there were 176 coke and anthracite stacks in blast [illegible] a total daily capacity of 63,050 tons; an increase of [illegible] tons over Feb. 1. Making allowance for the charcoal furnaces the total production of pig iron in the United States was [illegible] tons; for the two months ended Feb. 28 it was [illegible] tons. Of this total [illegible],373,250 tons, or 70.6%, were made by furnaces owned or operated by steel companies.

PITTSBURGH—Mar. 9

The steel mills are operating at fully 60% of their ingot capacity, showing a slight increase in the past fortnight. Orders for finished steel are coming in at a rate sufficient to maintain the pace, but no material increase is to be expected. There has been scarcely any railroad buying and there is hardly any structural steel being let, so that the present rate of operation indicates an almost normal consumption in miscellaneous lines. Merchant bars, which have a wider distribution among consumers than any other product, are in proportionately better demand than the majority of steel products, most of the large mills operating at 65 to 75% in this product.

The reported order of the Illinois Central placed with the Algoma Steel Co. at the Canadian Soo turns out to have been for 35,000 tons of rails, at $27.40, delivered Chicago, when the road could have bought at $30, f.o.b. Chicago or Ensley, from the domestic mills. The sales of the Canadian mill to roads in the United States now total about 60,000 tons, and it is understood more business is sought.

Finished steel prices are well maintained. The 1.10c. price on bars, plates and shapes has practically disappeared, the mills quoting 1.15c. on March business and 1.20c. on second quarter. As specifications are now coming in well on 1.10c. contracts the real test of the market will come in April or May.

Pig Iron—The pig-iron market continues very dull, there being no important inquiry for bessemer or basic, while buying of foundry grades is confined to small lots. We quote: Bessemer, $13.60; basic, $12.50; malleable, $12.75; foundry, $12.75@13.25; forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The English producers have advanced their contract price from $68 to $78, Baltimore, and now indicate that there will be deliveries of moderate tonnages, equally alloted between recent $68 contracts and old contracts at $35@38. Small lots of spot material are quoted at about $100.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 274,935 short tons; shipments, 201,712 tons. As compared with the first week in the year this is an increase of 65,333 tons in production, and 61,573 tons in shipments. Production of Greensburg and Upper Connellsville districts, 37,015 tons.

Connellsville Coke—The Perry Iron Co., Erie, Penn., is inquiring for furnace coke for second quarter or the remainder of the year, 10,000 to 12,000 tons monthly. We quote: Prompt furnace, $1.50; contract furnace, second quarter, $1.60; balance of year, $1.75; prompt foundry, $2@2.30; contract foundry, $2.20@2.30, per net ton at oven.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie in the month of January, in short tons:

	1914	1915	Changes	
Anthracite..	893,453	894,529	I.	1,076
Bituminous	3,820,719	3,571,345	D.	249,374
Coke.	846,950	685,546	D	161,404
Total..	5,561,122	5,151,420	D.	409,702

The total decrease this year was 7.3%. The greatest proportional decrease was in coke.

Chemicals

NEW YORK—March 10

The general chemical markets are quiet and business improves slowly as a rule.

Arsenic—Business is very quiet and not much improvement is looked for. Prices are unchanged at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and sales fair. Quotations are now $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is fair and prices are strong. Quotations are 2.20c. per lb. for spot and up to July 1; 2.17½ per lb. for later deliveries.

PETROLEUM

Exports of mineral oils from the United States in January were 163,292,765 gal. in 1914, and 146,769,701 gal. in 1915; a decrease of 16,522,064 gal., or 10.1%, this year.

The monthly summary of the "Oil City Derrick" reports new wells completed in February as follows: Pennsylvania grade, 261; Lima-Indiana, 40; Central Ohio, 101; Kentucky, 7; Illinois, 35, Kansas-Oklahoma, 387, Texas-Louisiana, 100, the total number being 931. The new production credited to the wells was 149,816 bbl., an increase of 1281. Included in the list are 182 dry holes and 198 gas wells. At the close of February there were 488 rigs and 1116 wells drilling.

Mining Companies—United States

Name of Company and Situation		Shares		Dividends			
		Issued	Par	Total	Latest		Amt.
Acacia, g	Colo.	1,454,304	$ 1	$ 122,004	Jan	'11	$0.01
Adams, s.l.c.	Colo.	1,438,989	10	778,000	Dec.	'09	0.04
Ahmeek, c.	Mich.	80,000	25	2,400,000	July	'14	2.00
Alaska Mexican, g.	Alas.	50,000	5	3,453,381	Feb.	'15	0.20
Alaska Treadwell, g.	Alas.	180,000	25	15,085,000	Feb.	'15	1.00
Alaska United, g.	Alas.	200,000	5	1,792,990	Feb.	'15	0.30
Am. Zinc, Lead & Sm.	U. S.	180,200	25	983,320	Jan.	'14	0.50
Anaconda, c	Mont.	168,640	25	94,245,000	Jan.	'15	0.25
Argonaut, g.	Calif.	4,992,500	5	1,620,000	Jan.	'15	0.30
Arizona Copper, pf.	Ariz.	200,000	1.20	2,009,744	Nov.	'14	. .
Arizona Copper, com.	Ariz.	1,426,120	1.20	17,092,498	Feb.	'15	0.18
Bagdad-Chase, g., pf.	Calif.	1,519,896	5	202,394	Jan.	'09	0.10
Baltic, c.	Mich.	84,819	25	7,950,000	Dec.	'13	2.00
Bingham N. H., c.	Utah	100,000	5	385,695	Apr.	'14	0.10
Bonanza Dev., g.	Colo.	228,690	1	1,425,000	Oct.	'11	0.20
Brunswick, g.	Calif.	395,287	1	106,727	Nov.	'14	0.06
Bunker Hill Con., g.	Calif.	300,000	1	820,000	Feb.	'15	0.02½
Bunker Hill & Sul., l.s.	Ida.	200,000	10	15,955,500	Feb.	'15	0.25
Butte-Alex Scott, c.	Mont.	327,000	10	148,000	Oct	'13	0.50
Butte & Ballaklava, c.	Mont.	74,000	10	125,000	Aug.	'10	0.50
Caledonia, l.s.c.	Ida.	250,000	1	286,550	Feb.	'15	0.02
Calumet & Arizona, c.	Ariz.	617,385	10	20,941,522	Dec.	'14	0.50
Calumet & Hecla, c.	Mich.	616,758	25	124,250,000	June	'14	5.00
Camp Bird, g.s.	Colo.	100,000	5	10,318,109	Jan.	'15	0.08½
Centen'l-Eur., l.s.g.c.	Utah.	1,100,051	5	4,050,000	Apr.	'14	1.50
Center Creek, l.z.	Mo.	100,000	10	521,000	Jan.	'15	0.05
Champion, c.	Mich	100,000	25	8,400,000	Oct	'13	1.00
Chief Consolidated, s.g.l.	Utah	871,384	1	262,969	Aug	'14	0.05
Chino, c	New Mex	777,458	5	4,081,120	Dec.	'14	0.50
Cliff, g	Utah.	864,820	1	90,000	Jan	'13	0.10
Cliff, g	Alas.	300,000	1	210,000	Oct.	'13	0.01
Colo. Gold Dredging	Colo.	100,000	10	650,000	Sept	'14	1.00
Colorado, l.s.g.	Utah.	100,000	0.20	2,570,000	Dec	'12	0.03
Columbus Con., g.s.	Utah	1,000,000	5	226,832	Oct.	'07	0.20
Commercial Gold	Ore.	285,540	1	43,750	Dec	'10	0.00½
Con. Mercur, g.	Utah	1,000,000	1	3,445,313	July	'13	0.03
Continental, z.l	Mo.	22,000	25	330,000	Jan	'15	0.50
Copper Range Con., c.	Mich	393,692	100	13,986,740	Oct.	'13	0.75
Daly Judge, s.l.	Utah.	300,000	1	900,000	Dec	'14	0.15
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan	'13	0.15
Doctor Jackpot, g.	Colo	3,000,000	0.10	45,000	Mar	'11	0.00½
Doe Run, l.	Mo	65,783	100	3,550,969	Dec	'13	0.76
Eagle & Blue Bell, g.s.l.	Utah	893,146	1	304,601	Oct	'14	0.05
Elkton Con., g	Colo	2,500,000	1	3,479,460	Nov	'14	0.02
El Paso, g.	Colo.	490,000	5	1,707,545	Feb.	'14	0.10
Ernestine, g.s.	N.M	300,000	5	120,000	Dec	'12	0.05
Fed. M. & S., com.	Idaho	60,000	100	2,708,750	Jan	'09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	8,986,946	Dec	'14	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr.	'11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan.	'08	0.05
Free Coinage, g.	Colo	10,000	100	180,000	Dec	'09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct	'14	0.02
Frontier, z	Wis.	1,250	100	146,202	Nov	'13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,305,000	Dec.	'14	10.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May	'13	0.03
Gold Coin of Victor	Colo	1,000,000	1	1,350,000	Feb	'09	0.02
Gold Dollar Con.	Colo	2,500,000	0.10	100,000	Dec.	'12	0.00½
Gold King Con., g.	Colo	5,750,370	1	1,407,319	Dec.	'11	0.03
Golden Cycle, g	Colo	1,500,000	5	3,825,000	Feb.	'15	0.05
Golden Star, g.	Ariz.	400,000	5	140,000	Mar	'10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	27,932,086	Feb.	'15	0.10
Grand Central, g	Utah.	500,000	1	1,620,750	Sept.	'14	0.05
Granite, g.	Colo	1,650,000	1	270,000	Nov.	'12	0.01
Hazel, g	Cal	900,000	1	971,000	Dec.	'13	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	3,210,000	Feb.	'15	0.01
Hercules, l.s.	Idaho	1,000,000	1	5,550,000	Dec	'13	
Homestake, g	S. D.	218,400	100	36,808,682	Feb.	'15	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,642,000	Sept	'07	0.05
Iowa, g.s.l.	Colo	1,666,667	1	233,499	Aug	'14	0.00½
Iowa-Tiger Leasing g.s.	Colo	12,655	1	9,250	Dec	'14	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	2,170,000	Oct.	'14	0.10
Iron Silver, s.l.g.	Colo	500,000	20	4,950,000	Dec.	'14	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan	'11	0.02
Jerry Johnson, g.	Colo	2,500,000	0.10	187,500	Nov.	'14	0.01
Kendall, g.	Mont.	500,000	5	1,505,000	July	'14	0.06
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr.	'10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug	'09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr.	'13	0.50
Knob Hill, g.	Wash	1,000,000	1	70,000	Oct.	'13	0.00½
Liberty Bell, g.	Colo	133,552	5	1,559,179	Sept.	'13	.
Little Bell, l.s.	Utah	300,000	1	75,000	Mar.	'11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan	'08	0.03
Mammoth, g.s.c.	Utah	400,000	25	2,300,000	July	'13	0.05
Mary McKinney, g.	Colo	1,309,252	1	1,169,308	July	'14	0.02
May Day, g.s.l.	Utah	800,000	0.25	172,000	Feb.	'15	0.02
Mexican, g.s	Nev.	201,600	2.50	161,910	June	'14	0.75
Miami, c.	Ariz	746,759	5	3,712,249	Aug.	'14	0.50
Modoc, g.s	Colo	500,000	1	275,000	Dec	'11	0.01
Mohawk, c	Mich	100,000	25	3,375,000	Feb.	'15	1.00
Monarch-Mad'a, g.s.l.	Colo	1,000,000	1	40,000	May	'11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec	'12	0.10
Mountain, c.	Cal	250,000	25	4,216,250	May	'08	0.44
National, g	Nev	770,000	1	570,000	May	'11	0.10
Nevada Con., c.	Nev	1,999,521	5	16,976,708	Dec	'14	0.37½
New Century, z.l.	Mo	330,000	1	237,600	Oct	'09	0.01
New Idria, q.	Cal	100,000	5	1,680,000	Apr	'14	0.10
North Butte, c.	Mont.	410,000	15	11,890,000	July	'14	0.50
North Star, g.	Cal	250,000	10	4,537,040	Dec	'14	0.70
Old Domin'n, M. & Sm.	Ariz	162,000	25	3,807,000	Dec	'14	0.50
Ophir, s.g	Nev.	201,600	3	2,068,360	Jan.	'12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	80,907	Jan	'13	0.02
Oroville Dredging	Cal	700,000	5	1,553,136	Aug	'14	0.12
Osceola, c	Mich	96,150	25	12,179,675	July	'14	1.00
Parrot, c	Mont	229,850	10	7,462,712	Feb.	'15	0.15
Pearl Con., g.	Wash	1,999,711	0.05	181,122	Dec.	'10	0.02
Pharmacist, g	Colo	1,500,000	1	7,500	Feb.	'10	0.00½
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct.	'11	0.03
Pittsburgh-Idaho, l	Ida	803,000	1	216,810	Oct.	'12	0.04
Pittsburgh Silver Peak, g	Nev	2,790,000	1	771,200	July	'14	0.02
Portland, g.	Colo	3,000,000	1	9,897,080	Jan.	'15	0.02
Quilp.	Wash	1,500,000	1	67,500	Feb	'12	0.01
Quincy, c.	Mich.	110,000	25	20,897,500	Dec	'13	1.25

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares		Dividends			
		Issued	Par	Total	Latest		Amt.
Ray, c	Ariz	1,482,436	$ 10	$3,266,796	Sept.	'14	$0.37½
Republic, g.	Wash	1,000,000	1	170,000	Nov.	'12	0.01½
Rochester, l.z.	Mo	4,900	100	190,846	July	'12	0.50
Round Mountain, g	Nev.	866,426	1	363,365	Aug.	'13	0.04
Seven Troughs Coal., g.	Nev.	1,500,000	1	37,500	July	'12	0.02½
St. Joseph, l	Mo	1,472,252	10	9,422,240	Dec.	'14	0.05
Shannon, c.	Ariz.	300,000	10	750,000	Jan.	'13	0.50
Shattuck-Arizona, c.	Ariz	350,000	10	2,275,000	Feb.	'15	0.50
Silver King Coal., l.s.	Utah	1,250,000	5	2,534,085	Apr.	'14	0.15
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July	'11	0.04
Skidoo, g.	Cal.	1,000,000	5	365,000	Oct.	'14	0.01
Snowstorm, c.g.	Ida	1,500,000	1	1,192,103	Oct.	'13	0.02
South Eureka, g.	Calif.	299,981	1	391,880	Feb.	'15	0.05
Standard Con., g.s.	Cal.	178,394	10	5,274,407	Nov.	'13	0.25
Stratton's Ind., g	Colo.	1,000,000	0.60	456,625	Dec.	'14	0.03
Success, z.	Ida	1,500,000	1	930,000	June	'13	0.02
Superior & Pitts., c.	Ariz.	1,499,792	10	8,578,820	Dec.	'14	1.00
Tamarack, c.	Mich.	60,000	25	9,420,000	July	'07	4.00
Tennessee, c.	Tenn.	200,000	25	4,456,250	Jan.	'15	0.75
Tomboy, g.s.	Colo	310,000	4.85	3,634,065	Dec.	'14	0.48
Tom Reed, g.	Ariz.	909,555	1	2,264,764	Dec.	'14	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	7,080,500	Feb.	'15	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	707,574	Jan.	'15	0.07½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	12,350,000	Jan.	'15	0.25
Tri-Mountain, c.	Mich	100,000	25	1,450,000	Dec.	'13	2.00
Tuolumne, c	Mont.	800,000	1	520,000	May	'13	0.10
Uncle Sam, g.s.l.	Utah.	500,000	1	495,000	Sept.	'11	0.05
United Cop. Min., c.	Wash	1,000,000	1	40,000	Nov.	'12	0.01
United (Crip. Ck.) g.	Colo	4,000,100	1	440,435	Jan	'10	0.04
United Globe, c.	Ariz.	23,000	10	2,127,500	Dec.	'14	7.00
United Verde, c.	Ariz.	300,000	10	34,822,000	Feb.	'15	0.75
Utah, s.l	Utah	100,000	10	281,860	Dec	'10	0.02
Utah, c.	Utah	1,624,290	10	25,807,813	Dec.	'14	0.75
Utah Con., c.	Utah.	300,000	5	8,550,000	Dec.	'14	0.50
Valley View, g.	Colo	1,000,000	1	210,000	Dec	'10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar.	'10	0.04
Vindicator Con., g.	Colo	1,500,000	1	3,127,000	Jan.	'15	0.03
Wasp No. 2, g.	S. D.	500,000	1	466,966	Dec	'14	0.01
Wellington Mines, g	Colo	10,000,000	1	350,000	July	'13	0.00½
Wolverine, c	Mich	60,000	25	7,980,000	Dec.	'14	2.00
Yak, s.l.	Colo.	1,000,000	1	1,847,685	Dec.	'14	0.02
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan.	'13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,159,789	Feb.	'15	0.03
Yellow Pine, l.z.s.	Nev.	1,000,000	1	453,008	Dec	'14	0.03
Yukon Gold, g.	Alas	3,500,000	5	6,622,000	Dec	'14	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	$91,280,147	Feb.	'15	$0.50
Am. Sm. & Ref., com	U. S.	500,000	100	27,333,333	Dec	'14	1.00
Am. Sm. & Ref., pf.	U. S	500,000	100	50,458,333	Dec.	'14	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	9,945,000	Oct.	'14	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	14,375,000	Oct.	'14	1.25
Greene Cananea	U. S.	450,642	100	4,371,646	June	'14	1.00
Guggenheim Expl.	U. S.	380,315	25	20,927,995	Jan.	'15	0.87½
Inter'l Nickel, com.	U. S	115,826	100	14,846,438	Dec.	'14	2.50
Inter'l Nickel, pfd.	U. S.	89,126	100	8,358,491	Feb.	'15	1.50
National Lead, com.	N. Y.	206,554	100	8,415,884	Dec.	'14	0.75
National Lead, pf.	N. Y.	243,676	100	29,266,672	Dec.	'14	1.75
Old Dominion, c.	Ariz	293,245	25	5,853,713	Dec.	'14	0.50
Phelps, Dodge & Co.	U. S.	450,000	100	36,659,304	Dec.	'14	3.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	222,360,438	Dec	'14	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	376,598,255	Feb.	'15	1.75
U. S. S., R. & M., com	U. S.-Mex	486,348	50	6,362,181	July	'14	0.75
U. S. S., R. & M., pf.	U. S.-Mex	351,114	50	15,002,929	Jan.	'15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex	50,000	$ 5	$ 212,500	Oct	'12	$0.25
Amparo, g.s.	Mex	2,000,000	1	1,580,884	Feb	'15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan.	'13	0.15
Beaver Con., s.	Ont.	1,996,490	1	469,868	July	'14	0.03
Buffalo, s.	Ont.	1,000,000	1	2,757,000	July	'14	0.03
Canadian Goldfields, g	B. C.	600,000	0.10	290,000	July	'14	0.00½
Chontalpan, g.s.l.z.	Mex	7,000	25	57,750	May	'14	0.75
Cobalt Townsite, s	Ont	45,000	1	1,042,259	May	'14	0.10
Coniagas, s	Ont	800,000	5	6,880,000	Feb	'15	0.30
Con. M. & S. Co. of Can.	B. C.	58,052	100	1,825,677	Jan	'15	2.00
Crown Reserve, s	Ont.	1,768,814	1	5,996,278	Jan.	'15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar	'11	0.25
Dos Estrellas, g.s	Mex.	300,000	0.50	10,335,000	Dec	'13	1.50
El Oro, g.s	Mex	1,147,500	4.85	8,668,418	July	'13	0.24
Esperanza, s.g	Mex	455,000	4.85	11,996,303	Jan	'14	0.24
Granby, s.l.c.	B. C.	148,496	100	5,533,457	June	'14	1.50
Greene Con., c.	Mex	1,000,000	10	9,544,400	May	'14	0.50
Guanajuato D., pf., s	Mex	10,000	1000	274,375	Jan	'11	3.00
Hedley Gold	B. C.	120,000	10	1,524,000	Dec	'14	1.00
Hollinger, g	Ont	600,000	5	2,850,000	Feb	'15	0.20
Kerr Lake, s	Ont	600,000	5	5,520,000	Dec	'14	0.25
La Rose Con., s	Ont	1,498,627	5	5,162,327	Jan	'15	0.25
Le Roi No. 2, g	B. C.	120,000	24.30	1,472,580	Jan.	'13	0.36
Lucky Tiger Com., g.	Mex	715,337	10	2,912,870	Feb	'15	0.10
McK.-Dar. Sav., s	Ont	2,247,692	1	4,405,471	Feb	'15	0.03
Mines Co. of Am. (new)	Mex	1,700,000	10	1,215,000	July	'13	0.12½
N. Y. & Hond. Ros., g	C. A.	150,000	10	3,610,000	Jan	'15	0.30
Nipissing, s	Ont	1,200,000	5	12,690,000	Jan	'15	0.25
Peñoles, s.l.z.	Mex	80,000	25	6,361,688	June	'13	1.25
Peregrina M. & M., pf	Mex	16,000	100	328,656	Sept	'10	3.50
Pinguico, pf., s	Mex	20,000	100	840,000	Oct.	'13	3.00
Right of Way Mines	Ont	1,685,500	1	219,115	Nov	'14	0.02
Rio Plata, s	Mex	374,518	5	345,745	Feb	'13	0.05
San Rafael, g.s	Mex	2,100	25	1,112,380	Jan	'14	0.50
San Toy, g	Mex	5,750,000	1	530,000	July	'13	0.01
[illegible]	Mex	19,200	20	3,979,240	Jan	'11	34.00
Stand'd Silver-Lead	B. C	2,000,000	1	1,550,000	Sept	'14	0.02½
Timiskaming, s	Ont	2,500,000	1	[illegible]	Apr	'13	0.06
Tem. & Hud. Bay, s	Ont	7,761	1	[illegible]	Nov	'14	3.00
Tretheway, s	Ont	1,000,000	1	1,061,998	July	'14	0.05
Wettlaufer-Lorrain, s	Ont.	[illegible]	1	[illegible]	Oct.	'13	0.05

Previous to reorganization, $5,258,881

Previous to January, 1910, $321,641

Assessments

Company	Delinq.	Sale	Amt
Brunswick Con., Nev	Feb. 16	Mar. 9	$0.01
Caledonia, Nev	Mar. 8	Mar. 31	0.05
Confidence, Nev	Mar. 11	Mar. 31	0.10
Con. Virginia, Nev	Feb. 24	Mar. 18	0.10
Copper King, Ida	Mar. 1	Apr. 1	0.005
East Hercules, Ida, (post.)		Mar. 3	0.001
Emerald, Utah three instal		June 9	0.01
Galena King, Utah	Mar. 25	Apr. 25	0.0075
Gethin Le Roi, Utah (post.)	Feb. 16	Mar. 7	0.02
Idaho-Nevada, Ida	Mar. 10	Apr. 2	0.002
Index, Ida	Feb. 27	Mar. 27	0.005
Indiana, Mich	Feb. 4		1.00
Iron King, Ida	Feb. 18	Mar. 19	0.001
Jack Waite, Ida	Mar. 1	Mar. 24	0.01
Kentuck, Nev	Mar. 18	Apr. 7	0.02
Keystone, Utah (post)	Feb. 23	Mar. 23	0.02
King Pine C'k., Ida	Feb. 12	Mar. 13	0.002
Laclede, Ida	Mar. 20	Apr. 6	0.003
Majestic-Idol, Nev	Dec. 15	Jul. 20	0.005
Neva, Utah	Mar. 18	Apr. 12	0.002
Nor. Bnkr. Hill, Ida	Jan. 30	Mar. 6	0.002
Ophir, Nev.	Feb. 11	Mar. 5	0.10
Oreano, Ida	Mar. 25	Apr. 26	0.0015
Overman, Nev	Mar. 8	Mar. 26	0.05
Pioche Metals	Mar. 20	Apr. 20	0.0025
Rescue-Eula, Nev	Feb. 11	Mar. 22	0.01
Rio Grande, Utah	Mar. 25	Apr. 17	0.003
Saltese, Ida.	Mar. 1	Apr. 1	0.002
Selma, Utah	Mar. 20	Apr. 6	0.0025
Sierra Nevada, Nev	Feb. 8	Mar. 2	0.05
Snowstorm Ex., Ida	Feb. 19	Mar. 22	0.003
Sonora, Ida.	Mar. 15	Apr. 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Syndicate, Ida. (post.)		Jan. 28	0.001
Tarbox, Ida. (post.)	Jan. 28	Mar. 25	0.0025
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Torino, Ida	Feb. 20	Mar. 20	0.001
Union Chief, Utah	Feb. 18	Mar. 15	0.01
Utah, Nev	Mar. 25	Apr. 15	0.02
Utah-United, Utah	Feb. 20	Mar. 15	0.01
Wanlass	Jan. 30	Mar. 20	0.00375
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

General financial conditions have continued to improve and the stock market has been strong all the week, especially the coppers. Zinc stocks have been high, but perhaps a little shaky.

COLO. SPRINGS Mar. 9 Name of Comp.	Bid.	SALT LAKE Mar. 9 Name of Comp.	Bid.
Acacia	.06	Beck Tunnel	06½
Banner	.01½	Black Jack	10
Cripple Cr'k Con.	.007	Colorado Mining.	11½
C. K. & N.	.06	Crown Point	02½
Doctor Jack Pot.	.08½	Daly-Judge	5 25
Elkton Con.	.45	Gold Chain	10
El Paso.	1 45	Grand Central	60
Findlay.	.03¼	Iron Blossom	99
Gold Dollar	.04	Little Bell	10
Gold Sovereign.	.05	Lower Mammoth	05½
Isabella	.16⅝	Mason Valley	1 15
Jack Pot	.06½	May Day	13
Jennie Sample	.03	Opohongo	01½
Jerry Johnson.	.03	Prince Con	44
Lexington	.0075	Seven Troughs	02
Mary McKinney	.31½	Silver King Coal'n	3 10
Pharmacist	01¼	Silver King Con	1 90
Portland	1 10	Sioux Con.	05½
Raven B. H.	03¾	Uncle Sam	06
Vindicator	1 25	Yankee	06

TORONTO Mar. 9			
Bailey	02	Dome Exten.	05
Coniagas.	4 25	Foley O'Brien.	15
Peterson Lake	21	Hollinger	22 25
Right of Way	03	Imperial	01
Seneca Superior	1 25	Jupiter	08
Silver Queen	02	McIntyre	31
T. & Hudson Bay.	20 00	Pearl Lake	01½
Timiskaming	16	Porcu. Gold.	‡ 25
Wettlaufer-Lor.	0[illegible]	Preston E. D.	01½
Big Dome	6 75	Rea	10

SAN FRANCISCO Mar. 9 Comstock Stocks		Misc. Nev. & Cal.	
Alta	17	Belmont	4 85
Belcher	32	Jim Butler	70
Best & Belcher	06	Lone Star	07
Caledonia	26	MacNamara	03
Challenge Con	‡ 05	Midway	13
Confidence	24	Mont.-Tonopah	18
Con. Virginia	16	North Star	15
Crown Point (Nev.)	32	Rescue Eula	11
Gould & Curry.	04	West End Con.	53
Hale & Norcross.	04	Atlanta	31
Julia	01	Booth	30
Mexican	38	C. O. D. Con	05
Occidental.	85	Comb. Frac.	08
Ophir	11	Jumbo Extension	91
Overman.	12	Pitts.-Silver Peak	10
Potosi	02	Round Mountain	57
Savage	05	Sandstorm Kendall	08
Sierra Nevada	10	Silver Pick	08
Union Con	20	Central Eureka	‡ 25
Yellow Jacket	52	So. Eureka	‡2 [illegible]

N. Y. EXCH. Mar. 9 Name of Comp.	Clg.
Amalgamated.	54¾
Am.Sm.&Ref.,com.	63¾
Am. Sm. & Ref., pf.	102
Am. Sm. Sec., pf. B.	‡78
Anaconda	26½
Batopilas Min	‡50
Bethlehem Steel	55¾
Bethlehem Steel, pf.	104
Chino.	35¾
Colo. Fuel & Iron.	24¾
Federal M. & S., pf.	24⅜
Great Nor., ore., ctf.	31½
Guggen. Exp.	51
Homestake.	116
Inspiration Con.	19⅜
Mex. Petroleum	67
Miami Copper.	20¼
Nat'l Lead, com.	54
National Lead, pf.	106
Nev. Consol.	12¼
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf.	1½
Ray Con.	17¼
Republic I&S, com.	20¼
Republic I&S, pf.	77¼
SlossSheffi'd, com.	26
Tennessee Copper.	27½
Utah Copper	53⅝
U. S. Steel, com	45¼
U. S. Steel, pf.	104¼

N. Y. CURB Mar. 9 Name of Comp.	Clg.
Beaver Con.	26
Big Four.	08
Blue Bell	06
Braden Copper.	6¼
Buffalo Mines	⅝
Can. Cop. Corpn	1
Can. G. & S.	03
Caribou.	.45
Chambers Ferland.	12
Con. Ariz. Sm.	.25
Coppermines Cons	‡1¼
Davis-Daly	.82
Diam'field-Daisy	07
Dia. Black B.	03
Ely Con	‡ 01
Florence	54
Goldfield Con.	1⅝
Goldfield Merger.	22
Greene Cananea.	27
Kerr Lake	4¾
La Rose	$\frac{11}{16}$
McKinley-Dar-Sa	50
Mines of Am.	2
Mutual Min., pf.	‡2½
Nevada Hills	28
New Utah Bingham	.32
Nipissing Mines	5½
Ohio Copper	08
Oro.	09½
Pacific Smelt.	$\frac{3}{32}$
South Utah.	10
Stand'd Oil of N.J.	392
Standard S. L.	1⅛
Stewart	1⅞
Tonopah	7$\frac{9}{16}$
Tonopah Ex.	2⅞
Tonopah Merger.	.40
Tularosa	⅛
West End Ex.	03½
Yukon Gold	2⅜

LONDON Feb. 20	
Alaska Tre'dwell	£7 2s 6d
Camp Bird	0 7 6
El Oro.	0 9 0
Esperanza	0 9 6
Mexico Mines	4 0 0
Oroville	0 11 9
Philippine Dr.	1 0 0
Santa Gert'dis	0 11 3
Tomboy	1 3 1½
Tough Oakes	0 13 0

BOSTON EXCH Mar. 9 Name of Comp.	Clg.
Adventure	1
Ahmeek	275
Alaska Gold M.	30½
Algomah	.50
Allouez	41¼
Am. Zinc	27⅜
Ariz. Com., ctfs.	4
Bonanza	32
Butte-Ballaklava	2¼
Butte & Superior.	48½
Calumet & Ariz.	54
Calumet & Hecla	385
Centennial	17½
Copper Range.	35
Daly West	2
East Butte	9¼
Franklin	5½
Granby	67
Hancock.	11½
Hedley	28
Helvetia	30
Indiana	3¾
Island Cr'k, com	44
Island Cr'k, pfd.	88½
Isle Royale	21¼
Keweenaw	2¼
Lake	7
La Salle.	3½
Mass.	4⅜
Mayflower	4¼
Michigan	60
Mohawk	57½
New Arcadian	5¼
New Idria Quick	‡3½
North Butte	24¼
North Lake	1
Ojibway	70
Old Colony.	3¾
Old Dominion.	40½
Osceola	72
Quincy.	56
Santa Fe	1
Shannon	5½
Shattuck-Ariz.	21
Superior	26¼
Superior & Bost.	1
Tamarack	30½
Trinity.	3¼
Tuolumne.	.28
U. S. Smelting	22
U. S. Smelt'g, pf.	40⅜
Utah Apex	2⅝
Utah Con	10¼
Victoria.	1¼
Winona	2⅝
Wolverine.	43½
Wyandot	.50

BOSTON CURB Mar. 9 Name of Comp.	Bid.
Alvarado	60
Bingham Mines	‡3½
Boston Ely.	14
Butte & Lon'n Dev.	20
Calaveras	1$\frac{3}{16}$
Calumet-Corbin	.10
Chief Con	.80
Corbin	.50
Cortez	15
Crown Reserve	80
Eagle & Blue Bell.	.78
First Nat. Cop.	1½
Houghton Copper.	1¼
Iron Cap Cop., pf.	3
Majestic.	13
Mexican Metals	14
Nevada-Douglas.	33
New Baltic.	1½
Oneco	40
Raven Copper.	08
Smokey Dev.	10
So. Lake	5
Tonopah Victor	‡ 17
Trethewey	10
United Verde Ext	2$\frac{13}{16}$

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January.	62.938	57.572	48.855	28.983	26.553	22.731
February.	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	......	26.669	26.788	
April.	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July.	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654	......	28.083	23.199	
November.	58.995	49.082		27.263	22.703	
December.	57.760	49.375		26.720	22.900	
Year	59.791	54.811	...	27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January.	14.223	13.641	64.304	60.756	69.488	65.719
February.	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	.	64.[illegible]76	....	69.170	..
April.	14.211		64.747		69.313	
May	13.996		63.182		67.786	
June	13.603		61.336		66.274	
July.	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November.	11.739		53.227		*	
December.	12.801		56.841		*	
Year	13.602		61.524	.	68.168	.

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March.	38.038		173.619	....
April.	36.154		163.963	
May.	33.360		150.702	
June	30.577		138.321	
July	31.707	.	142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301	......	156.564	

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	....	3.850	....	19.651	
April	3.810		3.688		18.225	.
May	3.900		3.808		18.503	
June	3.900		3.810		19.411	
July	3.891	.	3.738		19.051	
August	3.875	...	3.715		‡	
September	3.828	.	3.658		‡	
October	3.528	.	3.384		‡	
November.	3.683	.	3.585		18.500	.
December.	3.800		3.662		19.097	.
Year	3.862		3.737		19.079	

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250		5.100	...	21.460	..
April	5.113	.	4.963	.	21.569	
May	5.074		4.924	.	21.393	
June	5.000	.	4.850	.	21.345	
July	4.920		4.770	.	21.568	.
August.	5.568		5.418		‡	
September	5.380	.	5.230		‡	
October	4.909		4.750	.	‡	
November.	5.112		4.962		25.016	.
December.	5.592		5.430		27.369	
Year	5.213		5.061		22.544	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February.	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07		13.94	...	14.10	.....
April	14.90		13.90		14.13	..
May	14.90		13.90		14.27	..
June	14.90		13.90		13.96	
July	14.90	.	13.90		13.90	
August	14.90	.	13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November.	14.59		13.43		13.83	
December.	14.70		13.45		13.83	.
Year	$14.88		$13.78		$14.01	.

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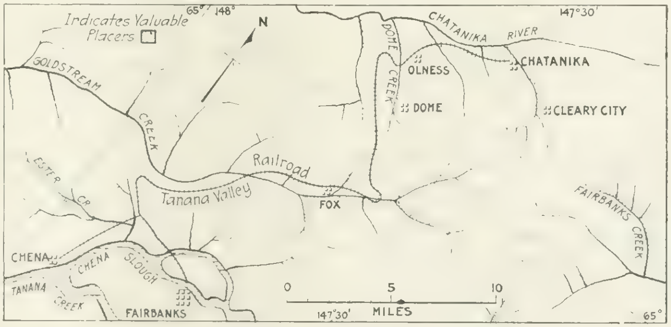
Dawson, Nome and Fairbanks

By Hubert I. Ellis*

SYNOPSIS—A brief sketch of the rise of Dawson, Nome and Fairbanks, the three famous placer camps of Alaska and the Yukon. A period of depression follows the first boom, and is in turn succeeded by a rise due to the introduction of machinery to work lower-grade deposits. The character of the gravels is described, together with the influence of various elements upon the prosperity of the industry.

Dawson, Nome and Fairbanks, named in the order of discovery, are the three world-famous placer districts of Alaska and the adjacent Yukon Territory. To these might be added Iditarod, but that camp never attracted the attention the others did. Indeed, each discovery has occasioned less excitement than the preceding. Thus Dawson aroused the wildest enthusiasm and was followed in order by Nome, Fairbanks and Iditarod. Dawson was discovered in 1896 and has produced $180,000,000; Nome was discovered in 1898 and has produced $69,000,000; Fairbanks was discovered in 1903 and has produced $63,000,000.



Sketch Map of Fairbanks District

Three Stages of Placer-Mining History

There are three distinct stages in the history of every placer-mining camp of the type under discussion. The first stage includes the wild extravagance attendant on discovery and extends through the days of the bonanzas. Money is plentiful, life moves at a rapid pace, and no one takes thought of the morrow. Then there comes a time when the failure of new discoveries to keep pace with the exhaustion of the old mines foreshadows a dwindling of production. This condition makes itself felt in the community before it is reflected in statistics of production, since profits are decreased by higher working costs and lower yield per unit of material handled before the output shows an important decline. Then the production commences to fall away and the total cost of mining approaches nearer and nearer to the total yield. The pinch of poverty becomes more than a vague possibility, an air of pessimism prevails and many of the residents become so discouraged as to leave the district.

The third stage is marked by the introduction of mechanical means for handling the gold-bearing gravel, in distinction to the crude hand methods of the early days. The prospector and the individual miner, on whom the prosperity of the district formerly depended, give way to the stock company with millions of dollars to invest in paving the way for extraction. Simultaneously, the pick, shovel and wheelbarrow are replaced by the dredge and the hydraulic giant, and hundreds of cubic yards of gravel are then moved where one was moved in former days.

Of the districts noted above, Dawson best exemplifies the working of the rule. This is brought out clearly in Fig. 1. George Carmack discovered "pay" on Bonanza Creek, a tributary of the Klondike River, in August, 1896. Robert Henderson had previously found gold in another portion of the same district, but for some reason, possibly because Henderson's discovery was scarcely rich enough to constitute "pay,"[1] Carmack is usually hailed as the discoverer of Dawson. The production increased by leaps and bounds to a maximum of $22,500,000 in 1900. That is, royalty was paid to the government on this amount. There are many, however, who maintain that the actual yield was considerably greater, much "dust" evading the vigilance of the officials and escaping the payment of royalty. From the high-water mark of 1900 the production fell away rapidly to a minimum of $3,150,000 in 1907. Since this time, thanks largely to the operations of the Yukon Gold Co., the output has gradually increased to about $6,000,000 in 1914. It may be noted that the figures quoted for Dawson include a small amount of gold from other portions of northern Yukon Territory.

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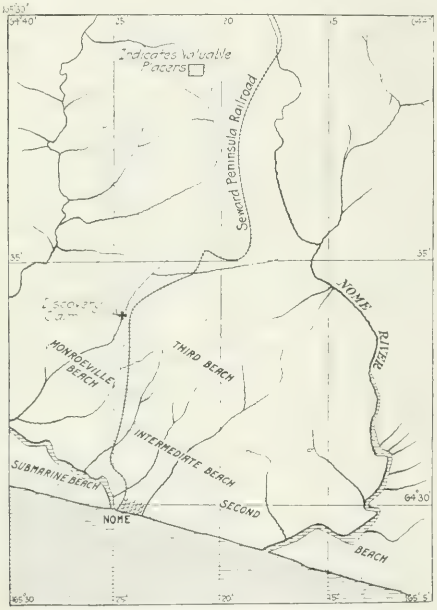
[1] The word "pay," in placer-mining parlance is used much the same as "ore" in lode mining. The idea of profit is always more or less distinctly in mind, but it is not uncommon to hear men speak of "pay" that is too low grade to be exploited at a profit.

Rise and Fall of District Production

The curve for Nome—or Seward Peninsula, to be exact, since the production for the whole area is usually given as a lump sum—is interesting as showing the influence of the famous Third Beach. Pay was discovered in 1898 and the output jumped to $4,750,000 in 1900. Then it held about even, until the discovery of the Third Beach line in 1905 led to a greatly increased production, reaching $7,500,000 in 1906. Since then the output has fallen away, but if preliminary estimates of about $3,000,000 for 1914 prove correct, it will indicate that bedrock has been reached and that the district may be expected to hold its own for some years to come.

In the Fairbanks district, Felix Pedro discovered gold on Pedro Creek in 1902, but no important production was made until the following year. There was a stampede from Dawson, Nome, and other places during the winter of 1902-3, but conditions were so unsatisfactory that it was proposed to hang the man whose glowing reports, made on his way outside on one of the last boats in the fall, were chiefly responsible for the stampede. Fortunately the man, a Japanese named Wada, was well beyond the reach of the disappointed gold seekers. During the following summer a production of $40,000 was made, and this led to a second stampede to Fairbanks. Even then the majority left dissatisfied, and condemned the district in the strongest terms, only to return a year later when the value of the find had been amply demonstrated by the persevering few whose confidence had remained unshaken from the first.



Sketch Map of Nome Mining District

A heavy sag will be noted in the Fairbanks curve, Fig. 1, for 1907; this was due chiefly to labor troubles. The maximum production, $9,650,000, was attained in 1909. The yield for 1914 is estimated at $3,000,000, but it is probable that this is a little high for the Fairbanks district proper, which includes only those creeks to the north of the Tanana within 30 miles of the town of Fairbanks. (See sketch map of district.)

It will be noted that production at Dawson fell away from the maximum for 7 years before it began to increase again. Curiously enough, exactly the same length of time passed at Nome from the maximum to the apparent minimum. As it is only 5 years since the maximum production at Fairbanks, analogy would indicate that the output will continue to decrease for several years yet, and this conclusion is borne out by a careful study of the district. Even at Nome the evidence is too meager to justify more than a pious hope that the lower limit has been reached and that the yield is now on the upgrade.

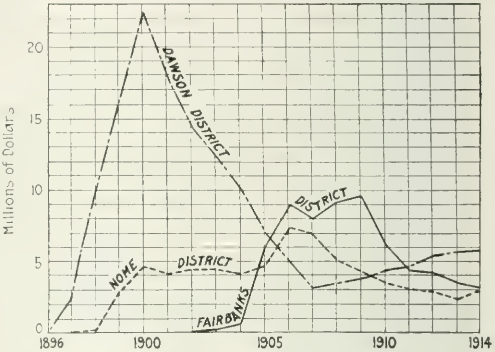


Fig. 1. Gold Production by Years

Dawson and Nome having demonstrated, more or less conclusively, their ability to "come back" by substituting mechanical handling of gravel for pick-and-shovel methods, it remains to consider the outlook for the future at Fairbanks. Since the character and situation of the gold-bearing deposits determine the possibility of mechanical methods, it seems desirable to describe briefly the occurrence of the auriferous gravels in the three districts.

Features of the Dawson Deposits

The most prominent features of the Dawson deposits are due to the fact that the present drainage has cut deeply through gold-bearing gravel beds formed by ancient streams flowing at a higher elevation. Terrace deposits lying well above the present drainage are therefore well developed, as illustrated at Fig. 2, showing the famous White Channel quartz drift, carrying workable quantities of gold in places, and a later, barren, deposit of upper flat gravel. There are also smaller auriferous terrace deposits, or "bench gravels," lying between the White Channel and the present drainage level. The gravel in the present

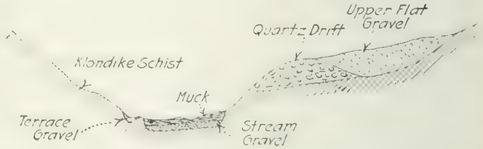


Fig. 2. Generalized Cross-Section of Bonanza Valley below Eldorado Forks

stream beds is, to a great extent, a reconcentration of the products of primary concentration by the ancient river system. They are—or were before being gutted by the pioneer—astonishingly rich, pans of $500 or more being too common to cause comment. Largely owing to lack of grade, the stream-gravels offer a better opportunity for the dredge than for the giant, especially in the case of the larger rivers, such as the Klondike, where dredging is the only possible method of attack. Although the richest portions of the creeks have been worked out by crude hand methods, there is enough gold left to make excavating by mechanical means a highly profitable enterprise.

One feature that has helped the dredge and the giant is the large amount of clay or "sediment" in the paystreaks, which prevented a thorough washing with the appliances formerly in use. This clay not only carried over the gold it originally contained, but it had a disgusting tendency to gather more in rolling down the sluice-boxes, thus "robbing the boxes," as the miners express it. Having been exposed to air, rain and frost for several years in old tailing piles, the clay now readily yields its precious metal to machines equipped with modern gold-saving devices.

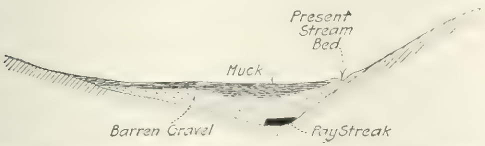


Fig. 3. Section across Valley of Creek at Fairbanks

Terrace deposits, the "happy hunting ground" of the hydraulic man, are not developed to the extent on Seward Peninsula that they are at Dawson. Much of the production of the district has come from the ancient beach placers, which are, in a way, a sort of terrace deposit themselves. Fig. 4 shows a cross-section of the various beaches and also the production of each up to 1911. Unfortunately, detailed figures of production are not available for the last few years, but since 85% of the production of Seward Peninsula was made previous to 1911, those given show clearly the relative importance of the various beach lines.

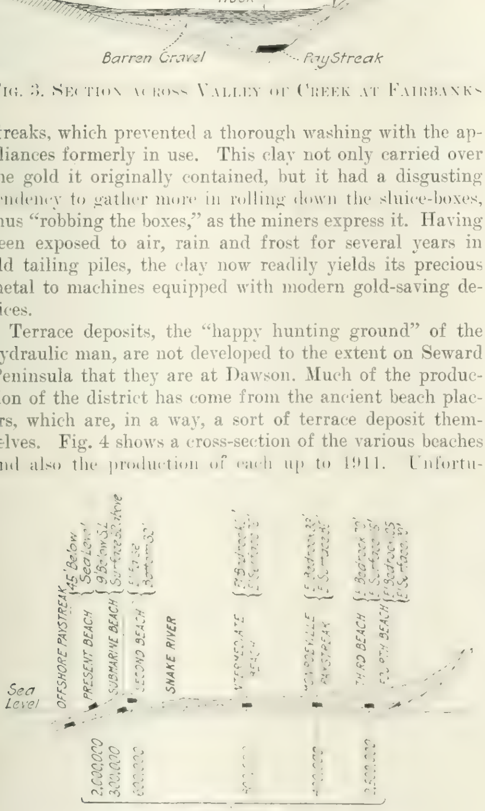


Fig. 4. Section of Beaches at Nome
(After T. M. Gibson)

It is evident from Fig. 4 that the beach deposits themselves offer little opportunity for dredging or hydraulicking, and their influence on the yield of the peninsula is decreasing each year. Of the forty-odd dredges on Seward Peninsula, only 11 are in the Nome district proper, the others being in the Council, Solomon, Teller, Inmachuck, Candle and Kougarok districts. It is estimated that 60% of the total output in 1914 came from dredging operations, chiefly on the placers of the present streams. Many of these are not over 6 to 10 ft. deep and carry gold throughout, so they are a favorable field for small dredges.

Working Systems on the Creeks

A section representative of the Fairbanks district is shown in Fig. 3. The pay gravels are buried deeply beneath an overburden of muck and barren gravel. The proportion of gold-bearing gravel to the total amount is comparatively insignificant. The depth of worthless overburden varies from a few feet near the source on some of the streams to more than 200 ft. in places on Vault Creek. It is difficult to arrive at the average depth to bedrock, but it is probably not less than 50 or 60 ft. Since the "pay" is concentrated in the lower 5 ft., and in a comparatively narrow channel at that, it is evident that the ground, being permanently frozen, can be mined much more cheaply by the present method of drifting than by dredging. Owing to lack of gradient and the difficulty of obtaining a dependable supply of water, hydraulicking is obviously not to be considered.

On a few creeks, such as upper Goldstream and its tributaries, upper Cleary, and upper Fairbanks Creek, there is considerable ground shallow enough to be worked by opencut; that is, it is cheaper to remove the barren overburden than it is to "drift out" the paystreak. Much of this ground is now being mined on a comparatively large scale by means of power scrapers. A small dredge was installed on No. 8 Above, Fairbanks Creek, several years ago, but it has never been regarded as a commercial success. The dredge was recently placed under the direction of a competent engineer, however, and made a profit in 1914.

The large areas of low-grade ground on Goldstream and its headwater tributaries could probably be dredged at a profit were it possible to purchase the claims from the owners at a reasonable figure, but the disposition to play the outside capitalist for a good thing leads to the belief that most of this ground will be worked piecemeal by scraping.

The total area of shallow ground is insignificant, however, compared with the area where the depth to bedrock precludes the feasibility of dredging. The main dependence of the district always has been and always will be on drift-mining methods, whereby a vertical shaft is sunk to bedrock through the barren overburden and the pay-gravel removed by horizontal stoping. If the material lying above the paystreak carried even a small amount of gold it might be profitable to install a dredge and mine the whole deposit, but the sorting action of the streams has been so thorough that this gravel is practically barren. In opencut mining, where the top gravel must be removed anyway, it is more economical to scrape it to one side than to sluice it.

The difference in occurrence of the gold in the three districts is brought out in Fig. 5. *A* is a section on Eldorado Creek where the width of the deposit, from rim rock to rimrock, is 80 ft. and the depth 24 ft. The muck layer is thin, while all the gravel carries gold in paying quantities—$1 to the pan being about $135 to the cubic yard[2]. Section *B* is representative of the Nome beaches. The greatest proportion of gold is concentrated on bedrock, but all the gravel carries important quantities.

Section *C* shows conditions at Fairbanks, with large quantities of muck and barren gravel above a thin paystreak. As noted, there are some shallow deposits, but they are much less extensive than the deeper ones.

Future of Lode Mining

It was hoped for a time that the lode mines would be able to maintain the prosperity of the region adjacent to Fairbanks. Although these mines have made considerable progress and have produced nearly $1,000,000 to date, this hope has now been largely abandoned, and it is recognized that the salvation of the district depends on reducing the cost of drift-mining. It is evident from a close study of local conditions that the lowest possible limit of working costs under present conditions has just about been reached by some of the more enterprising operators. Wood is becoming more expensive each year as the available supply is diminished and it becomes necessary to go farther and farther afield, the present cost being $15 per cord at many of the mines. Machinery cannot well be sold for much less than it is now, while provisions of all kinds have risen sharply in price during the past two years. The modification of some type of air drill for point driving bids fair to result in greater economy in the matter of thawing, but this innovation means an increased outlay for equipment and will not find immediate favor with many of the smaller operators.

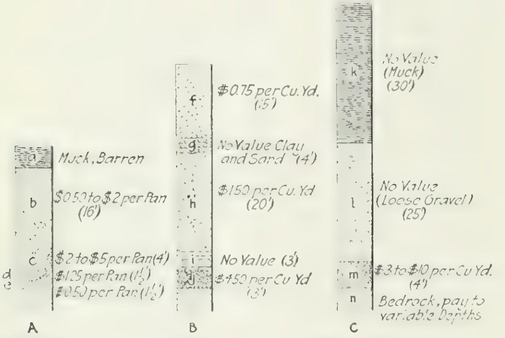


Fig. 5. Typical Vertical Sections of Placers

One of the most unsatisfactory features at Fairbanks, from the standpoint of the operator, is the high rate of royalty demanded by the claim-owner. This varies from 10 to 30% of the gross output and is rarely under 15%. The same attitude has been carried over into lode mining, many leases on the most insignificant prospects calling for a royalty of 20 or 25%, and that is one reason why the industry has not progressed as satisfactorily as could be wished.

Promised Change through Railway Bill

The outlook at Fairbanks was gloomy until Congress passed the Alaska railway bill early in 1914, but there is now every reason to believe that the cost of mining will be greatly reduced as soon as the railway is placed in operation. It will be several years, however, before the benefits of the road are available, and meanwhile the output will undoubtedly show a further decrease.

The reduction of costs through the influence of the railway will come about in several ways. Living expenses will be less, partly because of lower freight rates and partly because it will no longer be necessary for the merchants to carry such large stocks to last them through the closed season. With the decreased cost of living and the greater ease of getting in and out of the district, wages should be much lower than the present figure, which is about $7.25 per day of 10 hr. for unskilled labor and more in proportion for skilled. Power costs should be cut to a fraction of the present figure. Even if a central electric plant is built it is doubtful if current will meet with an immediate large demand, but a great saving will undoubtedly be effected by substituting coal for wood as fuel for generating steam. Steam must be generated in any case to thaw the frozen ground in drift mining, and since the quantity required for this purpose is many times greater than that required for hoisting, it will be more satisfactory to use the steam hoist than to change to electric winding. For opencut mining and for pumping water for sluicing, however, the advantage may lie with electric power, but this will be influenced by other factors than actual power costs, since the operators are more familiar with steam power and place more confidence in it.

The railway is also expected to have an important influence upon capital seeking investment. Owing to the inaccessibility of the district it has been so expensive in the past to send in high-priced engineers to make even a preliminary report that capital has confined its attention largely to the coast of Alaska and the interior has been left to its own resources. It is to be hoped that the future will see an improvement in this respect.

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Scandinavian Mining and Metallurgical Notes

Special Correspondence

In the recent Norwegian State budget the gross revenue from the Kongsberg silver mines is put at $192,500, which with interest of $48,610 on the drift fund gives a total income of $241,110. The working costs are placed at $201,805, including $2775 for a side line to the new railway station at Saggraenden. The manager says that the whole of the new development and construction work for which appropriations have been made during recent years will be completed in the autumn of 1915, when the whole of the mines will be regularly operated for an annual output of about 11,000 kg. For the last five years the average output was about 8230 kg., and for the prior five years about 7188 kg. The value of the silver is reckoned at 62 kroner per kg. The department points out that the rate of payment for silver used in the expired portion of the budget period had been lower than at any time for many years. Shortly after the outbreak of the war it went up, but had since steadily fallen, and was now between 22d. and 23d. per standard ounce. The budget figure at the par rate of the pound sterling is equivalent to a little over 59 kroner per kg., but at the present rate it is 63 per kg.

Fr. Kittelsen, of Stavanger, Norway, who recently left for New York in the "Bergensfjord," is stated to have purchased a parcel of aluminum in America valued at $278,000. This purchase is attributed to the closing of the German market.

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[2] Five pans are usually assumed to be a cubic foot of gravel in place, though as high as seven pans to the cubic foot is used as the factor at Fairbanks, in which case a pan is equivalent to a heaping shovelful with a No. 2 round-pointed shovel.

The total output of the Loekken pyrite mines, near Trondhjem, Norway, in 1913 was 124,182 tons of dressed and sorted ore. There was 129,660 tons shipped.

As regards the Meraker Smelteverk at Kopperaaen, in the province of Novdre Trondhjem, which has paid a dividend of 400% for two years in succession, it appears that the company was formed in 1906, and includes on the directorate A. E. Barton, chairman of the Alby company, Odda. The share capital is $13,750 in 50 shares of $275 per share, of which 49 are owned by the Alby company. The smeltery produces carbide, ferrochrome, ferromanganese-silicon and ferronickel.

Spitzbergen coal sells for 6.80 rubles per ton in Archangel, as against 15 rubles per ton for Newcastle coal in the same market. From this it may be gathered that Russian interests are very sanguine as to the future of their deposits on the island. An analysis of Spitzbergen coal gives the following results: Coke (free of ash), 64.58%; water, 1.55%; volatile, 33.89%; sulphur, 1.75%; and ash, 1.57%.

The Christiania "Aftenposten" remarks: "One hears so often about the copper famine in Germany, and that the government seizes copper kettles and similar houseware. In the meanwhile we have been told that in spite of the German prohibited copper exports there have, in the course of the last three months, been delivered to one Christiania firm alone goods weighing nearly 100 tons. We also know that a firm using copper as a raw material for its manufactures had in the middle of December a reserve of several thousand tons." The "Stockholms Blad" considers England's sulphur and pyrites embargo as being directed solely at the Swedish paper and pulp industry, as Germany can, unhindered, get her requirements by rail from Italy. The paper asks if it is England's intention to check Swedish industry to the advantage of Canada.

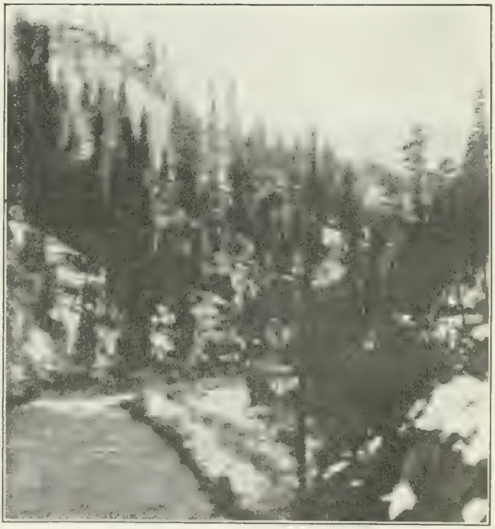
The Sulitjelma Pyrites & Copper Co., a Swedish company, has petitioned the Norwegian Government for permission to form a Norwegian company with the object of establishing, near the Christiania Fjord, before the end of 1915, a copper-extraction works to handle at least 30,000 tons of ores annually. It is proposed that Norwegian citizens shall have the first right to subscribing half the share capital. Director Holm Holmsen of the Sulitjelma Bolaget states that whereas there were originally only from 20 to 30 persons, there now dwell in the camp some 3500. The number of workmen is 1750, at an average daily wage of 5.04 kroner. Extensive development work and the establishment of the most modern plant are in hand, and he estimates that from 1916 the capacity of the works will have been increased by one-third, or corresponding to an output of 6000 tons of copper. Taxes during the last 20 years had increased abnormally. A sum of over 2,000,000 kroner had been paid in taxes, as against 2,880,000 kroner in profits, and the average profit for the whole period was only 2.953%. The share capital, formerly 3,000,000 kroner, was now 7,000,000 kroner. In wages the company had paid out 30,000,000 kroner, in commune tax 700,000 kroner, and in state taxes 500,000 kroner. Working conditions in this northern, sterile region were phenomenally severe. At times the snow lay 12 m. in depth, and ice formed on the lakes one meter thick. The present intention, however, is to keep up the traffic all the year round by means of a 600-hp. icebreaker. Of ore there was any amount, though it required a generation to establish an industry of that magnitude so far north. Things were looking bright, but new difficulties were being anticipated—namely, the labor question and the proposed factory inspection laws, with curtailment of working hours. The mines and camp of Sulitjelma, it should be mentioned, are situated in Norway, close to the Swedish border.

The Norwegian government has prohibited the export of nickel, unwrought, except that produced by Norwegian works and accompanied with certificate of origin. The prohibit, which dates from Jan. 5, also includes nickel ores.

Ski Travel in California

By W. H. Wright*

It's a long, long way to that dear railway, was the unconscious paraphrase of a recent popular song that frequently recurred to me as I slipped and stumbled, with a 30-lb. pack, 16 miles through the snow from Butt Valley to the railroad at Belden, Calif. The only really unpleasant feature of the trip was the long time required to make it, 15 hours.



On the Belden Trail

I had been engaged in placer examination in Plumas County during the summer and it was desirable to work as long as possible. The weather had been exceptionally fine all fall, but it so happened that it was necessary to go to San Francisco just as the first storm of the season came, about the beginning of December. It was an unusually heavy storm for that time of the year. Roads were blocked over night and stage lines were put out of commission for a short time. Many people were caught without sufficient supplies for the winter. The heavy snows do not usually begin until after Christmas, but when they do begin it is almost impossible to move about the country except on snowshoes. The district is not densely enough populated for ordinary travel to keep even the main roads open, and many a stockman has had cattle perish by being snowbound, and many miners have had to go through the winter short of provisions, or move to where supplies could be had. The great difference between the snow of the Sierras and snow as it is generally known elsewhere is that the former is very wet and heavy, while at the same time one storm may bring a depth of several feet. Again, a cold spell usually comes after a storm and forms a thick crust that will sometimes support a man, but not a horse, and will cut a horse's legs to ribbons unless they are protected. I know of one instance where a stage, having brought in mail and passengers on the bare ground one evening, was unable to get out the next day and was forced to lay up for six weeks. Over night 4 ft. of snow had fallen.

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Ski Tracks in the Forest Reserves

More than 3 ft. of snow fell at Butt Valley on the first night of the storm, blocking the stage line to Keddie, so it was decided to go out by the way of Belden on skis. The first two miles of the road leads through a fine growth of timber up over a spur overlooking the north fork of Feather River at a height of 1200 ft. above it and at an altitude of about 1500 ft. It took four hours to accomplish this stretch, and it was done with great effort. The weather was warm enough to cause one's clothes to become saturated with perspiration while traveling, and at the same time one could not rest for any length of time without becoming chilled to the bone. As the snow was soft, causing the skis to sink, and the grade high, only about a hundred yards could be made between rests.

This piece of road passes through a part of the Forest Reserve containing some fine specimens of sugar pine, yellow pine, Douglas fir, cedar and the less valuable white fir. Some of these trees are 5 and 6 ft. in diameter and rise to a height of about 200 ft. The forest covered with newly fallen snow forms an attractive picture, portions of which the accompanying illustrations fairly reproduce.

Reaching the summit of the grade, two miles from Butt Valley, the trail then leads downhill to Caribou, a further distance of five miles; but several pitches of considerable length made traveling slow, and the soft, sticky snow would not permit coasting. At Caribou the amount of snow rapidly decreased, and from there to Belden, a distance of nine miles, the trail along the cliffs above the river was bare in spots, although the footing was very bad and progress was about half that which could be made on dry ground. The skis had been left behind at Caribou. The rapidity with which one may obtain a change of climate in California is illustrated by the fact that at Oroville, 60 miles by rail southwest from Belden and at 2100 ft. lower elevation, the harvest of the orange and olive crops was in full swing.

A Keystone Drill Working in the Snow

Owing to the fine hospitality of the miners whose cabins are scattered along the river, the question of food caused no trouble.

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Conclusiveness of Mining Patent

By A. L. H. Street*

The rule of law that where the validity of a patent covering a mining claim has not been impeached in a direct proceeding brought for that purpose it is conclusive evidence of the existence of a discovery vein in the claim, that the land was properly located, and that all preliminary and precedent acts necessary to authorize issuance of a patent have been performed in the manner required by law, including a requirement that the boundaries of the claim to be so marked on the ground as to embrace not exceeding 300 ft. on each side of the middle of the vein and not exceeding 1500 ft. in length along the vein, is recognized by the United States Circuit Court of Appeals for the Ninth Circuit, in the recent case of Stewart Mining Co. vs. Bourne, 218 *Federal Reporter* 327.

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*Attorney, St. Paul, Minn.

Electromagnetic Ore Separation

By L. C. Clark*

SYNOPSIS—Electromagnetic ore separation depends upon differences in magnetic permeability. All known substances are either paramagnetic or diamagnetic, the great majority being diamagnetic. The chemical composition of minerals may occasionally serve as a guide to their magnetic properties. Many types of magnetic separators are in use, most of them using electromagnets. The type of separator to be used in any particular case depends upon the class of minerals treated. The separation of magnetite from gangue material and impurities is the most extensive branch of the process, and forms an important industry in the Eastern part of the United States and in several European countries.

Electromagnetic ore separation depends upon the principles of electromagnetism and the magnetic properties of minerals. All known substances are either attracted or repelled by a magnet. This attraction or repulsion depends upon the substance itself, the surrounding medium, the intensity of the magnetic field and the time the substance is subjected to it. The atmosphere has a definite magnetic permeability, and since it is the most common of all media, its permeability is assumed to be unity. The relative permeabilities of all other substances are determined by comparison with air. The great majority of substances are diamagnetics, though their magnetic repulsion is much less than the attraction of paramagnetics. Bismuth, the most diamagnetic substance known, has a permeability of —0.9998, while the permeability of iron may be more than 2000. The principal metals, divided into paramagnetics and diamagnetics, are as follows:

Paramagnetics—Iron, nickel, cobalt, manganese, chromium, cerium, titanium, palladium, platinum, osmium and certain alloys of the metals manganese, aluminum and copper.

Diamagnetics—Bismuth, antimony, zinc, tin, cadmium, mercury, lead, silver, copper, gold, sulphur, arsenic, uranium, rhodium, iridium and tungsten.

The magnetic properties of a metal vary considerably with the thermal treatment it has received. However, most metals may be heated to a temperature of several hundred degrees Centigrade (iron 650°) without greatly affecting their magnetic properties.

Action of Magnetic Flux

In a magnetic circuit all lines of force will follow the path of least resistance. In other words, the magnetic flux will pass through the most permeable substance at hand. Thus the magnetic lines of force are concentrated through paramagnetic substances and separated by diamagnetic substances. When paramagnetics are acted upon by a magnetic flux, they tend to align themselves in a direction parallel to the lines of force. The concentration of magnetic lines of force through paramagnetics induces magnetic polarity in them, causing the particles to arrange themselves in little bunches, north pole to south pole, etc. This is a common phenomenon in the magnetic separation of finely crushed minerals, such as pyrrhotite from blende.

Magnetic Properties of Minerals

Nearly all minerals are paramagnetic, but only a limited number are sufficiently so for commercial purposes. Paramagnetics are divided into strongly magnetic or ferromagnetic minerals and feebly magnetic minerals. The ferromagnetic minerals are magnetite, pyrrhotite, ilmenite, chromite, and franklinite; most remaining minerals are feebly magnetic. As yet no satisfactory method has been found to determine the specific magnetic permeabilities of minerals. The same mineral from different localities varies greatly in its magnetic properties, and no numerical factor could be of general use. The relative permeabilities of minerals can only be obtained by exhaustive tests under the influence of a magnetic field. Results from a large number of tests should be compared before any deductions are made. One or two tests might be inaccurately performed and misleading results obtained.

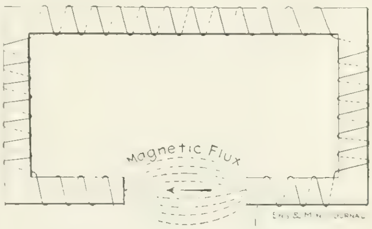

Fig. 1. Diagram of Magnet

The chemical composition of a mineral by no means determines its magnetic properties, though in some cases it may serve as a guide to them. Nearly all minerals separated by magnetic attraction receive their permeabilities from greater or less amounts of combined iron. Some ferrous minerals are sufficiently paramagnetic for such a separation, but their number is small. Oxygen is paramagnetic, while sulphur is diamagnetic. The metallic oxides are, therefore, more apt to be magnetic than their corresponding sulphides. Oxides are also more magnetic than carbonates. Iron pyrite contains nearly 47% metallic iron, the most magnetic of all known substances, and yet no magnetic field of sufficient intensity has ever been produced which will commercially attract this mineral. On the other hand, the bromide of copper, composed of two diamagnetic substances, is decidedly paramagnetic. Nonmagnetic sulphides and carbonates are frequently converted into magnetic oxides by roasting. In the examination of minerals for magnetic properties, a test should be made both before and after either an oxidizing or a reducing roast, and the results compared. Blende containing small amounts of combined iron is slightly magnetic and has been separated from marcasite and pyrite by direct magnetization. However, in most cases an oxidizing roast would materially aid in the magnetic separation of such minerals. Pyrite would thus be converted into the strongly magnetic oxide (Fe_3O_4) or sulphide (Fe_7S_8), and be much more susceptible to the magnetic field than the feebly magnetic blende or blackjack.

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ELECTROMAGNETIC SEPARATORS

The electromagnetic process employs a large variety of separators, differing widely in principle and in mechanical construction, each type being adapted for certain classes of work.

Two types of magnets have been used in magnetic separators: permanent and electromagnets. The first type has such a limited field of application in commercial magnetic ore separation that it is practically negligible. Electromagnets in the main consist of a soft iron or steel core, wound with one or more layers of fine, insulated, copper wire, through which an electric current is passed. Such a magnet is illustrated here diagrammatically.

Electromagnets all have north and south poles which may be interchanged by reversing the direction of the flow of current. A direct current is invariably used to excite an electromagnetic field. Electromagnets vary in strength according to the size of the magnet and the number of ampere-turns in the magnetic coil. The ampere-turns are obtained by multiplying the amperes of current passing through the magnetic coil by the number of turns the coil makes about the core. The size of the magnet and the number of turns remaining constant, the intensity of the magnetic field varies with the strength of the exciting current. Electromagnetic separators may have their magnetic poles which perform the separation directly energized by the exciting coils themselves, or energized by induction from the primary poles in whose magnetic field they lie.

In order to accomplish their work satisfactorily electromagnetic separators must fulfill the following conditions:

(1) The mixture of feed minerals must be properly presented to the magnetic field. (2) The magnetic particles in these minerals must be attracted by a uniform magnetic field of the proper strength. (3) The magnetic particles thus attracted must be removed from the magnetic field and promptly discharged from the separator. (4) The remaining nonmagnetic particles must be promptly discharged from the separator.

ATTRACTION OF MINERALS

Much importance is attached to the manner of presenting the mineral particles to the magnetic field. Theoretically they should be only one layer deep when subjected to the field action. This will insure the minimum amount of mechanical entrainment during the attraction of the magnetic particles, leaving all the nonmagnetic particles behind. If the layer of feed minerals presented to the machine were several particles deep, the attraction of the magnetic particles (especially in an intense field) might cause considerable amounts of the nonmagnetic minerals to be carried away with them. Some magnetic particles might also remain behind, buried beneath nonmagnetic particles. A one-particle layer of feed minerals is practically never feasible, but the layer must be sufficiently thin that the minimum mechanical entrainment of nonmagnetic particles with the maximum mechanical efficiency will result. The proper thickness of the feed layer as well as the amount of sizing required can only be satisfactorily determined by experience. The separation of magnetite, perhaps, offers a single exception to this rule. Such material is in some cases fed directly to the first separation step from a 2-in. crusher, undergoing no sizing whatever. These ores can be handled in this manner only because magnetite has a high magnetic permeability and is not always intimately mixed with the gangue material. The magnetite generally occurs in the gangue in lumps, and fine crushing is not necessary for its separation. Intimately combined minerals will require fine crushing and frequently careful sizing before magnetic separation. A thin feed-layer is also required in the treatment of such minerals. In the separation of unsized material the same effect of mechanical entrainment is noticed as with a thick feed layer.

FEEDING DEVICES

Several methods are employed in presenting the feed minerals to the magnetic field, four of which are as follows:

The ore, fed vertically on the machine, is carried through by specific gravity and subjected to the action of one or more electromagnets during its downward course. The Edison bar-magnet machine is a good example of this class, somewhat resembling the Huff electrostatic separator. The Mechernich separator also falls under this subdivision.

The ore, spread in a thin, uniform layer over the surface of a traveling belt or shaking table, is subjected to an upward pull by the magnets during its progress through the separator. The Dings, the Wetherill Type E, and the Cleveland-Knowles are examples of this type.

The ore, fed upon a revolving drum, is subjected to a magnetic field produced either by magnets within the drum or between which the drum revolves. Examples of this class are the International, Ball-Norton, Heberle, and some forms of the Gröndal separator.

The ore, spread over a conical, revolving table, is subjected to a magnetic field produced by magnets beneath all but a small section of the table. Air or water jets clear the table of nonmagnetic particles above the magnets while the magnetic particles are forced off at that sector having no magnetic attraction. The Froeding separator represents this type of machine.

MAGNETIC FIELD

The magnetic field to which the mineral particles are subjected, once being regulated, should be kept uniformly at the proper intensity. If too weak, considerable amounts of the magnetic minerals will pass off with the tailings product. If too strong, the intense action will cause some nonmagnetic particles to be mechanically carried over with the magnetic concentrates. If the magnetic field fluctuates in intensity, both products will vary with the strength of the field, a poor separation resulting.

REMOVAL OF PRODUCTS

All products from magnetic separators should be removed as simply and expeditiously as possible. Many devices are used to remove the magnetic particles from the magnetic field. Scrapers and brushes are employed to scrape them from the magnets and centrifugal force is used in the cylindrical-type machines. A change of magnetic polarity, jets of water, or an air blast are also effective means of accomplishing this purpose. The nonmagnetic minerals may pass through the machines by gravity and fall into bins placed beneath. They are also discharged at the end of a shaking table or traveling belt, or forced from the machine by means of air or water jets.

A large number of separators are on the market, but a wise choice will be made between a dozen or so standard makes. Obviously a very different type of machine is required to separate coarsely crushed magnetite from a gneiss gangue than finely ground blackjack from pyrite. In the first case a machine of rugged construction and low intensity field is required; in the second case a more delicately constructed machine with high-intensity field will be necessary. Before erecting a plant or purchasing the machines, tests should be made on the ore with several suitable types of separators.

MINERALS AMENABLE TO MAGNETIC SEPARATION

The process of electromagnetic separation is adapted to numerous types of minerals. The most important application of the process is, perhaps, the separation of magnetite from gangue minerals, with the separation of roasted pyrite and siderite from blende a close second. A partial list of other applications of the electro-magnetic process is as follows:

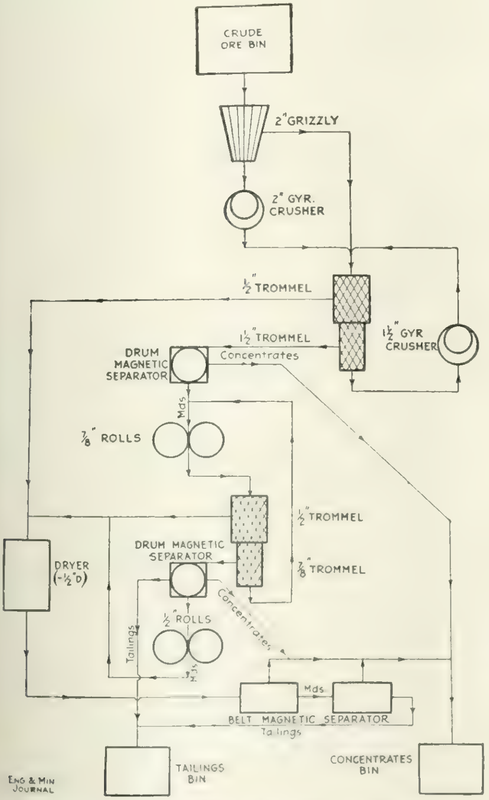

FIG. 2. ELECTROMAGNETIC SEPARATOR FLOW SHEET FOR MAGNETIC ORES

The separation of roasted chalcopyrite from garnet and epidote; pyrrhotite and roasted chalcopyrite from a quartz- and mica-schist gangue; roasted copper, iron and nickel sulphides; roasted chalcopyrite from blende; pyrrhotite and magnetite from galena; argentiferous pyrrhotite from garnet and quartz; roasted limonite from smithsonite and calamine; pyrolusite from quartz gangue; franklinite, fowlerite, tephroite, and garnet from willemite, zincite, quartz, mica and calcite (Franklin Furnace, N. J.); roasted wolframite from cassiterite; monazite from silicious gangue; leucite from lava; magnetite from corundum; magnetite, menaccanite, chromite, and pyrrhotite from diamond bearing concentrates; magnetic galena (probably iron bearing) from zinc ore and gangue; blackjack from pyrite; hematite from gangue minerals and others.

Magnetite, with a specific gravity of slightly more than five, has been successfully concentrated from its ores by specific-gravity methods. But a large number of these iron ores contain impurities which materially decrease their value for use in the blast furnaces. The chief impurities are apatite ($3\ Ca_3P_2O_5 + CaCl_2$), pyrite (FeS_2), pyrrhotite (Fe_7S_8), and menaccanite or ilmenite ($(FeTi)_2O_3$). Specific-gravity methods are of little value in the separation of magnetite from these minerals, on account of their similarities in this property. Electromagnetic separators are almost universally used when treating a magnetite ore containing such impurities.

Several methods have been used in the electromagnetic separation of magnetite ores. In this country the principal magnetite deposits worked at present are in New York and New Jersey. Here the ore is rather coarse-grained and the magnetite crystals are not usually intimately associated with the gangue. These ores are, therefore, adapted to electromagnetic separation with very little fine grinding. In Sweden, however, the minerals composing many of the magnetite ores are in much finer state of subdivision. Finer grinding is required in the separation of them, the magnetic concentrates being dried and briquetted in preparation for the blast furnace.

MINEVILLE DISTRICT, N. Y.

Some of the largest magnetic mills in the world are in the Mineville district, N. Y. Several classes of ores are treated, varying in iron content from 35 to 69%, and in phosphorous up to 3%. Some of the crude ore is of shipping grade, but most of it is treated in one of the magnetic separating mills. The ores contain granular masses of magnetite, which is of Bessemer grade in the Barton Hill orebody, but high in phosphorous in the Old Red series. The lean ores are mixed with minerals from the wall rock, chiefly the basic syenite. Where the magnetite occurs in coarse crystals or lumps free from impurities it is treated directly by cobbing. But where the magnetite and apatite crystals are small and intimately associated, fine crushing is necessary before separation. Concentrates from the cobbing machines contain about 65% metallic iron. Tailings from these machines are dried, recrushed and run over a second series of magnetic separators. The tailings from these last machines are reground and retreated on finisher machines. The final concentrates average considerably more than 60% iron and the final tailings are relatively high in phosphorous. There is often sufficient phosphorous, in the form of apatite, in the tailings to be chemically treated, converting the phosphorous into a soluble form which is extensively used as a fertilizer.

Mount Hope, N. J.

These are rich magnetite deposits in the Mine Hill belt near Wharton, N. J. Much ore of high shipping grade has been taken from these mines, but at present most of it requires concentration before shipment. At Mount Hope a magnetite plant capable of treating 600 tons of crude ore daily has been in successful operation for a number of years. The mill heads average about 35% iron, with considerable amounts of phosphorous and titanium. The gangue is a gneiss rock consisting chiefly of quartz, orthoclase, albite and anorthite. The shrinkage system of mining is practiced, and considerable wall rock is mixed with the ore in the stopes. The ore is crushed and sized, the large size being run through a cobbing machine which makes concentrates and tailings. The tailings are retreated over a second Ball-Norton drum separator, which makes final tails and concentrates. The small size from the first trommels is dried and concentrated on Ball-Norton belt separators. About half of the final products is tails and half concentrated magnetite. The concentrates averaged over 60% metallic iron, with some titanium and phosphorous as impurities. The tailings consist of sized, crushed rock, and are utilized for concrete construction work, top dressing for the state highways, and as filler for drawn stopes.

Separation of Magnetite from Impurities

When pyrite occurs as an impurity in magnetite a clean magnetic separation can generally be made. No magnetic field of commercial intensity has yet been produced which will appreciably attract pyrite; magnetite, on the other hand, is readily attracted by even a weak magnetic field. Pyrrhotite is a ferromagnetic mineral, and difficulty has been experienced in separating it from magnetite. A partial magnetic separation of these minerals has been attempted, but the results are generally unsatisfactory. The best practice in most cases is to pull off both magnetite and pyrrhotite as magnetic concentrates, which are then given an oxidizing roast to eliminate their sulphur contents. Experiments have been made on the magnetic separation of magnetite from ilmenite, but so far they have been largely unsuccessful. Since ilmenite is somewhat less magnetic than magnetite, a fractional separation of the two minerals can be made, but only at the expense of high iron loss in the tailings.

When magnetite and apatite crystals are intimately associated the ore must be finely ground before separation. Large deposits of such ores are found in some parts of Sweden. Apatite is an exceedingly brittle mineral which crushes easily to a fine powder, forming a coating over the magnetite crystals. Considerable amounts of phosphorous may be carried over into the magnetite concentrates in this manner. These concentrates should be cleaned by blowing this dust with an air blast or washing with jets of water. Such ores are usually ground so that 80 or 90% will pass through a ⅛-in. opening. The concentration is carried on entirely under water, magnetic slime separators being used. By this procedure the concentrates are washed free from the powdered apatite and no dust is given off into the surrounding atmosphere. The concentrates are dried and briquetted before shipment to the blast furnaces.

A typical flow sheet of a magnetic concentration, treating magnetite ore with gneiss gangue, is represented by Fig. 2. These flow sheets vary considerably with each type of ore treated, but the general principles of separation always remain the same.

Separation of Blende from Pyrite

The magnetic separation of zinc blende from iron pyrite is, perhaps, second in importance to the separation of magnetite from its impurities. This process has found extensive application in Missouri, Wisconsin, Colorado, Utah, British Columbia, and in several European countries. Ores containing blende or blackjack and pyrite free from gangue minerals have been separated directly by this method. Ores containing galena, blende and pyrite, together with gangue minerals, are also adapted for electromagnetic separation. In the latter case electro-magnetic separators usually follow wet concentration where galena-pyrite concentrates, blende-pyrite middlings, and tailings are made. Here the pyrite acts as a separating medium between the galena and blende, possessing an intermediate specific gravity. Galena has a specific gravity of 7.5, pyrite of 5.0 and blende of 4.0. A clean separation can be made between galena and blende, particularly in the presence of pyrite. The slight difference in specific gravities between pyrite and blende makes their separation practically impossible by ordinary wet methods. Consequently these blende-pyrite middlings are generally re-treated by some other method whereby commercial products may be obtained. Pyrite free from zinc, when it contains gold and silver, is readily salable to the lead smelter. A severe penalty is imposed upon pyrite containing more than 5 or 10% zinc, so freedom from this metal is essential. Blende containing little or no iron is also demanded by the zinc smelter. The iron content in blende above 5 or 10% is heavily penalized, so that only small amounts can be present to bring a good price. In some ores the gold and silver values lie chiefly with the pyrite, and the zinc smelter pays little or nothing for these metals. The saving in precious metals alone in such ores might easily pay for the cost of electromagnetic separation. When the minerals are pre-roasted to make the pyrite magnetic, the 15 or 20% sulphur reduction in the pyrite greatly increases its value to the lead smelter.

Electromagnetic vs. Electrostatic Separation

In the separation of blende-pyrite middlings the electromagnetic process has a close competitor in the electrostatic process. The method of treatment which will give better results in the long run can only be determined by exhaustive tests on a commercial scale. When the ore contains considerable amounts of gold and silver, their behavior alone may decide the question. That process which recovers the large percentage of gold and silver with the pyrite will be the one best adapted to such an ore. In many ores other considerations far outweigh the importance of gold and silver value. The Wisconsin and Missouri zinc ores usually carry less than 0.5% of combined iron in the blende. On the other hand, Colorado and Utah blendes may have as much as 15% of iron chemically combined with them. Such iron-bearing blendes are commonly known as blackjack, and are both slightly magnetic and fair conductors of electricity. When blackjack is to be separated from pyrite, both the electromagnetic and electrostatic processes present considerable difficulties. In either case the pyrite product will contain large amounts of combined zinc, and the blende product will contain large amounts of combined iron. There may be as much as 15% zinc in the pyrite product and 10% iron in the blende product. These impurities in both products are due primarily to the chemical combinations of zinc and iron sulphides which no degree of fine grinding will free. The metallurgical treatment of such ores is a delicate process, and considerable experience is necessary to secure a good separation. Extensive tests with both the electromagnetic and electrostatic processes should be made before the final adoption of either. One process may work admirably on some ores where the other is a failure, and *vice versa*.

SEPARATION OF MAGNETIC BLACKJACK FROM PYRITE

Blende containing small amounts of combined iron is slightly magnetic and has been separated from raw pyrite as a magnetic product. This process was tried out at Leadville, Colo., where the International separator was used. Preliminary tests on certain ores gave excellent results, and for a time the process was operated successfully on an extensive scale. But the ore supply was suddenly exhausted and the custom ores milled had a different mineralogical composition. The blende refused to be readily attracted even by an intense magnetic field, and neither the blende nor the pyrite products were satisfactory. Repairs to the separators themselves were both numerous and expensive. The teeth on the rotor soon wore smooth, thus decreasing the concentration of the magnetic flux. The brass guide plates separating the various products were also soon worn out and were expensive to replace. Experiments were soon instituted on a process which roasted the ore and separated the pyrite as a magnetic product on Cleveland-Knowles separators. This process was finally adopted and remained in successful operation for a number of years.

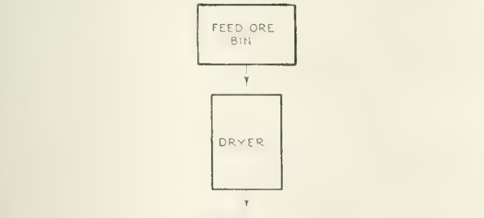

FIG. 3. ELECTROMAGNETIC SEPARATOR FLOW SHEET FOR BLENDE-PYRITE MIDDLINGS

ROASTING PYRITE FOR MAGNETISM

Roasting pyrite for magnetism is practiced in many localities, both in this country and abroad. The types of roasters used include shaft furnaces, hearth furnaces, and revolving cylindrical furnaces. The last named roaster has probably given the best results and been used in more localities than either of the others. All roasters should be constructed so that the amount of air in contact with the roasting minerals can be carefully controlled. The White-Howell furnace is a typical example of the cylindrical roaster and has been widely used in the process. These roasters have either a stationary or movable firebox at one end, and both coal and oil have been used for fuel. More external heat is required to start the roast than is necessary after the roaster has been running for some time. After the sulphur in the pyrite has once been ignited this reaction alone may furnish enough heat to carry on the operation. One firebox may be mounted on movable trucks and used to start several roasters in succession. After ignition the burning sulphur will give off sufficient heat to continue the process indefinitely. The air supply is obtained either by natural or forced draft, and is constantly under the control of the fireman.

The two strongly magnetic iron minerals are magnetite (Fe_3O_4) and pyrrhotite (FeS). These minerals are found in nature and may be made by artificial means. In roasting pyrite for magnetism one or the other of them (or both) is formed. Sulphur is first driven off at 370° C., but not until 450° is reached does all the pyrite become thoroughly magnetic. The ignition temperature of blende is 600° C. If the heat is carried much above that point some of the zinc will be oxidized to ZnO and lost by volatilization. The roast is generally carried on at a temperature just below the ignition point of blende. This insures the complete conversion of pyrite into either the magnetic oxide or sulphide. In most cases the minerals should be crushed to 10- or 20-mesh size before roasting and sometimes sizing is also necessary. If considerable difference in the size of the mineral particles exists, fine particles will be over-roasted to the nonmagnetic oxide (Fe_2O_3), before the coarse particles are completely converted into the magnetic sulphide. Usually a feed ground to 20-mesh can be successfully roasted and separated magnetically with no further sizing. Roasting for magnetism is an important and delicate operation and must be carefully performed to insure good work by the separators later. All magnetic particles of the roasted product should possess uniform magnetic permeabilities, so far as is practicable. Under-roasting will convert the fine particles into magnetic sulphide, leaving the coarse particles with only their surfaces partially oxidized. Over roasting will convert the coarse particles into the magnetic oxide but burn the fine particles to the nonmagnetic oxide. Proper roasting should convert the fine particles into the magnetic oxide and coarse particles into the magnetic sulphide with a layer of magnetite on the surface.

The proper roasting temperature is only obtained by making numerous tests on the ore. Once determined, however, no difficulty should be experienced in keeping the roast constantly at the correct temperature. The roasted minerals may be subjected to a reducing atmosphere immediately before leaving the furnace. This completely reduces any nonmagnetic oxide formed back into the black magnetic oxide.

Magnetite formed in nature is an exceedingly stable compound. It has never been known to oxidize further into hematite when exposed to atmospheric agencies at ordinary temperatures. Artificial magnetite, on the other hand, is comparatively unstable and readily oxidizes into hematite upon exposure to the air (especially in the presence of moisture) at ordinary temperatures. For this reason roasted pyrite should be cooled immediately upon leaving the furnace and run over the separators as promptly as possible. A tight steel drum revolving in a trough of running water makes a cheap and efficient cooler. This drum is fed directly from the roasters and discharges on a conveyor leading to the separators. If passed through the machines immediately after roasting the ore need not be cooled to atmospheric temperature. Tests have been made where the feed to Cleveland-Knowles machines was so hot that it blistered the conveyor belt. The resulting separation was fully as perfect as when the roasted minerals had been cooled to ordinary temperatures. The degree of cooling necessary and the amount of exposure the roasted minerals will stand before over-oxidation takes place depend entirely upon the character of the ore treated.

When blende-pyrite middlings are roasted it may be necessary to dry the feed before passing it through the roaster. Large quantities of SO_2 and SO_3 are formed by the rapid oxidation of sulphur in the furnace. In the presence of moisture sulphurous and sulphuric acids would be formed, both of which are powerful corrodents. These acids rapidly destroy any metal work with which they come in contact, but in the absence of moisture their corroding action is greatly diminished. If the moisture is expelled from the ore in the drier, where practically no oxidation takes place, the sulphur gases formed in the roaster will do little or no harm.

Flow sheets of electromagnetic mills separating roasted pyrite from blende differ widely from mills treating magnetite ores. When separating magnetite, some ores are treated as large as 2-in. size, while in blende-pyrite separation practically all the feed will pass a 10- to 20-mesh screen. Fig. 3 illustrates a typical flow sheet of a mill treating blende-pyrite middlings resulting from wet concentration. A middlings product may be made on the first separation and re-treated on middlings machines This is not always necessary, and finished products are often made with only one pass through the separator. The electromagnetic machines best adapted for this separation are the Dings, Cleveland-Knowles, and the Wetherill.

MISCELLANEOUS SEPARATIONS

Many other minerals are suitable for electromagnetic separation, and a description of each branch of the process would require a large-size volume. Siderite ($FeCO_3$) is rendered strongly magnetic by calcination, and limonite ($2\ Fe_2O_3 + 3\ H_2O$) by roasting in a reducing atmosphere. Occasionally an ore whose appearance would seem to defy any sort of separation has been treated successfully by the electromagnetic process. One such ore consisted of a mixture of partly oxidized iron and zinc sulphides containing blende, pyrite, limonite, siderite, hematite, smithsonite, zincite, and their transition minerals. This appeared to be a pretty tough proposition for magnetic separation as none of the minerals could be separated directly. It was decided to roast the ore at a temperature slightly lower than that required for a raw blende-pyrite mixture. After cooling, the roasted minerals were passed over a Dings separator, and the magnetic and nonmagnetic products made were both of commercial grade. Evidently sufficient CO was given off during the roast to reduce all Fe_2O_3 present to the magnetic oxide. The pyrite was oxidized to the magnetic sulphide and siderite, and limonite was converted into the magnetic oxide, thus rendering practically all of the iron minerals magnetic. When siderite or limonite are roasted for magnetism it may be expedient to add a little powdered coke at the end of the roast to insure a reducing atmosphere and prevent the formation of the nonmagnetic oxide. The above-cited example illustrates the possibilities of electromagnetic separation on some peculiar ores. No doubt many other similar cases exist.

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Iron and Steel in Sweden

According to the report of the Swedish Ironmasters' Association for 1914, the war resulted in a decrease in the export trade and consequently a considerable decrease in production. The abnormally dry weather and the lack of water for the works were contributory causes. The iron and steel works during the latter part of 1914 maintained production at about the level to which it was reduced by the outbreak of the war. During the period August-December there were from 63 to 66 blast furnaces in operation out of a total number of 124, and 110 to 134 Lancashire hearths out of 260. At the end of the year only 45 out of the existing 75 openhearth steel furnaces were operating, while of 24 bessemer converters only six were working.

The production figures for three years past were as follows, in metric tons:

	1912	1913	1914
Pig iron	699,800	730,300	635,100
Puddled (wrought) iron	148,800	158,500	113,300
Converter steel	107,300	115,800	93,000
Openhearth steel	404,100	469,400	407,600

During the winter months of 1914 an abundant supply of charcoal was available, though the imports of coal were obstructed and prices 50% higher on account of freight rates. The rise in coal prices was particularly felt, since the lack of water involved ironworks in a greater use of coal.

The exports showed a heavy decrease, most of which was due to the war. The foreign trade was as follows for two years past, in metric tons:

	1913	1914
Pig and scrap	194,100	167,400
Ferro and spiegel	21,400	12,200
Ingots, blooms, etc	59,700	34,800
Wire rods	38,900	27,500
Iron bars	154,800	103,000
Other iron and steel	33,700	38,100
Totals	502,600	383,000

Of the total decrease, 84,000 tons was in the five months August-December. The exports of iron ore decreased in 1914 by 1,459,000 tons.

Some Results of B., A. & P. Railway Electrification*

SYNOPSIS—The electrification of the Butte, Anaconda & Pacific Ry. was described in the JOURNAL, *Mar. 14, 1914. After months of operation, remarkable results and costs were obtained. In operating expenses, average decrease of 36.19% secured over steam operation. Ton miles hauled increased 8.77%.*

The electrification of the Butte, Anaconda & Pacific Ry. was described in the JOURNAL, Mar. 14, 1914. Since that time, however, more interesting and complete data are available concerning the cost of electrical operation and the results as compared to the steam methods previously employed. Prior to the decision to electrify the railroad, the machinery at the mines and the smeltery had mostly been electrified, and the results had been so satisfactory that the railway company investigated the advantages that might be expected from the electrification of its lines. As a result the work was done under contract with the General Electric Co. In order to understand the costs and results obtained by the new system, however, it should be understood that probably a vital consideration leading to the electrification was the rapid development and physical consolidation of a network of hydro-electric power plants in the territory tributary to the railroad. A contract for power was made with the Great Falls Power Co., which, operating under the same management and in physical connection with the system of the Montana Power Co., was enabled to guarantee an ample supply of power at all times with exceptional freedom from interruptions to service and at a reasonably low price.

POWER

The Butte substation, with which the Anaconda substation is connected by three high-tension trunk lines, receives power over five separate transmission lines from six hydro-electric stations of the following rated capacities:

Big Hole development	3,000 kw	60-ft head
Madison River development	9,000 kw	110-ft head
Canyon Ferry development	7,500 kw	35-ft head
Hauser Lake development	14,000 kw	60-ft head
Black Eagle development	3,000 kw	44-ft head
Rainbow development	21,000 kw	110-ft head
Total	57,500 kw.	

In addition, there is now under construction the Great Falls development, with a capacity of 60,000 kw. and with a 155-ft. head. All of these plants are on the Missouri River watershed, and operate with a free interchange of power. The individual plants are also provided with storage reservoirs aggregating 125,000 acre-feet of total available storage capacity. All of these reservoirs operating under one control are capable of developing from stored water alone the equivalent of about 100,000 electrical horsepower for a period of 100 days.

The advantage of purchasing electric power from this large operating system, instead of developing the required power independently, was readily apparent in the case of the Butte, Anaconda & Pacific Ry. The road was relieved of all the first cost of development and transmission of power, and of all operating expense up to the point of delivery of power to the two substations. The cost of the delivered power is less than it would have been from an independent development, because the power company is enabled to operate large generating stations at a relatively high load factor, about 75%, whereas an independent plant purely for the operation of the railway would have to operate in this case at about 30% load factor, with correspondingly high fixed and operating charges per kilowatt-hour used. The large number of generating stations and the complete network of transmission lines already developed by the power company afford ample insurance against the interruption of the railroad service due to possible failure of any part of the generating or transmitting system of the power company. The enormous flywheel effect of the motor loads connected to the power system maintain extremely steady speed and voltage under the most extreme variations of load on the railroad. While these factors should be borne in mind when considering the results and comparative costs it is also interesting to observe that the operating records amply bear out these contentions.

Tabulated results from a comparison of the delays to the passenger trains for June, 1913, under steam operation, with the same month in 1914 under electrical operation, is shown in Table 1. While the month of June was selected at random, the results are considered representative of general performances. It will be observed that under electrical operation, 2.94% more trains were operated, with a decrease of 75.66% in time lost at meeting points; 45.45% decrease in time lost because of engine failures (offset by some stoppages due to power failure), and 90.10% decrease in lost running time, with a total decrease of 75.13% in delays of all kinds. A comparison of trains and tonnage during the same periods shows that with a slight increase in the total tons of ore hauled, the average tons per train was increased from 1761 to 2378 or 35%, thus decreasing the average number of trains per day from 12.5 to 9.3, or 25.6%. A comparison of the time per trip for these trains, covering the first three days of June in 1913 and 1914, respectively, is representative of the gain in this direction to be added to the decrease in the number of trains. The average time per

TABLE I

	No. of Trains	Meeting Points, Hr.	Meeting Points, Min.	Delays on Account of Engine and Power Failure, Hr.	Delays on Account of Engine and Power Failure, Min.	Lost Running Time, Hr.	Lost Running Time, Min.	Total Delays, All Cases, Hr.	Total Delays, All Cases, Min.
Steam, 1913	272	15	49	0	44	4	13	20	46
Electric, 1914	280	3	54	0	51	0	25	5	10
Decrease	8	11	55	0	7*	3	48	15	36
Percentage of saving due to electrical operation	2.94%	75.66%		15.91%*		90.10%		75.13%	

* Increase

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*Abstract of article by J. B. Cox, in "General Electric Review."

trip during steam operation was approximately 2 hr. 25 min., while with the electric locomotive it was approximately 1 hr. 45 min., showing a decrease of 40 min., or 27.5%. The distance in this case was 21.8 miles. As a consequence, the overtime in this service between Rocker and Anaconda was decreased 73.5% and the total time 42%, resulting not only in greater economy to the railway company, but in shorter and easier hours for the crews. The changes effected in the service on the Missoula Gulch line, running between Rocker and Butte Hill yards, is particularly striking. This line is 4.5 miles long with a ruling gradient of 2.5%. Under steam operation, two complete crews with locomotives of the Mastodon type had been required to handle the service, each averaging six trips per day. In their place, a single crew with a double-unit electric locomotive performed the work successfully. From 35 to 45 loaded ore cars are taken down from Butte Hill yard to Rocker and about an equal number of empties taken up. In addition to the empties, large quantities of timber and supplies for the mines are delivered over this line.

At the time this was the first installation of 2400-volt direct-current apparatus for the operation of a railway in this country, 1500 volts being the highest previously installed for such purposes. The results have been more satisfactory than anticipated, and the development charges, due to such imperfections as usually show up during the first year of operation, have been perhaps smaller than is customary with an undertaking of like magnitude, even where standard apparatus is used. After a mileage of from 25,000 to 50,000 each the motors of the locomotives without exception were found to be in excellent condition. Small change in the personnel of the maintenance or operating departments of the railway has been made on account of the electrification and there has been no reduction in salaries or wages. An extra man with electrical experience was placed in the shops to supervise the electrical repairs to the locomotives and three linemen were retained for the maintenance of the trolley system.

Costs

With approximately 20% of the total locomotive miles operated with five steam locomotives, it was found that the cost of the latter was about 10% of the total cost of all locomotive performance. Some of the savings that apparently result from the electric operation are remarkable. From comparative figures covering operations by steam from December, 1912, through May, 1913, and electricity from December, 1913, through May, 1914, the saving from the partial substitution of electric power for coal, for instance, was at the rate of $150,727 per year. This is still more remarkable when it is considered that more than 39% of the total combined costs for fuel and power for the period considered was for coal, and charged against electrical operation. In this instance, the saving in this one item alone would undoubtedly justify the expenditure covering the entire cost of electrification. It is to be noted (see Table 2) that with a single exception, that for depreciation of equipment, every item shows a substantial percentage of decrease in favor of electrical operation. One cause for the high showing under "maintenance of equipment" is the method of apportioning same on new equipment, made necessary by the rulings of the Interstate Commerce Commission.

TABLE II. PERCENTAGE OF SAVING, ACCOUNT OF ELECTRICAL OPERATION

Maintenance of Equipment Expenses	
Repairs	39.17
Depreciation	50.95*
Supervision	10.54
Total	26.05
Transportation Expenses	
Wages of enginemen	31.81
Enginehouse expenses	37.68
Fuel and power	47.81
Water	75.90
Lubrication	49.31
Other supplies	21.83
Total	43.62
Grand total	39.93

* Increase

The total saving from locomotive performance alone was at the rate of $237,581 per year, to which should be added the credit of handling an increase of traffic at the rate of 13,938,136 ton-miles per year, or 8.77% more than was handled by the steam locomotives during the period compared. To this saving from locomotive performance should be added the saving from trainmen's wages which is at the rate of $31,146 per year, or a decrease of approximately 21%, due largely to the elimination of overtime, making the total saving from these two items $268,728 per year. Deducting $10,839 for maintenance of the distribution system leaves $257,889 as the net operating saving per year due to electrical operation.

The total cost of the electrification including a change of signal system on Smelter Hill, the extra motor-generator set recently installed at Anaconda, interest during construction and all incidentals due in any way to the electrification, was, in round numbers, $1,201,000. This does not include the step-down transformers, which are the property of the power company; but on the other hand no deduction was made for the salvage due to the elimination of 20 steam locomotives. By making the correction for the item of depreciation, the total saving per year from locomotive performance would be reduced to $221,991, making the total net saving $242,299, which is equivalent to 20.02% on the entire cost of electrification, to say nothing of the increased capacity of the lines, the improvement in the service and more regular working hours for the crews. If taken on the basis of the increase shown in net operating revenue or operating income, this percentage is slightly greater, the rate of increase per year for these items being $288,150 and $282,016 respectively. The estimate on which the decision to proceed with the electrification of the road was made, placed the annual net saving expected at 17.5% of the cost, so that the results financially have been quite as satisfactory as the general performance of the equipment.

TABLE III

Item of Operating Expense	Steam, 1913	Electric 1914	Decrease, 1914	Per Cent. Decrease
Fuel and power	$315,235.74	$164,508.70	$150,727.04	47.81
Repairs	124,787.90	92,278.08	32,509.82	26.05
Enginemen's wages	104,461.18	71,225.28	33,235.30	31.81
Enginehouse expenses	29,907.80	18,638.38	11,269.42	37.68
Water	4,953.66	1,193.70	3,759.96	75.90
Lubricants	9,751.44	4,942.32	4,809.12	49.30
Other supplies	5,823.52	4,552.36	1,271.16	21.83
Total locomotive performance	$594,921.24	$357,339.42	$237,581.82	39.93
Trainmen's wages	$147,632.30	$116,486.00	$31,146.30	21.10
Grand total	$742,553.54	$473,825.42	$268,728.12	36.19
Ton-miles hauled	158,917,720	172,855,856	13,938,136	8.77*

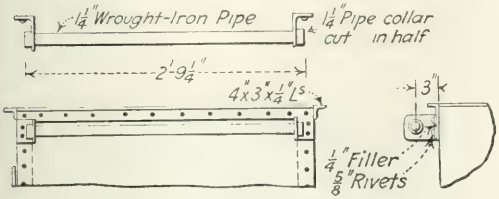
* Increase.

Details of Practical Mining

Safety Hand Grip for Mine Car

By H. H. Hodgkinson[*]

When ore is loaded from chutes and the cars are heaped up, the trammers often receive badly bruised hands due to the chunks on the top of the car striking another chute on the way to the dump, since the men persist in gripping the angle iron around the rim of the car body. Then, too, it is sometimes necessary to hold back the car, to stop it or prevent it going downgrade too fast and leaving the track. There is no suitable place on the car for holding, and the angle-iron rim gives a poor grip.



A Pipe-Bar Grip for Mine Cars

The convenience here described consists of a piece of 1¼-in. wrought-iron pipe, 2 ft. 9¼ in. long, threaded at each end and attached to the car by means of two 4x3x¼-in. angle irons, which have each a 1⅝-in. hole bored to fit the outside of the pipe. These two angle irons are riveted fast to the body of the car in such a position as to bring the grip just under the angle iron, which would then act as a guard to the hands of the trammers. A 1¼-in. pipe collar is cut in half to take the place of a nut, half being put on each end of the pipe or grip.

Air Compressor or Steam Engine

An unusual air-compressor installation has been prepared by the Nordberg Manufacturing Co., Milwaukee, Wis., for the Canadian Mining & Finance Co., Timmins, Ont. It is a standard two-stage cross-compound machine having cylinders 22x37x31 in., with mechanically operated Corliss valves. The compressor is to be driven by a 25-cycle synchronous motor at 105 r.p.m. The unusual feature about the machine is that it is to be used as a steam engine in case of necessity, this being possible with the type of valve used.

The mining company operates its equipment—consisting of the mine hoist, compressors, underground pumps and concentrating mill—electrically, purchasing power from an outside source. To guard against a possible delay to operations due to any irregularity in the transmission service a steam reserve plant was considered necessary. Ordinarily a full equipment of boilers, engines and generators would be necessary, but with compressors of the type furnished only the boilers are to be installed. Steam may be turned into the high-pressure cylinder of the compressor, being delivered to the intermediate receiver and thence to the low-pressure cylinder as in any Corliss engine. The operation will, of course, be reversed, and the motor turning in the opposite direction will act as a generator. With a slight readjustment of the valves, the economy will be nearly as good as that of an engine designed for the work.

The quantity of steam is regulated by an angle-throttle valve in the discharge pipe of the compressor between the high-pressure cylinder and the receiver.

By this arrangement enough current can be generated to run the mine at reduced capacity until service from the usual source is resumed.

Safe Hand Tools[*]

Personal caution is the greatest safeguard; a spill from a 20-ton ladle of molten metal may cause a serious burn, and a chip struck from the battered head of a 20c. chisel may result in blindness to an employee. A defective weld in a crane chain may allow a load to "let go" with disastrous consequences, while the use of a weak, cross-grained or splintered sledge handle may let the sledge fly across the shop and injure workmen who may be in its path. Many injuries may also be traced to the use of loose-fitting wrenches, splintered or broken shovel handles and to other uncared-for hand tools.

The largest contributors to injuries in the latter class are chisels, punches, wedges, blacksmith's tools, stonecutter's tools and similar small hand tools which are subjected to frequent hammer blows, in consequence of which their heads become readily "mushroomed." A mushroomed head presents a dangerous condition, for the next hammer blow may break off one of the slivers of steel hanging to the body of the tool and send it flying through the air, with great risk of injury to the man handling the tool or to others near by. The remedy costs little, is well known, simple and effective. When the head of such a tool is found to be chipped, cracked or mushroomed, it should be promptly laid aside and not used again until the head has been ground down or dressed to its proper shape. A good practice applicable to cold-chisels and other tools that must be sharpened frequently is to grind down their heads every time the tools are sharpened, thus preventing the development of a mushroomed condition, and at the same time retaining the hammer-hardened ends, which will not spread so rapidly in the future life of the tools. This practice also avoids much waste of the steel, which would have to be cut off if the heads of the tools were reforged. As a further precautionary measure, all steel hand tools that are likely to be struck by hand hammers or sledges should have the upper part of the shanks shaped round and slightly tapered from the top downward before they are used at all; care should also be taken to make such tools of the right grade of steel, else the battered, overhanging portions of the tools will readily break off.

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[*] Mining engineer, Franklin Furnace, N. J.

[*] From N. F. A. "Safety Bulletin," Dec. 1, 1914.

The character of hammer and sledge handles and their method of fastening are worthy of more than passing notice. If not straight-grained or if the wood used is "short" in texture, it must be expected that such handles will quickly splinter and break; if attached in a slipshod manner, or if insecurely fitted, or if wedged by nails instead of wedges, or if water soaked so as to swell and become only temporarily tight in the hammer head, it is obvious that they will become loose and that the hammer or sledges will fly off when the nails loosen or when the handle dries and shrinks. When it is recognized that the peculiar function of hammers and sledges is to strike blows with considerable force, it becomes clear that there is no economy in cheap, weak handles, and that all handles should be carefully purchased and properly fastened in place.

The use of defective file or screwdriver handles also contributes to the sum of injuries caused by hand tools. When such handles are split, the handle end of the file or screwdriver is liable to be forced through the handle and puncture the users' hands; when these tools are used without handles similar injuries sometimes result. The use of only the best handles is a safe as well as an economical measure.

When smooth-faced hammers or hatchets are used for driving nails, the nails frequently glance and strike persons who are working in the vicinity. This danger can be minimized by using hammers or hatchets with roughened faces.

Wrenches are wrongly used and are abused often because the management is over-economical, but usually because the employee is too lazy or too hurried to secure the right wrenches for the job. Solid wrenches that are too large for the nut or the bolt head are soon worn into a rounded shape that allows them to slip and bruise the workmen's hands, also spoiling the shape of the nut or the bolt head, which in turn presents an added risk of the same kind. Wrenches of the right size but worn beyond the possibility of giving safe and effective service cause similar injuries. Again the remedy is simple and even economical; the wrenches should be ground or milled to suit larger nuts, or if there is too little stock left, they should be scrapped. Monkey wrenches or Stillson wrenches with bent jaws or worn adjusting parts are also likely to cause injury by slipping; such wrenches should be repaired or replaced. Wrenches are cheap; when in good condition they are not only safest, but they do more and better work than the faulty variety.

Another tool in common use which has contributed a large quota of accidental injuries is the pinch bar used to pry heavy bodies short distances or to "pinch" railroad cars or industrial cars to a new position on their tracks. These tools are found to slip occasionally and bruise or crush the users' hands. A disk with a hole through it slipped over the bar would protect the workmen's hands from injury. This safety device also lends confidence to the user and thus promotes more rapid work.

Some effective system should be adopted and carefully followed in each shop to prevent the use of improper or defective handles or tools. Only such handles and tools should be purchased or put into service as are safest and best for the purpose. Even these may in time become unsafe by wear; it therefore becomes imperative that they should be inspected regularly and their safe condition maintained. In shops where such tools are turned into the toolroom or stockroom every night, the storekeepers can be instructed to issue again only such tools as are safely fit for service. Where such tools are kept out for longer periods, the foreman or subforeman in small shops, or a regularly appointed inspector in large plants, should see to it that defective tools are turned in promptly for renewal or repairs. In some plants the foreman or inspector condemns such unsafe tools by wiring a red tag to them, indicating that they must not be used again until they have been put in good condition.

Furthermore, the danger of using defective tools must be impressed upon the workmen from day to day by friendly counsel, stern reproof, and in some cases by severe discipline. The matter will not take care of itself.

Collapsible Geological Model

The E. J. Longyear Co. in its exploration work has occasion to draw geological maps. W. J. Mead, geologist for the company, has developed the typical geological map until it is really a collapsible model. The idea of a geological model is not, of course, new. Various kinds have been in use for years. A type of rigid transparent model made of celluloid strips is shown in Fig. 1. The top of this model represents the surface of the property, and contains the drill-hole cross-section lines, property lines, etc. The square, vertical partitions represent vertical sections through each line of holes, and the data from each hole are shown on them. By properly marking or coloring any given formation in each section, a graphic representation of the exploration is obtained. In the case of this celluloid model, some trouble was experienced with warping.

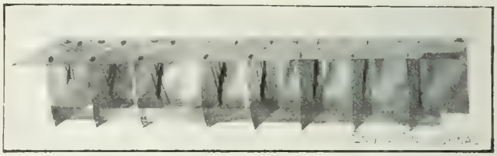

Fig. 1. Rigid, Transparent Model of Celluloid

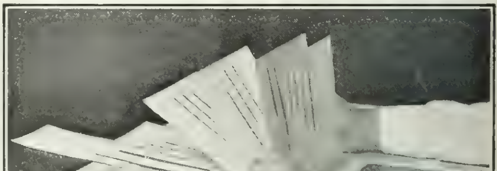

Fig. 2. The Collapsible Model in Use

Mr. Mead's collapsible model has many of the advantages of the celluloid and has not the disadvantages of bulkiness or possible warping. Fig. 2 shows such a model in use, its manner of operation being apparent. The sections through the holes are made on squares of cardboard, hinged by canvas strips to a common base. Various geological formations and other features can be shown in colors, and the relation of one hole to another is quickly observed by holding up any number of the leaves. When flattened out, the whole can be closed up like a book the covers of which are stiff bristol board.

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Storage-Battery Locomotives

In the discussion of J. W. Gwinn's paper on "Underground Haulage by Storage-Battery Locomotives in the Bunker Hill & Sullivan Mines," at the annual meeting of the American Institute of Mining Engineers, Girard B. Rosenblatt pointed out that the efficiency of the storage-battery locomotive declined rapidly when too great a drain was made upon its power, comparing the effect with that on a small steam boiler on which large sudden demands were made for steam, with resulting reduction in steam pressure. Hence he cautioned the user against buying too small a battery for a locomotive, and also against specifying too large a motor, because the motorman would invariably use the motor at maximum capacity when he had an opportunity. Successful surface locomotives were not necessarily well suited to underground service, and the underground storage-battery locomotive should therefore be designed for that purpose and not copied from a successful surface locomotive. He said that the storage-battery locomotive had evidently proved satisfactory at the Bunker Hill & Sullivan properties, since associated properties under the same management, Alaska Treadwell and Alaska-Juneau, were also installing this type of locomotive for underground work.

He also called attention to the fact that the storage-battery locomotive is best suited for short hauls, its power efficiency not being so good as that of the trolley locomotive, which is best adapted to long hauls and heavy loads. John Langton developed the latter idea further and reduced Mr. Gwinn's figures of power consumption to the ton-mile basis. He computed that the power consumption of the storage-battery locomotives at Bunker Hill & Sullivan mines was 1.785 kw.-hr. per ton-mile. At Bisbee, Ariz., Charles Legrand had previously reported a power consumption for storage-battery locomotives of 1.6 kw.-hr. per ton-mile, which might be considered in fairly close agreement with the Bunker Hill & Sullivan results. These figures were about double the power consumption of trolley locomotives, but he nevertheless considered the storage-battery locomotive worth while for special purposes, as the power cost was so small a proportion of the total cost of the mining operation. The storage-battery locomotive had features of safety much superior to the trolley locomotive, and its convenience in operating close to the working face was likewise superior.

George R. Wood, of the Perwood White company, told of two seven-ton storage-battery locomotives which his company was operating. These had probably the most severe duty of any such locomotives in the country, being largely engaged in hauling empties up a 1½% grade. The motors had been set low so that any sparking would be at an extremely low point, and if explosive gases had reached as low as this in the working place, it was not likely that the miners would be there. About 7 hr. was required to charge the battery of one of these locomotives, and 1 hr. was devoted to "boosting." The cost of the locomotives was about twice that of equivalent trolley locomotives, not counting trolley wires and track bonds. These storage-battery locomotives cost approximately $4000 each, about one-half the cost being represented by the battery.

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Water-Disinfecting Outfit for Field Use

A water-disinfecting outfit for field use, consisting of a canvas bag as a water-holder and canteen-filler and a carton of sealed glass tubes containing calcium hypochlorite, has been got up by Major William Lyster of the United States Army, according to *Engineering News.* The bag is of specially-woven flax canvas, 20-in. diameter and 28 in. long. At the top it is sewed to a flat galvanized-iron ring, hinged so as to fold in half. At the bottom are five self-closing nickel faucets, from each of which a canteen may be filled in ten seconds.

Water-Sterilizing Bag and Canteen-Filler

The bag is to be used only in a stationary position, when it may be suspended by ropes, as shown by the view. When filled it weighs about 330 lb. When empty its weight is 7 to 7½ lb.; it may then be folded into a convenient package, ready for transportation.

The calcium hypochlorite used for disinfection is put up in ⅜x3-in. sealed glass tubes, 60 of which, weighing only 10 oz. altogether, are packed in a 7½x3½x1¼-in. corrugated paper carton. The tubes are marked with a file so as to be readily broken without splintering the glass. Each tube contains 14 to 16 grains of calcium hypochlorite, containing 30 to 32% effective chlorine, or just enough to treat one filling of the water bag at the rate of 1 to 500,000. Bacterial tests have shown that with this dosage 15 minutes of contact kills most of the amœbæ causing dysentery, and 30 minutes all of them, and that usually water so treated is safe to drink in 5 to 10 minutes. The use of a filter cloth placed over the mouth of the bag in filling is recommended, as the hypochlorite acts more readily on clear water than on that containing suspended matter.

Although designed primarily for army use, the equipment described would be just as serviceable for any other body of men on the move where lightness of baggage is important.

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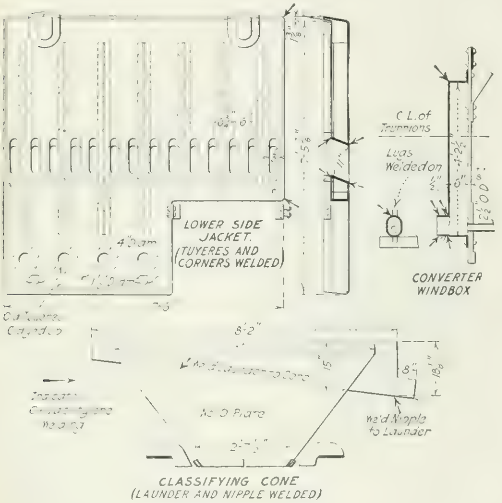
Mt. Hope Mine Model

In the article on the Mt. Hope mine model in the Journal of Mar. 6 the author's name is given as J. C. Stockland, whereas it should have been J. C. Stoddard.

Details of Milling and Smelting

Oxyacetylene Welding at Great Falls, Mont.

Mention was made in the Journal of Feb. 27, 1915, of the frequent use of oxyacetylene welding apparatus at the Boston & Montana works of the Anaconda Copper Mining Co. Some of the work is illustrated in the accompanying drawings. The company purchased in 1910 a Sanford portable welding machine, and during the last five years the mechanics at Great Falls have had an opportunity to become expert in the use of this apparatus, which is now frequently called into service both for repair and construction work.



LOWER SIDE JACKET. (TUYERES AND CORNERS WELDED)
C L. of Trunnions
Lugs Welded on
CONVERTER WINDBOX
8'-2"
15"
8"
18⅛"
Weld Nipple to Launder
CLASSIFYING CONE (LAUNDER AND NIPPLE WELDED)

Some Acetylene-Welding Jobs at Great Falls

One of the accompanying drawings shows a blast-furnace water-jacket to which oxyacetylene welding and cutting were applied. The corners of this jacket are welded with the oxyacetylene apparatus, as are also the fourteen 3x11-in. tuyeres. These openings are burned out of the solid plate and then the tuyere sleeves, which have been previously welded, are placed in position, held by clamps and welded to both of the jacket sheets. The old method of flanging the corners was expensive, and it was also difficult to avoid thinning the metal at the corners. The new method of flanging the plates and welding the corners is much cheaper and better. Considerable welding is done on the windbox and tuyeres for the Great Falls 20-ft. vertical converters. The windbox shown in the accompanying drawing was built up of two 4x6-in. angle irons with a ½-in. plate welded on the bottom edge for a distance of about 22 ft. around the converter. The tuyere nozzle is usually made of 4-in. extra-heavy pipe welded to the above-mentioned ½-in. plate. On the nozzles are also welded four 3x⅜-in. lugs to receive the bolts that hold the tuyere valves in place.

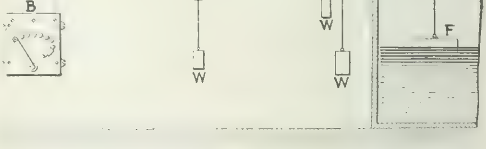
The hydraulic-classifying cones used in the concentrator at Great Falls are also shown in the accompanying drawing. The seams of these cones are welded and the overflow launders around the outside are welded in a water-tight joint around the circumference. A nipple is also welded to the overflow launder, to make a suitable connection for carrying away the water. These devices are by no means all to which acetylene welding is applied at Great Falls, but give some idea of its extended use at the Boston & Montana reduction works.

⁂

The Effect of Air in Zinc-Dust Precipitation Systems

By D. W. Minier*

In precipitating from cyanide solutions by means of zinc dust, the admission of air to the precipitation line and presses must be carefully avoided. Upon starting one Arizona mill there was absolutely no precipitation when the solution was pumped through the presses. The pressure rose to over 25 lb., with the presses handling but 50% of their capacity. A careful examination at the precipitate pump showed that the zinc-feed pipe entered the solution line between the pump and the pregnant sump, permitting a large volume of air to enter the pipe line and press. Upon correcting the piping arrangement there was no further trouble.



Automatic Stopping Device for Solution Pump

Another Arizona plant found that the effluent solution from the precipitation presses instead of being barren was actually 200 to 300% richer than the solution in the pregnant sump. A careful examination showed that at times the pregnant solution sump was being pumped dry, allowing large volumes of air to enter the precipitation system, and re-solution was taking place.

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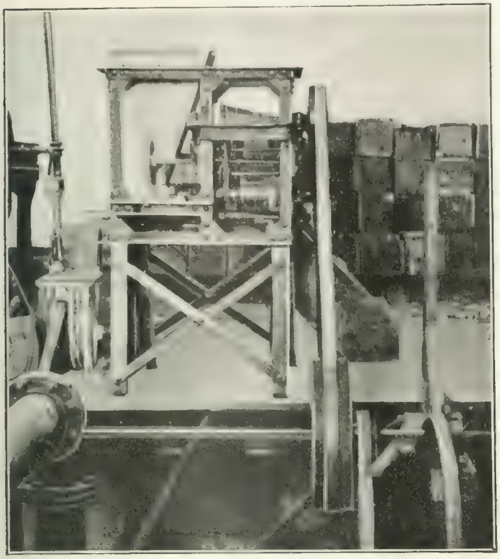
*Mining engineer, Pearce, Ariz.

To avoid such a possibility the precipitation system of the Commonwealth mill, at Pearce, Ariz., was equipped by B. A. Bosqui with an automatic trip to stop the motor-driven pump when the level of the solution in the pregnant sump reached a point 6 in. above the pump-suction line. The arrangement is simply a "figure-four" trip operating a knife-blade switch on one of the lead lines to a starting box. When the sump is again full, the trigger is re-set and switch engaged by hand. The starting box is used in the ordinary fashion.



ZINC FEEDER DIRECT-DRIVEN FROM SOLUTION PUMP

As the precipitation pump is driven by a back-geared motor, the automatic feeder is driven from a belt on the pump pinion-shaft, so that the feeder stops with the stopping of the pump.

When the plant was started, trouble occurred in keeping the pump packed. Graphite and flax packing having been found useless, hydraulic packing was tried, which prevented leakage and gave long service.

Refining Base Bullion

By Wm. Seward Mann*

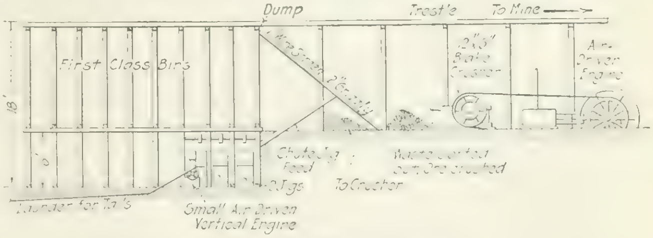
The output of many small mills is retorted and melted in the ordinary blacksmith forge, and it is often a question of finding the simplest method of refining bullion containing the bits of steel and wrought and cast iron which come from a broken crucible. Commercial sulphur may be used and is best pulverized to pass a 60-mesh screen. As wrought iron and steel melt at a higher temperature than gold, the contents should be brought to a bright red and the powdered sulphur slowly added. After two or three additions the matte which is formed is skimmed and then more sulphur added, this process being continued until but little matte forms. If inconvenient to skim, the charge can be poured together with the matte, cooled until the metal is chilled and a greater part of the matte poured, as it melts at a lower temperature.

Before pouring, the contents of the crucible should be vigorously stirred with an iron rod to take up any free sulphur that may be present. The mold should be heated just too hot to handle with the bare hands. It may then be smoked evenly by inverting over a fire of cotton waste and oil, lubricated with paraffin or painted with bone ash. As soon as the slag has assumed a deep red, the mold and the contents should be plunged into cold water. This sudden cooling will cause the bar to loosen and oftentimes the slag to separate. If it does not, it can easily be detached by a sharp tap with a hammer if done while the bar is still hot. Should there be a thin film of matte remaining it can be removed by heating to a dull red and plunging into dilute sulphuric acid, or better, if potassium nitrate is sprinkled on the bar, nitrates will be formed which are soluble in water. If a black film or tarnish still remains on the bar, this can be removed by immersing in a dilute solution of sulphuric acid to which has been added a small quantity of common assay soda and giving a vigorous scrubbing with a stiff brush. The matte formed may carry some silver, and if much is produced it had better be saved and sold to a smelting plant.

A Leaser's Milling Plant

By S. S. Arentz*

A small plant used by leasers at the Honerine mine of the Bullion Coalition Mines Co., Stockton, Utah, serves the purposes for which it was built, and cost less than $1000. The saving is excellent.



A LEASER'S MILLING PLANT

The ore is siliceous silver-lead material, containing much limonite. Lead is in the form of galena with some carbonate, and it runs from 6 to 20%, with 2½ to 10 oz. Ag per ton. The illustration shows the plant in detail. The grizzly has two compartments, the fines going at once to the jigs; and the medium size, too fine for sorting but too large to send to the jigs, is put through the crusher. The grizzly oversize is hand-sorted, and the good ore crushed. All material is moved by hand from the crusher floor to the crusher, and again into the jig-feed bin.

The top of the trestle and the ore bins form a roof over the plant, and canvas tacked on the trestle bents gives sufficient shelter on the sides. All the machinery is second hand, but good for much service.

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*M[illegible], Dooly Building, Salt Lake City, Utah

The Assayer and Chemist

The Phosphate Method for Alumina

By F. G. Hawley*

The determination of alumina is of almost daily occurrence in many metallurgical laboratories. Nevertheless its assay is one of the least satisfactory that the chemist is ordinarily called upon to make. During recent years the phosphate determination for alumina, a direct method and well adapted to use on most complex ores, has come into general favor.

By carefully following standard directions an experienced analyst can usually obtain good results, but a chemist having many determinations to make and using some of the shortened commercial methods will frequently find that he does not check by 1 per cent. or more.

During the last six years I have had to make many alumina assays by the phosphate method and naturally wanted as much information on the subject as possible.

As the literature on the subject is not extensive and some of it is contradictory, it was thought that the subject was one that justified considerable research. A great deal of study was given to the question and nearly 200 experiments made in testing different phases of the method. Considerable information was obtained. A new method to separate aluminum and iron hydroxides from copper was devised and several of the details of standard methods were modified to meet special requirements.

INFLUENCE OF FLUORINE

One of the first things investigated was the interference of fluorine. It was found that even minute quantities would seriously interfere with the accuracy of the results. My attention was called to this fact by noticing that when making alumina determinations on reverberatory slags that had been decomposed by HF and H_2SO_4 the results were frequently much too low. The slag was decomposed in a platinum dish and at the end was heated to strong fumes of SO_3. Theoretically the fluorides should have been completely decomposed but I judged that such might not always be the case and that possibly some fluorine might remain and cause incomplete precipitation of the alumina.

The following experiment was made: 2.5 grams of slag were decomposed by a carbonate fusion; evaporated to dryness with HCl, and the SiO_2 filtered out; the solution diluted to 500 c.c., and then divided into five equal parts. All were run by the regular phosphate method and treated alike except for the HF:

No. 1—No addition, found 10.6% Al_2O_3.
No. 2—No addition, found 10.6% Al_2O_3.
No. 3—1 drop HF added, found 6.[illegible]% Al_2O_3.
No. 4—2 drops HF added, found 1.8% Al_2O_3.
No. 5—4 drops HF added, found 0.8% Al_2O_3.

The experiment was repeated with similar results. I thought that the alumina might be precipitated by ammonia, filtered from the ammonium fluoride and then dissolved and precipitated as phosphate. Experiments to test this showed that even when as little as 0.005 gram of fluorine was present, enough was always retained by the hydroxides to affect the determination. The results were from 0.6% to 1% too low.

When it is desired to decompose a sample with HF preparatory to making an alumina determination it is best to evaporate with H_2SO_4 twice to dryness to insure complete expulsion of all fluorine. Under these conditions good results may be obtained.

INFLUENCE OF CU, SB, AS AND PB

Most authorities state that these metals will interfere with the phosphate method and usually recommend that they should be removed by precipitating with H_2S. When many samples are to be assayed the use of H_2S is a disagreeable and tedious operation and many chemists dispense with its use whenever possible. Instead of using H_2S from a generator some chemists generate it in the assay by adding sodium sulphide to the acid solution. The sodium sulphide should be tested as it often contains impurities. Lead is frequently removed as sulphate, and copper by precipitating the alumina by ammonia; most of the copper going in the filtrate.

Numerous experiments proved that when copper, antimony and arsenic are present they will be precipitated as sulphides when the solution was boiled with "hypo" to precipitate the aluminum phosphate.

Lead appeared not to be precipitated under the conditions of the assay, but as comparatively few experiments were made with lead the results may not be conclusive.

Fortunately these metals when present, even in small quantities, make their presence known by the distinctive colors their sulphides give the solution, 0.3-0.4% being readily noticed. On igniting these sulphides they are changed to oxides. The copper oxide all remains with the aluminum phosphate, the antimony mostly so, as little volatilizes, but the arsenic being volatile, is entirely expelled. Although some authorities recommend differently, I find it unnecessary to eliminate As before precipitating $AlPO_4$ as its volatility insures its complete removal.

The following experiments show the amount of error caused by Cu, Sb, As and Pb:

	Al_2O_3 Taken	Added	Al_2O_3 Found
No. 1	0.0550 gram		0.0550 gram
No. 2	0.0550 gram		0.0552 gram
No. 3	0.0550 gram	—.01 gram Cu	0.0605 gram
No. 4	0.0550 gram	—.02 gram Cu	0.0660 gram
No. 5	0.0550 gram	—.02 gram Sb	0.0695 gram
No. 6	0.0550 gram	—.05 gram Sb	0.0820 gram
No. 7	0.0550 gram	—.05 gram As_2O_3	0.0545 gram
No. 8	0.0550 gram	—.10 gram As_2O_3	0.0550 gram
No. 9	0.0550 gram	.02 gram Pb	0.0542 gram
No. 10	0.0550 gram	—.10 gram Pb	0.0540 gram

Copper when present in small amounts may be removed sufficiently well for most work by a single ammonia separation, but when there is much present, two or even more precipitations may be required before it is entirely eliminated.

NEW METHOD FOR ELIMINATING CU

An original method for complete separation of copper from iron and aluminum hydroxides has been devised, which gives entire satisfaction. It is particularly well adapted to use on copper concentrates and any other material containing alumina together with much iron and copper. Either iron or alumina can be determined in the hydroxides thus freed from copper, and lime and magnesia can be determined in the filtrate.

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*138 Custer Ave., Los Angeles, Calif.

To make the separation proceed as follows: Put the hydrochloric-acid solution of the aluminum and iron hydroxides, containing at least 20 c.c. of HCl, in a 300-c.c. beaker; add ammonia very carefully until neutral and then 4 c.c. excess; add slowly and with constant stirring a solution of KCN (about 40 grams per liter) until the blue color of the copper has nearly but not quite disappeared. If there are a number of samples it is a good plan to add a little KCN to each one and then beginning at the first a little more, repeating this a number of times until finished. Working in this manner there is little danger of overrunning as the first sample will have partially settled by the time the last one is reached so that the amount of blue can be easily seen. The beakers are now covered and heated on the hot plate to boiling; the boiling is continued for two minutes and then the sample removed and settled a short time. The samples are filtered and well washed with hot water. The hydroxides are now ready to be dissolved in HCl and the alumina precipitated by the regular phosphate method. If the KCN is added too fast or too much is used some of it will combine with the iron forming ferrocyanide and this will cause trouble later by forming prussian blue, but if the KCN is used as directed very good results are certain. The following experiments were made to test the efficiency of KCN in preventing iron and aluminum hydroxides from retaining copper. Each sample contained 0.170 gram Cu; 0.160 gram Fe and 0.050 gram Al_2O_3; 10 c.c. HCl was added and then neutralized with NH_4OH and 8 c.c. excess added. Samples were boiled, filtered and washed six times with hot water.

No. 1—KCN added 27 c.c., Cu in hydroxides—trace
No. 2—KCN added 25 c.c., Cu in hydroxides—0.0010 gram
No. 4—KCN added 16 c.c., Cu in hydroxides—0.0122 gram
No. 5—KCN added 0 c.c., Cu in hydroxides—0.0254 gram

A previous test had shown that it took 27.5 c.c. of KCN entirely to decolorize the solution.

Effect of Impurities

When a sample contains antimony it is possible to eliminate it by volatilizing as $SbCl_3$. While this method has little advantage over that of removing the antimony by H_2S, there may be times when a generator for H_2S is not available and it would be desirable to use this separation. The method is as follows: Put the sample in a casserole with 0.5 gram NaCl and 10 c.c. HCl and evaporate to dryness and heat to 220 to 250° C. for 5 min. The antimonious chloride formed is volatile at this temperature. If there is enough sodium chloride present to form the double salt the aluminum chloride will suffer no loss. The temperature can be known sufficiently close by means of a beaker containing a little H_2SO_4 placed near the assay. It is hot enough when the H_2SO_4 fumes rather strongly but does not boil.

Effect of Other Metals

Experiments were made to determine what effect the presence of Zn, Mn, Ca and Mg would have on the assay. The tests indicated that these elements had no effect on the accuracy of the results.

As iron is one of the metals most commonly associated with alumina it is important to know what effect it will have on the assay. It was found when the assay is made exactly according to the standard directions usually given, that iron, even when present in considerable amount, will not materially affect the results. One of the conditions usually required is that the solution should be diluted to 400 c.c. before precipitating the alumina. On account of the length of time required to boil and filter so much solution it is a common practice with many chemists to use less.

However, experiments seem to prove conclusively that this is bad practice, especially when much iron is present, as the aluminum phosphate is always contaminated with iron.

These experiments show how the results are affected:

	Al_2O_3 Taken	Added	Bulk	Al_2O_3 Found
No. 1	0.0350 gram	....	400 c.c.	0.0352 gram
No. 2	0.0350 gram	....	400 c.c.	0.0354 gram
No. 3	0.0350 gram	0.270 gram Fe	400 c.c.	0.0354 gram
No. 4	0.0350 gram	0.270 gram Fe	400 c.c.	0.0356 gram
No. 5	0.0350 gram	0.270 gram Fe	300 c.c.	0.0366 gram
No. 6	0.0350 gram	0.270 gram Fe	200 c.c.	0.0382 gram

It is a well known fact that when alumina with iron is precipitated by means of ammonia and ammonium chloride that the small amount of silicic acid that is almost invariably present in the solution will be almost entirely precipitated with the alumina. If the hydroxides are ignited and the Al_2O_3 determined by the difference method the results will be slightly too high unless allowance is made for the SiO_2 present. Although this will frequently amount to several milligrams, it is usually neglected in the commercial assay. It was proved by several tests that when a small amount of silicic acid is similarly present in solution in the phosphate assay that the SiO_2 is not precipitated with the alumina. This is one reason why some chemists have claimed that the phosphate method gives low results.

In conclusion I would say that I consider this method entirely reliable and the best for general work. The only exception I make to this is in the case of samples containing over 15% alumina, little iron and no appreciable amount of phosphorus or other interferences. In this case I consider it better to make a double ammonia precipitation, weigh the combined oxides and deduct the iron oxide.

⁂

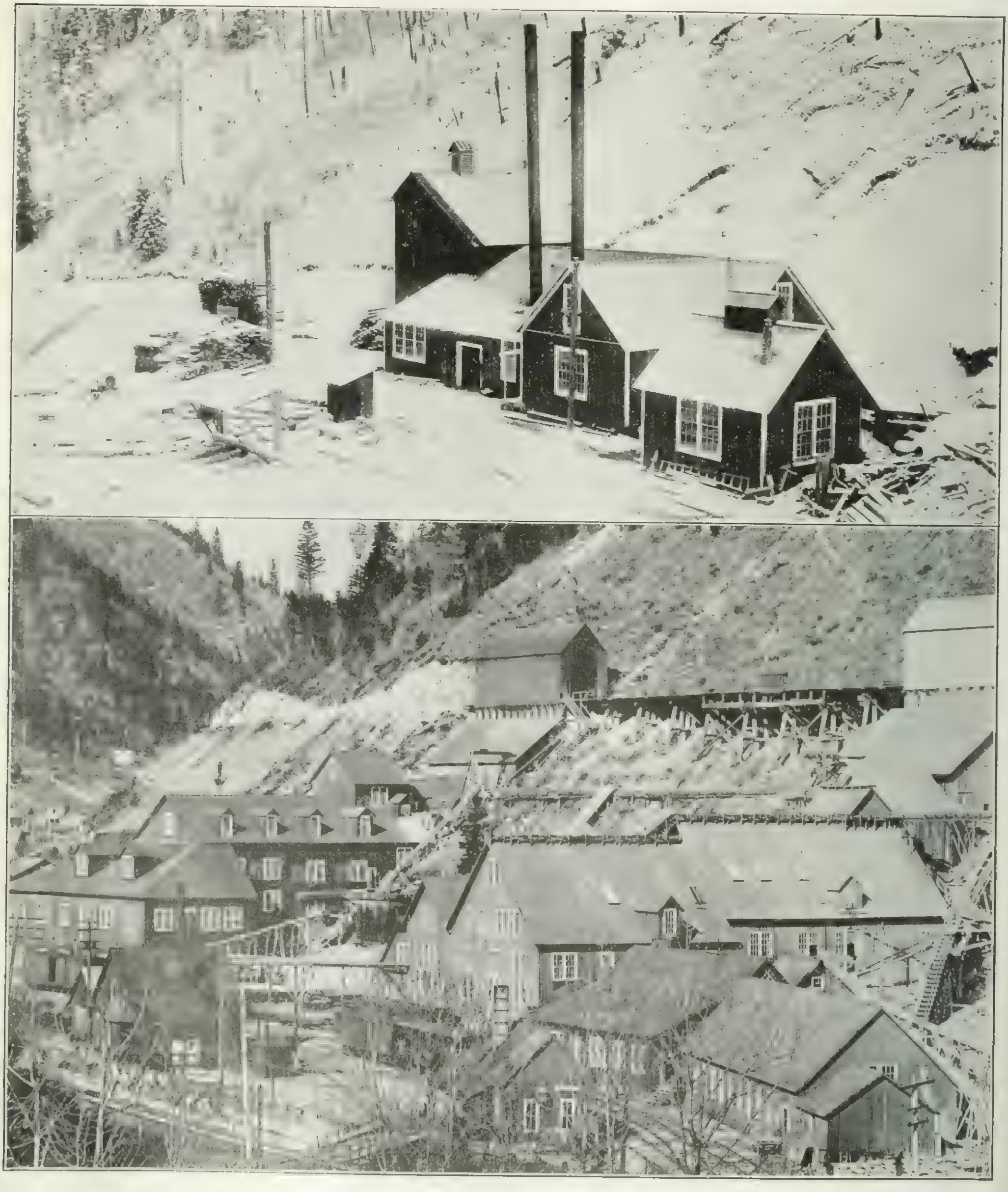
Reduction Test for Tungstic Acid

Some simple prospectors' reduction tests for tungstic acid are described by G. Torossian (*Am. Journ. Sci.*, December, 1914, p. 537) from which two are selected.

Place the powdered substance on a piece of aluminum plate or foil; moisten with a drop or two of water; then add a drop or two of concentrated hydrochloric acid. A blue color, which develops even in the presence of oxidizer and ferric oxide, shows tungsten.

Another test is: Place water in single big globules (not spread out) on aluminum foil; sprinkle a little of the finely powdered material on them, and add a little hydrochloric acid to the globules. A blue color, developed in the presence of insoluble carbonaceous material, copper oxide, hematite, lead oxides, sulphur, rare-earth oxides or calcium fluoride, shows tungsten.

Photographs from the Field

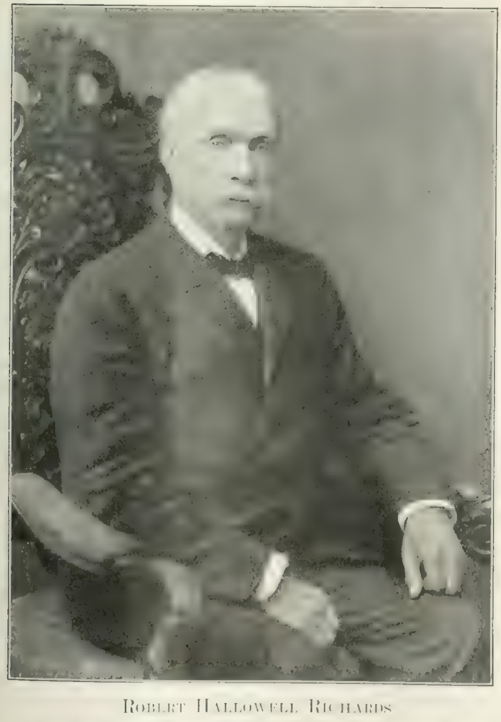


IN THE CŒUR D'ALENE DISTRICT

Surface plant at the [illegible]. Lower view is of the Green Hill-Cleveland and the Stewart concentrators at Wallace; the latter distinguished by the arrow. Both plants belong to the Federal Mining & Smelting Co.

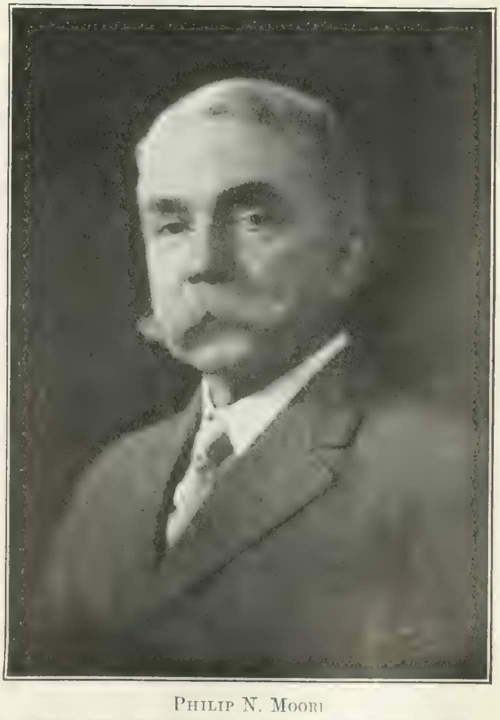
AT THE HERCULES MINE, BURKE, IDAHO
This mine operates its own sawmill, providing timber for all purposes

Men in the Public Eye



ROBERT HALLOWELL RICHARDS

Awarded the gold medal of the Mining and Metallurgical Society of America for distinguished service in the advancement of the art of ore dressing



PHILIP N. MOORE

Elected first vice-president of the American Institute of Mining Engineers. Mr Moore is a distinguished mining engineer, whose home is in St Louis

Pig-Iron Production in 1914

The full statement of production as given in *Bulletin* No. 1 for 1915 of the American Iron & Steel Association gives the total make of pig iron in the United States in the second half of 1914 at 10,796,150 long tons, making the total for the year 23,332,244 tons, which is a decrease of 25% from that of 1913. The *Bulletin* says that in these totals all pig iron and ferroalloys are included, whether made in blast furnaces or in electric furnaces. Pig iron made with bituminous coal is included under coke pig iron. Pig iron made with mixed anthracite and coke is included in anthracite pig iron. Pig iron made with coke and electricity is included in coke pig iron; that made with charcoal and electricity is included in charcoal pig iron. Low-phosphorus pig iron—that is, iron running under 0.04 P—is included in bessemer pig iron. Pig iron containing from 0.04 to 0.10% P is classified as bessemer. The figures for 1913 and 1914 include under basic iron a small quantity of charcoal iron of basic grade. In 1912 and prior years charcoal pig iron of basic quality was not included in the basic production. Nearly all the charcoal iron is classed as foundry pig iron. Ferrosilicon is included in foundry pig iron. Pig iron containing 7% or over of silicon is classified as ferrosilicon.

Under the old classification by fuels used the production for two years past has been as follows:

	1912	1913	1914
Coke	29,132,733	30,348,973	22,976,856
Anthracite	247,179	277,347	91,464
Charcoal	347,025	339,832	263,924
Total	29,726,937	30,966,152	23,332,244

A few small furnaces using raw bituminous coal are included in the coke stacks; their production is too small to make it worth while to separate them. Nearly all the anthracite stacks use some coke mixed with the coal. Of the charcoal iron reported, 9294 tons were made with cold blast and 254,630 tons with hot blast. Practically 98% of our pig iron was made with coke as fuel.

The following table shows the production of iron by grades, and also the proportion made by the steel works' furnaces for their own use and by the merchant furnaces for sale in 1914:

	For Use	For Sale	Total	Per Cent
Basic	8,190,966	1,479,721	9,670,687	41.5
Bessemer	7,331,222	527,905	7,859,127	33.7
Foundry	140,165	4,393,089	4,533,254	19.4
Malleable		671,771	671,771	2.9
Forge	165,593	196,058	361,651	1.5
All other	141,318	94,436	235,754	1.0
Total	15,969,264	7,362,980	23,332,244	100.0
Total, 1913	21,232,063	9,734,089	30,966,152	

Included in the "all other" kinds are 79,035 tons of spiegeleisen, 106,083 tons of ferromanganese and 49,736 tons of white and mottled iron, direct castings and miscellaneous ferroalloys. Merchant iron was 31.6% of the total in 1914 and 31.4% in 1913, or practically the same proportion in both years.

The methods by which pig iron was cast or otherwise delivered from the furnace were as follows in 1914:

Delivered	Tons	Per Cent.
Molten to steel furnaces, etc.	11,911,247	51.0
Sand cast in pig	4,814,959	20.6
Machine cast	5,854,661	25.1
Chill cast	738,018	3.2
Direct castings	13,359	0.1
Total	23,332,244	100.0

Basic and bessemer were naturally the classes of iron most largely delivered in molten form. Of the basic iron made, a total of 6,436,146 tons, or 66.5%, was so delivered; of the bessemer pig, 5,467,687 tons, or 69.6%. Outside of the steel-making irons only 7414 tons were delivered in molten form.

The production by states is given as follows for two years:

States	1913	1914
Pennsylvania	12,954,936	9,733,369
Ohio	7,129,525	5,283,426
Illinois	2,927,832	1,847,451
Alabama	2,057,911	1,826,929
New York, N. J.	2,187,620	1,559,864
Ind., Mich	1,775,883	1,557,355
Wis., Minn.	367,326	329,526
Virginia	341,815	271,228
Mo., Col., Cal	324,263	267,777
W. Va., Ky., Miss.	315,731	236,393
Tennessee	280,541	216,738
Maryland	289,959	195,594
Conn., Mass.	12,810	6,594
Total	30,966,152	23,332,244

Pennsylvania made in 1914 the largest proportion, 41.7% of the total. Ohio made 22.6%; Illinois, 7.9, and Alabama, 7.8%. There were no great changes among the states, except that Alabama increased its proportion, having a lesser decrease than any other state.

Present Operations of Great Northern Iron Ore Properties

Special Correspondence

The Great Northern Iron Ore Properties is at present operating the following mines in the Mesabi Range in Minnesota:

The Thorne property is a new operation, situated near Buhl. Sinking of the shaft was completed early in the winter, since which time development underground has been continued. The ore in this property developed to date is unusually hard for the Mesabi Range, and the management is contemplating the installation of an air compressor and Jackhamer drills. Butler Bros. is making an ore approach into the Dean mine, also situated near Buhl, which property was transferred last season to the Tod-Stambaugh interests, and will be operated during the coming year by the Dean Iron Mining Company.

At the Dunwoody property, near Chisholm, stripping operations will soon be resumed by Winston & Dear. Ore is now uncovered in portions of this pit, and this property will be in shape to ship a considerable tonnage this season. The Leonard property, also near Chisholm, is hoisting a large tonnage through its No. 2 shaft; and the North Bank of the openpit portion of the mine, which lies north of the No. 2 shaft workings, is being rapidly developed. This property is in shape to ship from the openpit during the coming season.

Near Hibbing, underground operations are being carried on in three properties—the Harold, the North Uno, and the Dale. The Harold, which is producing heavily, is owned in fee by the Great Northern Iron Ore properties. The two other properties are owned in fee by the Northwestern Improvement Co., and are being operated as a separate company, but under the direction of the officials of the Great Northern. These two operations are confined to underground ore areas which are a continuation of the orebodies which have been largely removed by the Oliver Iron Mining Co. in openpit mining. The Smith property, which is part of the above group, is now stripped and ready for openpit steam-shovel mining. There is still remaining a comparatively small tonnage of openpit ore in the Dale, North Uno and South Uno openpits, which were operated last season by the Oliver Iron Mining Co., but which will be operated in the future by the Great Northern. The Mississippi mine, an underground property, located near Keewatin, is operating at full capacity. A. Guthrie & Co., stripping contractors, who were given the stripping contract on the Hill-Annex property near Marble last season, ceased operations in January, but will resume early in March, after which these operations will be pushed to the fullest possible extent.

Developments at Atlanta, Nev.

By Paul W. Meyers*

The Atlanta gold camp is situated in the northeastern part of Lincoln County, Nev., at an elevation of 6700 ft. It is about 45 miles north of Pioche and about 65 miles south of Ely, being connected with both camps by good wagon roads. Within a mile or two of Atlanta is the old silver-mining camp of Silver Park, which flourished in the '70s.

Boulders carrying free gold were discovered at Atlanta seven or eight years ago, and large outcrops located. The first shaft was sunk by George M. Latimer to a depth of about 60 ft., and in June, 1909, an option was taken on the property by Elmer M. Bray and associates, of Los Angeles, and active development begun. A Nevada "boom" ensued. The original group of claims was promptly surrounded on every side by locations, and the country was dotted with discovery holes. Rumors were in circulation of a projected railroad from Ely to Pioche, passing near Atlanta, and signs of returning animation appeared at abandoned properties in the surrounding country. But Atlanta is a low-grade camp, and the boom subsided.

In the meantime Mr. Bray and his associates exercised their option, and in the latter part of 1911 organized the Atlanta Consolidated Gold Mining Co., which, after a period of inactivity, resumed the work of development and is now proceeding with a small force of men.

The outcroppings on the Consolidated property are on the west slope of a mountain which rises to a height of between 500 and 600 ft. above the valley, the prominent croppings being near the foot. Above these croppings the mountainside is of limestone, while porphyry appears below. The orebody appears to be in the altered limestone lying along a porphyry contact which has a general north-south strike and dips west at about 45°, although strike and dip are so far indeterminate.

The most characteristic feature of the orebody is its brecciation. The length of the outcrop as indicated by outcropping masses of breccia is possibly 3000 ft. The width of the brecciated zone is over 100 ft. To the south of the present workings the masses of breccia which appear on the surface carry angular fragments of chalcedony. The gold varies with the degree of alteration, and where manganese predominates it seems to diminish.

There appear to be no definite limits to the orebodies. The outcrops wherever sampled have carried small amounts of gold. Two shafts, 300 ft. apart, have been sunk on the lower side of the two most prominent outcrops near the contact with the porphyry, and crosscuts from these shafts have shown ore of commercial grade only a short distance below the surface. The gold is largely in the free state and finely divided, so that pan tests would lead one to suppose a higher grade than that shown by subsequent assay. Developments to date have shown the lateral limits of commercial ore to have a dip corresponding to the dip of the porphyry contact, but the width of commercial ore in the brecciated zone is determined only by sampling, the values sometimes changing abruptly, but usually grading off gradually.

The workings in the two shafts comprise about 1500 ft., but the deepest development to date is only 215 ft. All the workings are dry. On the 200-ft. level the brecciated zone appears more oxidized and leached than on the 100-ft. level, with much manganese, some barite and traces of copper, but no sulphide minerals appear. The width of ore shown by sampling the main crosscut on the 200-ft. level is about 80 ft. The average gold content is lower than on the 100-ft. level, while the silver content is higher. The average grade of the ore shown to date depends upon the width considered. From careful samplings it can be conservatively stated that the workings in general show a width of 55 ft., which will average between $3.50 and $4.50 per ton, while the upper levels of both shafts show higher-grade portions of the orebody from 25 to 30 ft. in width, averaging from $5.50 to $7 per ton.

Looking across Atlanta Camp from No. 1 Shaft

The Atlanta Consolidated property is still in the development stage, with its future depending upon showing at depth. However, the widths of commercial-grade ore shown justify the hope that the property will contain much low-grade ore. Should this be realized, general conditions should permit operations at a low per-ton cost. It is probable that $3 ore can be mined and milled at a profit, based on the adaptability of the ore to cyanidation, and the feasibility of a hydro-electric power installation with a 35- to 40-mile transmission line. There are springs and small creeks in the district which would supply ample water for milling and cyaniding.

At present there is nothing going on at Atlanta except the rather limited operations of the Atlanta Consolidated and performance of assessment work by owners of sur rounding claims, who are awaiting developments at the Consolidated property. These developments should be of interest to the mining world, as they may result in adding another successful low-grade gold property to the list of such enterprises.

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"Safety First" at Butte Mines*

Safety-first work at mines meets with more difficult problems and different conditions than are experienced in mills, smelting works and shops; or, to make it more general, the men who work underground have a greater variety of chances for accidents than are met with in surface operations of any kind. On the surface, men have a general order of action in their work and fixed conditions in regard to their surroundings, while in the mine the scenery changes every shift and in a majority of cases many times a shift.

At Butte, underground as on the surface, efforts were first made to establish a set of rules concerning certain precautions to be taken in the work and the posting of many printed signs of warning. This was an easy thing to do. The troublesome part of "safety first" is the enforcement of these rules or the education that the great majority of men in mines need. Carelessness is the worst fault that a miner has, and until that is eliminated accidents will continue.

It is impossible to make every place in the mine "foolproof," because the surroundings change day after day. Guard rails and grizzlies at chutes and manways save many careless miners. Overhead stringers and lagging save others. Gates on cages and stations, inspection of machinery and tools, the best of material to work with, better sanitary conditions and bosses interested in "safety first" are protections which the company is giving the men.

On the first of each month a meeting is held, which all foremen and shift bosses attend. At this meeting each shift boss is called upon to explain the cause of accidents to his men and to suggest safeguards and precautions that may be taken to avoid similar accidents in the future.

Believing that frequent telling has no effect upon most men, all bosses have been instructed to discharge men who do not carry out the safety-first rules and who do not immediately follow the orders given to them to make their working places safe or to guard the lives of other men. There have been several cases where men have been injured after failing to obey orders, but these men have not been discharged because the lesson they learn is regarded as sufficient for the future.

Since the first of this year there have been four men discharged at the Tramway mine for disregarding the safety rules in blasting, and two other men were laid off for not covering the chute in which they were working. At the Leonard mine two men were discharged for not cribbing bad ground over timbers under which they were working. One man was discharged for leaving the guard rail of a waste chute up, and another man for working underground without protection. At the Leonard mine, also, a man was badly injured when he failed to put in stringers after he had been ordered to do so. At the West Colusa mine two men were discharged for not going to the level above while blasting in their stope.

To many this course of discharging men in every case where they do not follow orders may seem rigid, but it is considered the only way to attain the desired results for all concerned.

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*Abstract of an article in the "Anode" by Chauncey L. Berrien, assistant general superintendent of mines, Anaconda Copper Mining Co., Butte, Mont.

NEW PUBLICATIONS

METAL STATISTICS, 1915. Eighth Annual Edition. Edited by C. S. J. Trench and B. E. V. Luty. 3¾x6¼, pp. 344; American Metal Market Co., 81 Fulton St., New York, N. Y.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY, DEPARTMENT OF MINES, FOR 1913. 6½x10, paper, pp. 422, illus.; R. W. Brock, Deputy Minister of Mines, Ottawa, Canada.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE, Vol XC., No. II, 1914. Edited by George C. Lloyd, 5¼x8¼, pp. 448, illus.; Iron and Steel Inst., 28, Victoria St., London, S. W., England.

MINERALS OF PENNSYLVANIA. By Amos P. Brown and Frederick Ehrenfeld. 6x9, pp. 160, illus., Report No. 9 (1913), Topographic and Geologic Survey Commission of Pennsylvania; R. R. Hice, State Geologist, Beaver, Penn.

PUMPING BY COMPRESSED AIR. By Edmund M. Ivens. 6x9¼, pp. 244, illus.; $3. John Wiley & Sons, Inc., New York.

A handbook and descriptive treatise in a heretofore unoccupied field.

METALLURGY: A CONDENSED TREATISE FOR THE USE OF COLLEGE STUDENTS AND ANY DESIRING A GENERAL KNOWLEDGE OF THE SUBJECT. By Henry Wysor. 6x9, pp. 391, illus.; $3. Chemical Publishing Co., Easton, Pennsylvania.

ELECTRIC MINE SIGNALING INSTALLATIONS. A Practical Treatise on the Fitting-up and Maintenance of Electrical Signaling Apparatus in Mines. By G. W. Lummis Paterson. 4¾x7¼, pp. 196, illus.; $1.50. D. Van Nostrand Co., New York.

MINES AND QUARRIES: GENERAL REPORT WITH STATISTICS FOR 1913. By Chief Inspector of Mines. 8¼x13⅓; paper. Part II, Labor, 125 pp., illus.; Part III, Output, 139 pp., illus.; Part IV, Colonial and Foreign Statistics, 189 pp. Home Office, London, England.

A POPULAR TREATISE ON THE COLLOIDS IN THE INDUSTRIAL ARTS. By Kurt Arndt. Translated from the Second Enlarged German Edition by Nahum E. Katz. 5½x7¾, pp. 73; 75c. Chemical Publishing Co., Easton, Pennsylvania.

This has some sections on the ceramic industry, but does not otherwise touch mining and metallurgy.

THE ELECTRIC FURNACE IN METALLURGICAL WORK. By Dorsey A. Lyon, Robert M. Keeney and Joseph F. Cullen. Pp. 216, illus. Bull. 77, U. S. Bureau of Mines, Washington, D. C.

Contents: Design, construction and operation of electric furnaces; the smelting of metals in the electric furnace; the manufacture of ferroalloys in the electric furnace.

THE CYANIDE HANDBOOK. By J. E. Clennell. Second edition, revised and enlarged. 6x9, pp. 601, illus.; $5. McGraw-Hill Book Co., New York.

In this edition Mr. Clennell has taken advantage of the opportunity to include all of the developments and improvements, which are many, since the first appearance of the work. It remains the best general basic treatise on the cyanide process; not better than before, since that is hardly possible, but more up to date. If any criticism were to be made, it would be that the book is not practical enough for the ordinary workman, but it is not to be expected that the same work should be suitable to all conditions. As a complete exposition of the scientific basis of cyanidation, and a review of its application in general the book is supreme.

INDUSTRIAL CHEMISTRY. A Manual for the Student and Manufacturer. Edited by Allen Rogers. Second edition, revised and enlarged. 6¼x9½, pp. 1025, illus.; $5. D. Van Nostrand Co., New York.

The principal subjects discussed are: General processes; water for industrial purposes; fuels; sulphuric acid; chlorine and allied products; electrochemical industries; lime, cement and plaster; clay, bricks and pottery; glass; white lead; zinc oxide; pigments and paint oils; mixed paints; fertilizers; illuminating gas; coal tar and its distillation products; the petroleum industry; lubricating oils; soaps and soap powder; glycerine; shellac; rubber and allied gums; varnish; sugar; starch, glucose, dextrin, and gluten; brewing and malting; wine making; distilled liquors; textiles; dyestuffs and their application; explosives; leather; glue and gelatine. The work contains many other chapters, and each subject is treated by a recognized authority in its field. It is a useful reference work for anyone coming into contact with the commercial side of chemistry.

Correspondence and Discussion

Why Is the Patent Mania?

Referring to Stuart Croasdale's article in the JOURNAL of Jan. 30 on "Why is the Patent Mania, or Why the Patent Office?" it is doubtful if his views will be shared by many who have had occasion to work along patent lines.

Except for certain defects, which it is hoped will soon be remedied, it is difficult to see how the present patent system could be greatly improved. If the restrictions suggested by Mr. Croasdale were carried into effect, so that only basic principles or radical improvements could be patented, the entire patent system would be nullified, and this is one of the greatest calamities that could happen in the United States. What is a "basic principle," and what is a "radical improvement"? How is it to be decided? Who is to decide? There is only one way in which an ineffectual attempt could be made, and that would be to go through a regular court proceeding for every patent application. This would mean that every patent would have to be litigated instead of comparatively few. The result would be that men of ordinary means who had intellectual property to protect could not protect it, and that would mean an end to the entire patent system, for, after all, it has been the men of very ordinary means who conceived and patented most of the great inventions.

Take the cyanide process, for example: There are two sets of patents which, if any, would come under the class of "basic" and "radical improvement"; these are the original MacArthur-Forrest patents and the suction-filter patents. The MacArthur-Forrest patents made the cyanide process workable, and the suction filter revolutionized and broadened its application. Few metallurgical patents have been the cause of as much litigation as these, and yet after all testimony bearing on the subject had been thoroughly threshed out in the courts the patents were sustained in some countries and defeated in others. Even in the same country there was no unanimity of opinion. How then can the patent office decide on the merits of the case when an application is presented to it? No one ever yet invented anything so wonderfully new that some had not thought along somewhat similar lines before. It is for this reason that the Gevernment regards all patent applications as an "improvement" in the art. Is it not an absolute fact that it is mostly the patents which are termed "basic" or "radical" that are most bitterly contested?

The present patent system is by far the best. If the patent office has a reasonable doubt as to the merits of an application, the applicant should be given the benefit of the doubt. Certainly if a man has a questionable right to intellectual property, he should have the same privilege of establishing his right as a man who may have a questionable right to material property. It costs the man to defend his patent quite as much as it costs the man he claims is infringing, and no patentee is going to commence infringment proceedings, and meet the expenses incidental thereto, unless he is well advised.

Practically everything used in the metallurgical art is either patented or has been patented. If a user buys a metallurgical machine which is modern and up to date, whether he knows it or not, he is certainly paying for the patented improvements, and the only way to avoid it is to take the art as it was 17 years ago. Take, for example, a modern MacDougall furnace. It is questionable if any of the patents now in force on the MacDougall type of furnace would come under the head of "basic" or "radical," and yet it is precisely these patents that have made the MacDougall type of furnace what it is today. It is only right, therefore, if a user wants the benefit of those patented improvements that he should pay for them, or if he does not want them, to build a MacDougall furnace as it was 17 years ago or make his own improvements. No one denies him that privilege.

The import of a patent is never known until it has been thoroughly exploited, and patents are not usually exploited at least until the application is acted upon. Even inventors themselves are usually ignorant of the full significance of an invention or its best application at the time of filing; then how is the patent office to decide on its true merits? Few patents, indeed, are fully exploited until much of the time allotted to them has expired.

It is a fact also that ideas lie dormant until someone with energy and willingness to sacrifice comes along and shows their utility and gives them definite shape, and then the literature of the entire world is ransacked to show that there is nothing new under the sun.

No class of men, taken as a whole, gets as little from the Government for their labors as patentees. Let us compare, for example, the privileges of a patent with other governmental privileges—locating mining claims, for example. If an inventor applies for a patent—that is to say, for what he regards as intellectual property—the United States, the English and the German patent-office records are at once ransacked to see that he does not get anything that does not belong to him. If anything anticipating him is found in the literature on the subject or in the domestic or foreign patent-office records, his application is denied. He must in truth be the original and first inventor or at least establish a reasonable doubt, and then he is given a right for 17 years, which right may be attacked or questioned in the courts at any time. And this is as it should be, because the other fellow may have some rights in the matter.

Now suppose a man wants to get material property—say a mining claim. If the claim has been "discovered" a thousand times, and he is the one thousand and first one to locate, he is still the "discoverer" in the eyes of the law, and so far at least as the government is concerned, he may acquire the property for himself and his heirs forever, and a patent having once issued its validity cannot be questioned. If the same rules were to apply to the location of mining property as apply to process or apparatus patents, a mineral deposit, once discovered and then abandoned, should never again be open to location.

What, then, is the use of saying that a man who has a process or apparatus patent has more than he is entitled to? All he gets, at the best, is the privilege of establishing his rights in the courts. Before a patent is issued the records are pretty thoroughly searched, and it is not an easy matter to get a patent on an application that does not possess merit and originality. It is true that shrewd patent attorneys sometimes get patents that should not be allowed, but no scheme is entirely free from error. It will also be found that the patent office draws a strict line between "combinations" and "aggregations" and that it is difficult to put through an application on mere "aggregation."

It is a question whether any patentee ever got fees or royalties that did not belong to him. Certain it is that until quite recently patentees were obliged to be public benefactors, for in many cases patents have expired and the inventors passed into the Great Beyond before the final court decision was awarded, and many inventors were deprived of their rights through mere exhaustion. Unless an investigator can get ample protection he will not investigate, and the metallurgical art, above all others, owes much, if not everything, to patentees. The patentee himself is usually the one to get the least benefit.

The liberal patent laws of the United States have done much in making the Americans the foremost inventors in the world. Any defects in the patent system should be remedied from time to time, but it certainly would be a grievous mistake to make a radical departure.

There is a bill now before Congress to insert a two-year working condition in the patent laws. If such a bill is passed the patent system might as well be abolished. All the Latin republics of South America have such working provisions, and do they present an enviable example? How many patentees could faithfully comply with a two-year working condition? Probably not one in a hundred, especially in chemical and allied metallurgical patents. And if the working conditions are nominal, as in the Latin-American republics, why burden the poor devil of an inventor with such an unnecessary graft? For graft is all it would be. Why issue a patent at all, if there is such a string to it? Either the inventor is entitled to his intellectual property or he is not; if not, he should not be given a patent, and if he is, his possession should be as absolute as the Government can make it. Patent litigation is even now burdensome enough, but this is not even a circumstance to what it would be if a working clause were inserted in the patent laws. So long as an individual can hold a piece of ground indefinitely without improving it, and so long as an individual can hold patented mineral land without improving it, so long, at least, should a patentee of a process or apparatus be entitled to his intellectual property under the same conditions for 17 years.

What is most needed in patent reform is a technical patent court to hear patent cases and expedite patent litigation. And in addition to this, a patentee should be obliged to show diligence in acting against infringers, and if he does not show diligence, fees, royalties and damages should be limited to such a time as would be dictated by diligence—say two years. He should not be allowed to threaten indefinitely and not bring action, nor should he be allowed to let the infringement proceed indefinitely, and then expect to collect years of back fees and royalties on accounting. Both the patentees and the public would be greatly benefited if these two evils of the present patent system could be remedied.

W. E. GREENAWALT.

Denver, Colo., Mar. 10, 1915.

[We think probably the gist of the whole matter is in the last paragraph—the need of a technical patent court, in which expense and delay would be reduced to a minimum. The argument as to its costing the defender of a patent quite as much as it does the infringer seems to take no notice that, with a new device, one is usually an individual, the other a corporation.—EDITOR.]

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The A. I. M. E. Meeting

Misther Editor: Well, I was illicted to Tim's minin' society without a dissentin' vote. The Public Service Commission engineer boy watcher bein' called as a witness wan day last week, we cud not do anny work on the subway contract, so Tim an' I attinded the meetin' av the men that folly minin'. There's manny a man follies it with more or less success. Some gets plain tired av the chase, an' others like me an' Tim sits back wance in a while an' studies its habits while we mend our traps an' get the grub ready.

Some folks folly minin' with a rope, aimin' to hog-tie it an' put their own brand on it; while other fellies are content with minin' folly. There's plinty av raw material.

Well, whin we got to the hall Tim luks over a table filled with sheets av paper for the college men to register their affillyayshuns; but some wan had neglected Scranton. So Tim an' I swallyed our disappointment an' tobaccy, rayspictively, an' passed in to the show.

A young felly made some cubist pictures with colored chalk an' put up a good argymint for Montany as a lodgin' place for min'rals. After assignin' rooms on different levels to each kind av min'ral an' gettin' thim all nicely to bed he heaved a sigh av relief an' sat down amid applause an' the hearty approval av mesilf an' his inspirayshun. Whin some av the older wans wint after him like Samsons an' Goliaths, inspirayshun give him a smile av encouragement an' he jumps up like a husky David, lettin' fly a few rocks av the raysarve stock. An' so it went, back an' forth; wan side beltin' the other over the head, figuratively speakin', with a few square miles av granite, an' the other side claimin' a Scotch verdict on copper at great depth but offerin' no alibi.

Whin the referee called it a draw an' adjourned for lunch, wan av the plain minin' engineers sez to another, "The geologists seem to have had the floor." Sez the other, "They have the floor, the hangin' wall, the hoist, the mill an' the compressed-air plant. 'Tis good free-millin' stuff, but they ought to concentrate a little."

Now, Misther Editor, I understand some av the minin' words, but I'm hazy about that rock talk. Was it argymint, was it advertisin', or was it the inishyayshun av the neophyte? Whin I speak my first piece before the organizayshun I'll coax my inspirayshun to go along an' listen; but I'll tell Kathleen to carry a rollin' pin under her *rebosa*, so as to be prepared for anny evenchooalities.

BILL MCGINTY.

Brooklyn, N. Y., Feb. 24, 1915.

Editorials

What Brought About the Collapse in Spelter

When the price for spelter rose above 7c. and started to soar to dizzy heights, a collapse was inevitable. The only question was when it would come. The higher the price went and the more acute the situation became, the sooner was the break to be expected. The advance started from firm ground, statistically, with the exception that the shortage in supply was of spelter, not of ore. There is evidence that the supply of American ore was increasing last December, and of course there was always the huge supply of Broken Hill ore, the blockade of which was the source of all the trouble.

The buying of spelter for consumption is in the main the negotiation of contracts for delivery ordinarily during the ensuing two or three months, the seller thus disposing of the spelter that he expects to make from the ore he takes in. A few smelters sell no spelter until they have made it, but the bulk of the business is done otherwise.

Now, when the market began to advance in January the smelters sold their contracts as usual. The absorption of the small stock of spelter on hand deprived the market of its flywheel and everything became unbalanced. Consumers who were caught short paid large premiums for such prompt metal as could be scraped up, but being apparently of the opinion that they were the victims of an artificial corner they did not quickly enough pay attention to the usual deliveries of the trade.

In the meanwhile the extraordinary prices stimulated the production of ore in all quarters and the smelters taking it in had to sell further and further ahead against it, the supplies becoming more than could be converted into spelter in the ordinary time. The smelters were aware they were riding the whirlwind. Of prompt spelter the market was practically bare, but for April delivery there was considerable available, and of May probably plenty. If spelter for delivery beyond May could be sold in sufficient volume the metal remaining on this side might fetch premiums. The market could have been broken at any time by releasing early deliveries.

Obviously the explosion was bound to come as soon as contraction in consumption and expansion of production intersected so as to strike the spark. The first manifestation of disruption was the common-sense disinclination of anybody to buy the distant futures that smelters were obliged to sell, then the refusal of Europe to buy any more spelter at the prices asked here. Next ore prices sagged, while spelter was still nominally rising. Some ores became unmarketable. Zinc miners who always had wanted a high price experienced the strange sensation of seeing spelter at the acme of price and of being tantalized by the unwillingness of anybody to buy their ore at all. The largest producer of zinc ore was notified that after Mar. 1 only the contractual minimum would be accepted. The producer made arrangements elsewhere for the smelting of its surplus on toll, which immediately added greatly to the probable production of the United States by returning a large inactive and moribund smelting capacity into use. The climax came when a canvass of the galvanizing districts exhibited a greater curtailment of consumption than anybody had previously supposed to be the case. There was immediately an effort to sell spelter for the usual deliveries, but nobody then wanted to buy.

One of the great evils of a period of high price for spelter is the incentive to put money into the building of new smelting works, the equipment of new concentrating mills, the opening of new mines, etc. When the boom has departed the industry finds itself overbuilt and then comes the long, lean time of strenuous competition and narrow margins while the demand is growing up to the productive capacity. The recent events in spelter were different from those of any previous rise, both in cause and in nature, and being so short we probably shall not suffer the consequences so badly as we have previously. Even in its slump spelter has lodged at what is normally a high price, and it may be expected to remain high while the war continues. Once the war is ended there will be available so much smelting capacity that spelter will find its natural level.

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Copper Miners' Wages

In several important copper-mining districts wages had to be reduced last August, but in all cases the companies were as considerate of their men as circumstances permitted, in many cases keeping all of their men on part time, and in those cases where dismissal was necessary giving consideration to the men having families. The miners throughout the country faced the situation without a murmur, recognized intelligently that their employers were in no wise to blame for what had happened and were in no way trying to get the better of them; and indeed the men expressed to their employers their appreciation of the consideration with which they were treated. This exhibition of good will on both sides was a bright thing in a gloomy time and will perhaps contribute toward a better mutual understanding in some controversial matters of the day. The sincerity of the copper-mine operators has recently been well demonstrated by the advances in wages that they made voluntarily when the price of copper rose to a figure which enabled them to produce profitably.

The average cost of producing American copper—which is to say about two-thirds of the world's copper—is probably about 10c. per lb. for direct operating expense. The porphyry mines do it for less than that, the Anaconda, Phelps-Dodge and Calumet & Hecla mines experience just about that figure, while there is a considerable production by other mines that runs up to 12 or 13c. per lb. The plant investment for copper production is about 15c. per annual pound of output. If a producer found a mine and borrowed the capital necessary for its equipment at 6% and set aside 3% for paying it back and 5% for replacement of parts wearing out he would have to get about 12c. per lb. for his copper to come out even. If he bought the mine he would have to get more. At the rate most stockholders have paid they probably ought to get about 14c. in order to get their money back with a reasonable net income. At anything less than 14c. per lb. for copper their dividends begin to be trimmed. At about 12c. they really begin to be out of pocket. This reasoning finds confirmation in the knowledge that all the copper sold during the 10 years ended with 1913 realized an average of 11½ to 11¾c. per lb.

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Safety First at Butte

As noted elsewhere in this issue, safety-first work at Butte is proceeding apace. The Anaconda company now requires all foremen and shift bosses to assemble each month to discuss accident prevention. It issues a monthly bulletin on this subject and has erected numerous gates and signs to promote the safety-first idea and keep it before the attention of the miners. More efficient than these, we surmise, is the rigorous action taken by the company for violations of the safety rules. Since the first of the year, a dozen men have been laid off or discharged from Anaconda mines for disobeying the safety rules. This is the quickest, surest and perhaps the only way to get the safety-first idea established on a working basis, as many miners will continue to disregard safety rules unless some penalty be attached. The unions have been as lax in forcing their members to promote the safety of their fellows as they have in promoting individual efficiency. The "open shop" prevailing at Butte, together with general industrial conditions, make the present an excellent time for establishing the safety-first movement on an efficient basis.

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The Benzol-Toluol-Gasoline Madness

We have long been accustomed to saying that metallurgical researches and installations go by fashions. Everybody jumps simultaneously into coal-dust firing, or leaching experiments, or into flotation, or long blast furnaces, or grows excited as if playing a game of follow-the-leader.

And so it is that when Dr. Walter O. Snelling comes before the American Institute of Mining Engineers with a new gasoline process, which greatly excited that meeting, according to all veracious reports, probably because most of the excited ones knew very little about the matter, we immediately hear from Dr. Walter F. Rittman that he has discovered a method of producing gasoline, benzol and toluol from crude oil, and immediately afterward Thomas A. Edison likewise blossoms forth with a benzol plant.

Speaking seriously, just what is this all about? We have become accustomed to the Scotch shale-oil distillers producing a light motor spirit, an illuminating oil (paraffin) and a heavy series of oils, which seems to be essentially a cracking of hydrocarbons of heavy molecular weight into those of light. We have seen the Burton process producing over 70% of gasoline from Pennsylvania crude. We have heard of an independent plant where a heavy residue from which all the gasoline had been removed by an ordinary distillation was cracked to produce 15% of gasoline, without, so far as we could see, infringing on the Burton patent. We have seen German references going back to 1906 to a process for producing toluol and benzol from petroleum hydrocarbons. We have seen Doctor Rittman's own thesis, now nearly a year old, in which all essentials of his process seem to be developed and made public. Why all this present excitement?

Therefore, before going on cheering over these processes, can we not stop long enough to have some explanations of wherein the "revolutionary discoveries" differ from what has been known, wherein the discoveries are more at present than interesting laboratory processes, such as is the synthesis of alcohol, using lime, carbon, water, sulphuric acid and an alkali, and whether we should ever have heard of them had not the war cut off the supply of benzol and toluol from Germany; and having heard of them, whether they are not doomed to die a-borning by the pressure of those processes already turning out benzol and toluol from coal distillation?

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The elimination of the side door from reverberatory matting furnaces is now taking place as the result of feeding and fettling through the roof along the sides of the furnace. When this system of feeding and fettling was applied at the furnaces of the Canadian Copper Co., at Coppercliff, Ont., in 1913 and found to be successful, the side doors were bricked up. When the coal-dust firing, successfully worked out by the Canadian Copper Co., was applied at Anaconda and the furnace there remodeled, no side openings were made as it was felt that the new feeding arrangement would protect the side walls satisfactorily; however, some fettling was found necessary near the skimming end and charge pipes were then installed the entire length of the furnace so as to protect the walls at the skimming end. The newly changed No. 5 furnace at Anaconda is similarly arranged. Though the side doors of the Steptoe furnaces at McGill, Nev., have not actually been eliminated, they no longer have side-door coverings; the openings are piled full of fettling material which is left on the outside sill or shelf of the old door openings; the fettling is still applied with shovel and ladle through the side-door openings, but the general tendency now is undoubtedly toward the elimination of this feature and the making of solid side walls along which the charge and fettling will be dropped.

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It will be interesting to figure out the connection between the coal-dust firing or reverberatory copper-smelting furnaces and the flotation process of ore concentration. The dust-fired reverberatory has sounded the death-knell of the blast furnace, and consequently the roasting furnace—of course, some one of the McDougall type—comes into its own again as a preliminary to the smelting furnace. This locks in with the flotation process which produces a sulphide concentrate. The new plans at Anaconda require 28 Wedge furnaces, we understand. The turning of the Anaconda staff from the Evans-Klepetko type of McDougall to the Wedge type is also an innovation in Montana practice that is worthy of notice.

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Things in Mexico have gone from bad to worse. Never were they so bad as now. The situation is characterized by one word Chaos. The questions are asked here: "What are we going to do about the assassination of McManus?" "Why did we occupy Vera Cruz and then withdraw?" The American government has no program. A Mexican government does not exist. There is not even any strong party in Mexico. Let the rival chieftains carve that unhappy country into palatinates, if they want to. Let Washington aid anybody who is strong and promises to be responsible. But let there be some kind of a policy tending toward restoration of order.

BY THE WAY

The Peruvian Corporation, Ltd., which manages most of the railways of that country and does some mining incidentally, is having trouble with the present Peruvian government in regard to its rights to mine and ship guano. When the Peruvian Corporation was formed to rehabilitate the Peruvian finances, it was granted, among other considerations, the right to mine and ship 2,000,000 tons of guano. It considers that these rights are infringed by the law passed by the last Peruvian congress declaring a preferential right in favor of the national agriculture.

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The Surrogate's Court in New York has ordered a reappraisement of the estate of the late Herman A. Frasch, to the original valuation of which reference was recently made in this column. The chief reason for the order was that the appraisement of Union Sulphur stock at $2250 per share was too low. In court is was stated by counsel that the company had paid dividends as high as $4,500,000 in one year; that these profits had far exceded the value placed on the stock. These statements were not supported by evidence presented in court, but were sufficient to induce the Surrogate to order a new appraisement.

⁂

Recently in the *London Financial News* an account was given of an accident which occurred at the City Deep circular shaft and resulted in two white men and several natives being killed. The accident was due to a round of holes being fired by a flash of lightning, and at the time was described as unique in the history of electric blasting on the Rand. Early last month, however, the possibilities of lightning playing down the wire ropes of a shaft were again demonstrated. For a second time a round of holes which had been connected was fired by lightning, with the result that a white miner was severely cut about the head and a native was killed.

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A contributor to the *Chino Herald*, telling of experiences during a summer trip into the desert, narrates that while he watched a lizard run across a sunbaked open strip of sand, it disappeared in a puff of vapor. The intense heat of the sand had turned the moisture of its body into steam, the pressure of which rose so high that the little creature was blown into bits so minute that no trace of it was afterward to be found. In backing up his statement, he quotes an old prospector's allegation that in Death Valley, during the heat of the day, water poured from a canteen will not reach the ground, being turned into steam as fast as it leaves the mouth of the canteen. Can you beat it?

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At the Last Chance Mine, at Wardner, on Oct. 3, 1914, Leslie Wilson, employed as a miner, while assisting the pipe men in a raise, was standing on a platform of 3-in planks forming the floor of a drift set that connected with the raise. The connection was completely floored over, except for one plank 12 in. wide and 5 ft. long. When he let go his hold on the small pipe which was being bent he fell through this hole to the level below, and received, among other injuries, a fractured skull, from which he died later. One of the victim's assistants in this work was standing within 6 ft. of him but had his back toward him and did not miss him until he heard a noise down in the raise. It is hard to conceive how a man could fall through such a hole in a normal condition, as it was a snug fit for an ordinary sized man's body.

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Robert N. Bell, the state mine inspector of Idaho, always enlivens his annual report with picturesque language. Here is his account of an accident of a kind that is becoming more and more common in mining. It is a foolish accident, but never an amusing one, inasmuch as the fool almost always loses his life.

> An experienced timberman, while attempting to blast a hung-up ore chute, was caught in the sliding muck and smothered to death. The chute had an opening from an adjacent manway through which the powder could have been pushed on the end of a stick, but the victim took the chances of going personally up the chute to place the powder, which was about as foolhardy a thing to do as it would be for a man to climb into a loaded cannon of 4-ft. caliber, with an intoxicated force known as "natural gravity" lolling on the trigger.

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Another one of our contributors has fallen into the vice of relieving his feelings in verse, the following being his essay:

CALLED BACK

Prospectin'? Well, I reckon you
Might call it that, but what I do
Is look around an' hammer rocks
An' never think of minin' stocks
Nor grubstake deals an' like o' that.
I jest puts on my old slouch hat
An' prowls around the mountains here
An' ketch some trout or kill a deer.

Then p'rhaps some day I'll find a vein,
Or strike some little creek again
With gravel rich enough to dig
By hand, or fixed so I can rig
A little boom-gate with a dam;
Then I can stretch myself back ca'm,
An' smoke my pipe where I can see
Old Mother Nature work for me.

That's how I made my first big stake;
An' every Saturday I'd take
The riffle poles from water cold
An' harvest crop of yellow gold.
Then all the week the pond would fill
Up night and day from mountains rill
Until, all with a rush, she poured
A torrent forth to bare the hoard.

Gone busted? Yes, I have done that
At times; an' tossed a fine silk hat
Up with the crowd at races, too,
An' opened wine for birds that flew
As high as any you have seen.
(I reckon you know what I mean.)
But, still, I weren't what you'd call wild;
An' nowadays I'm pretty mild.

Yes, mild and meek is what I am,
An' down home I don't dare say damn,
For fear a certain toddlin' mite
Will lisp out "Gran'pa, 'tisn't right
To say such awful naughty words." ——*
I swan — She twitters like the birds
Say, stranger, come to town with me
My motor's down behind that tree

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*Business of wiping sweat from brow with faded bandanna.

Gold Deposits in Alabama

There are a number of paying deposits of gold in Alabama which will probably be worked profitably in the future. In fact more than $500,000 has been credited to the state by the U. S. Mint, and it can be safely estimated that the yield was more than double this amount, for a great deal of gold was mined which was never reported to the Mint, according to R. C. Barnard, writing in the *Birmingham News*. This was because, until recent years, no systematic means were employed in gathering statistics, and a correct estimate would have been absolutely impossible.

The gold was obtained principally from placer mines, which were worked in a crude and extravagant manner. It is usually true that the placer deposits of any gold-mining country, while the first to be mined, are of secondary importance, and soon worked out.

The lode ores of Alabama are not refractory, and can be worked by well known processes which deliver high percentage extractions. They occur in the Algonkian formation, which in Alabama is composed principally of argillaceous, gneissic and micaceous schists, traversed by belts and dikes of granite, diabase, diorite, and various other granitic rocks. The gold is found in quartz veins, placer deposits, and in some of the pyritic rocks. Quartz veins occur in fissures or openings in the country rock, and have been variously classified. Owing to their tendency to assume a lenticular form they have been often called stringer leads. Often the smaller stringers are disconnected, but can almost always be found again in the foot or hanging wall. The veins are of imbricating character and usually show much shingling.

The auriferous rock of these veins consists of quartz of various kinds and colors, varying from pure white to brown or a bluish black. Gold-bearing sulphides are often found in the quartz, and near the surface, where the sulphides have become oxidized, the gold is free and amenable to amalgamation. At depth, where the pyrites are unaltered, the ore, although equally auriferous, is refractory and yields only a part of its value to the plates of the ordinary stamp mill. This problem can be solved by giving the pulp, after it passes over the plate, a secondary treatment by the cyanide process, to which the ores have been shown to be amenable.

The deposits should be explored below the line of oxidation, or to where the solid rock is to be found in place, in the hope that gold will be found to permeate the whole structure, as it does in many large, paying, low-grade mines. Under ordinary conditions if an average value of but $2 or $3 per ton could be maintained in these large orebodies the mine would be assured of success. A number of these deposits have been worked in Alabama in the past, but only so long as the decomposed rock could be sluiced, or the free gold saved with quicksilver.

In some localities these large ore zones can be traced by a system of pits, which today are nearly filled with rubbish and cavings. These pits were dug many years ago, before the establishment of an authoritative record, and in many places are quite extensive, much larger than would have been required in mere prospecting. But of course at that time it was utterly impossible to save anything but the placer gold; therefore it followed that as soon as solid rock was reached, although auriferous, operations were necessarily suspended.

Many of the gold ores in Alabama are particularly adapted to the cyanide process, and if they are given a fair trial by competent and experienced men I firmly believe there will result the redemption of many old mines and the opening of many new ones.

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Lead Imports and Exports

The imports of lead into the United States in 1914, as compared with previous years, showed a remarkable decrease, which was chiefly in the receipts from Mexico. These imports are almost entirely of metal in ore and base bullion, to be refined here. On the other hand, the exports for the year showed an increase of 80.1%, owing to the large shipments of domestic lead, which compare with a negligible quantity in 1913. In 1914 these were 73% of the total exports. The extraordinary demand in Europe, coupled with a decrease in home consumption, easily accounts for these changes. The exports were mainly in the second half of the year, as shown in the accompanying table. Those reported in the first half were chiefly in May and June, as follows:

IMPORTS AND EXPORTS OF LEAD, 1914
(In Pounds)

		Exports		
	Imports	Domestic	Foreign	Total
First half year.	25,628,703	40,323,662	17,666,875	57,990,537
July	1,523,614	21,787,779	2,237,414	24,025,193
August	4,117,601	10,657,551	....	10,657,551
September	3,841,648	5,585,246	1,845,692	7,430,938
October	6,707,267	15,659,012	5,041,979	20,700,991
November	6,265,514	16,833,879	10,593,265	27,427,144
December	8,569,709	6,281,771	5,703,050	11,934,821
Second half ..	31,025,353	76,805,238	25,421,400	102,226,63
Apparent correction	22,747	315,000	2,100	317,100
Totals for 1914.	56,676,803	117,443,900	43,090,375	160,534,275
Totals for 1913	114,293,966	....	89,087,111	89,087,111

The line of "apparent corrections" in the table expresses a discrepancy of the monthly and yearly statements, which seems to be due to small corrections made in the monthly reports after their issue. In 1913 no exports of domestic lead were reported in quantities, though there were exports of "manufactures of lead" valued at $738,135 during the year.

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Route of Alaskan Railway

President Wilson has decided upon the route for the Alaskan Railway, the building of which is to begin this spring, according to reports from Washington dated Mar. 16, but an announcement will await the outcome of negotiations with one of the two existing lines which the Government may buy. Secretary Lane said before the Cabinet meeting, Mar. 16, that the announcement might be delayed several weeks and until after his return from San Francisco.

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Juneau Harbor

The photograph on page 456 of the JOURNAL of Mar. 6, 1915, is erroneously described, due to a mistake in the caption furnished by the photographer. It is not a view of the harbor of Juneau, but of Wrangell harbor, Alaska.

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Radium, Uranium and Vanadium ore production in 1914 in the United States amounted to 4300 tons of dry ore, according to the U. S. Geological Survey, carrying 87 tons of uranium oxide and 22.4 grams of metallic radium. The total amount of vanadium in the carnotite and other ores mined was about 432 tons. Two companies produced radium during the year, the Standard Chemical and the Radium Co. of America, and Dr. W. A. Schlesinger opened a radium-refining laboratory

PERSONALS

John T. Fuller is president of the Fuller-Shepherd Mining Co., operating at Rush, Marion County, Arkansas.

Charles E. Dyer, of Denver, has moved to Ray, Ariz., to join the engineering staff of the Ray Consolidated company.

D. C. Jackling and F. S. Janney will start soon on a trip to inspect the property of the Alaska Gold Mines Co. in Alaska.

Thomas M Skinner, Jr., whose former address was Box 41, Red Cliff, Colo., is now with the Inyo Development Co., of Keeler, California.

H. L. Heath has resigned his position with the Smuggler Union Mining Co. at Smuggler, Colo., and is now with the Crown Point Mining Co. at Gold Hill, Nevada.

Leo Von Rosenberg recently left the Ray district, Arizona, and has gone to the Cripple Creek district in Colorado. He will return to New York about the end of March.

A. A. Hassan has his temporary address with the Tennessee Copper Co. at Copperhill, Tenn. He is examining manganese ore deposits in Tennessee, West Virginia and Virginia.

Dr. H. T. Kalmus, who for the last five years has been conducting experiments in metallurgy at the School of Mines, Queen's University, Kingston, Ont., has completed his work there and returned to Boston.

Frank H. Sistermans has returned from a professional trip to the northwestern part of Nicaragua, Central America, after an absence of over two months, and is again with the Mines Management Co., at 60 Broadway, New York.

Charles Cantley, former assistant manager of the Nova Scotia Steel & Coal Co., and son of Thomas Cantley, the general manager, has been appointed quartermaster-general with the Canadian expeditionary force in France.

George O'Brien, instructor in training at the Provincial Government mine-rescue station at Fernie, Crow's Nest Pass, B. C., has been appointed a district inspector of mines in British Columbia to succeed the late Evan Evans.

J. L. Nichols, of the Pittsburgh Crucible Steel Co., has been appointed assistant superintendent and assistant metallurgist of the open hearth department at Midland, Penn. Mr. Nichols has had five years' experience making different kinds of steels.

Frederick Brulé, who was superintendent of the surface department at the Washoe reduction works at Anaconda, some years ago, has recently been appointed superintendent of the surface department at the Boston & Montana reduction works.

T. J. Vaughan-Rhys, for several years connected with mining in the Portland Canal district of British Columbia, is now developing a mine situated near Rocher Deboule Mountain, a few miles from New Hazelton, in the Skeena district of that province.

M. E. Appelbaum has moved his offices from No. 55 Liberty Street to the United States Rubber Co. building at No. 1790 Broadway, corner of 58th Street, New York. The location of large copper brokerage offices so far up town in New York is a decided novelty.

Dr. August Ledoux, who was professor of mineralogy in the University of Brussels before the war, and was wounded at the battle of Liege, has received a special appointment as lecturer on the staff of the University of Toronto and will devote much of his time to research work

T. A. Rickard is on his way from London to San Francisco, where he intends to make his permanent residence, taking entire editorial charge of the "Mining Press." H. Foster Bain for some years past editor of the "Press" has gone to London to take charge of the "Mining Magazine."

Richard Wareham, a retiring carpenter, residing in Hancock, Mich., helped to frame the timbers for the first stamp mill erected by the Calumet & Hecla Co. at Lake Linden in 1867. He has the plans of the original mill, drawn by the late Alexander Agassiz in his own hand, on ordinary brown wrapping paper, at Calumet. Mill was 83x50 ft. built by a contractor named Palmer

H. G. Wright, formerly chief draftsman at the Washoe reduction works, has been appointed superintendent of construction and will have general charge of the new work that is to be done at the converter and reverberatory-smelting plants at Anaconda J. B. Johnson, formerly assistant, has been appointed chief draftsman, and S. Bishop has been made assistant chief draftsman. The Anaconda Copper Mining Co. is now employing about 75 draftsmen at the Washoe reduction works, and about 20 at the Boston & Montana reduction works. This force has been organized for the purpose of drawing up plans for the extensions to be made at these works and is said to be the largest engineering force ever gathered together in the Rocky Mountain district.

Roy O. Olivier has been appointed superintendent of the Franklin stamp mill, in the Michigan copper country, in place of Edward Wearne, deceased. Mr. Olivier is a graduate of the Michigan College of Mines. Upon graduation he went to the Franklin, working first as trammer, then miner, then lander in the shaft and then engineer, later as assayer and assistant to the superintendent of the mill

OBITUARY

Carl Benjamin Franc, a mining engineer, died of typhoid pneumonia on Monday at Gold Road, Ariz., where he had been superintending mining operations for the past six years. Mr. Franc was born in Brooklyn 31 years ago and was a graduate of the Columbia School of Mines.

William H. Cole, of Duluth, Minn., head of the Cole & McDonald Exploration Co., died on March 9, at Pasadena, Calif., where he went to spend the winter. The funeral took place in Duluth on Monday, March 15. William H. Cole was one of the prominent mining figures in the Lake Superior field and an authority on mining exploration work. He was directly responsible for the opening of a number of the large iron properties on the Mesabi and other Minnesota ranges. He was interested in the Whiteside, Agnew, Buffalo & Susquehanna and other mines. He was also the president of the American Exchange National bank, of Duluth, one of the strongest financial institutions in that city. Mr. Cole was born in Ontonagon, Mich., 58 years ago. At an early age he became interested in diamond drill work, and went to the Marquette range in 1879, where he assisted in putting down the first drill holes on that range. He was at that time connected with the old Bullock company, which was later taken over by the Sullivan Machinery Co. In 1885 he went to Tower, Minn., on the Vermilion range, where he assumed charge of the exploration work for the old Minnesota Iron Co. He continued with that concern until 1892, when he resigned to go into business as an independent diamond drill contractor. He formed the Cole & McDonald Co., which was later changed to the Cole & McDonald Exploration Co. At the time of his death he had retired from business to a large extent.

After a continuous search of over three months, through all parts of rough and almost impassable mountains, the body of Captain Michael Cooney, noted mine operator and member of the Board of Regents of the New Mexico School of Mines, was found in an arroyo near Turkey Creek 50 miles north of Silver City, N. M., in the Mogollon range. The remains were decomposed but were packed to an automobile road three miles where they were removed to Silver City and later shipped to the old home, Socorro, N. M., where interment took place Feb. 21. Captain Cooney left his home at Socorro on Oct. 26 with his two pack-ponies, "Tom" and "Jerry," for a prospecting trip in the country surrounding his former haunts He was 76 years old, but was strong and hearty and went on his trip alone From the day he left nothing had been heard of him Many searching parties had gone into the mountains but each effort was futile as severe snow storms drove them back Robert Lewis, the Socorro County cattle inspector and several associates, found the body on Feb 15 Death was doubtless due to exposure, and lack of food and water. One of the horses had met death by falling over a steep cliff but the other was found wandering not far from the corpse Captain Cooney's saddle was found and tied at the horn was a pocket diary in a cloth bag. The diary contains a pathetic account of the prospector's adventures from the day he left his home until Nov 15. It depicts the suffering and endurance of the aged man Throughout the pioneer keeps in constant thought his two horses. At times he writes of smelling cooking meat and hearing the ringing of bells Toward Nov 12 he found water but was overcome in the storms that followed His last entry was made on Nov. 15 and reads: "Let in a little sun and feels better." The writing was firm until the last. Captain M Cooney, was a brother of the late J C Cooney the noted scout, Indian fighter and prospector, who discovered the gold and silver veins of the Mogollon mountains and who was killed by Indians while operating the mines at the camp near Mogollon bearing the family name "Cooney." The late Captain M. Cooney came to New Mexico following the death of his brother in 1880 and took up the mining work where his brother had stopped. He was at various times, mayor of the town of Socorro, N. M., county treasurer and member of the state legislature. He is survived by a wife and one son. The house of representatives at Santa Fé adjourned out of respect to his memory. This closes another chapter in the passing of the pioneers of New Mexico as practically all the early prospectors and developers in the Mogollon mountains are gone. In Captain Cooney the state loses one of its best citizens and mining men.

SOCIETIES

Engineers' Club, of Virginia—A meeting of the club was held March 11 in the public library at Virginia, Minn. A. A. Beville read a paper, entitled "The Engineer and His Work."

Colorado School of Mines Scientific Society—At a meeting held at Golden, Colo., Feb. 26, the following officers were elected. V. D. Howbert, pres.; C. E. Carstens, vice-pres.; F. E. Briber, corresponding secretary.

American Chemical Society—The fiftieth meeting will be held at New Orleans, Mar. 31 to Apr. 3. The headquarters of the society will be at the Grunewald Hotel; meetings will be held there and at Tulane University. At the close of the meeting there will be an excursion to the salt mines on Avery's Island.

Society of Chemical Industry—A regular meeting was to be held in Rumford Hall, New York, March 19. After the annual election the following papers were read: "The Causes of the Opalescence of Glass," by J. G. Smull; "Some Interesting Phases of Glass Making" and "The Use of Barium Compounds in Glass," by Alexander Silverman.

American Institute of Chemical Engineers—The seventh semi-annual meeting of the Institute will be held in San Francisco, Calif., Aug. 25 to 28. An itinerary is being arranged so that the interesting natural scenery of the West may be seen and also some of the more important mining operations as well as the typical chemical industries of California.

Australasian Institute of Mining Engineers—At the annual meeting at Melbourne, Jan. 29, the following officers were elected: President, Robert Sticht, Tasmania; vice-president James Horsburgh, Queensland. Council, E. G. Banks, New Zealand; W. H. Corbould, John W. Moule, Queensland; C. F. Courtney, New South Wales; H. Lipson Hancock, South Australia; H. Herman, Ernest W. Skeats, Victoria.

Montana Society of Engineers will hold its annual meeting in Butte, April 8-10. A committee consisting of Reno H. Sales, president; Clinton H. Moore, secretary, and Messrs. B. H. Dunshee, Sam Barker, Jr., and H. C. Bacorn, has been named to arrange the program and all the details for the meeting. A number of important subjects are scheduled to be covered by papers from leading members. Electrical engineering as applied to mining, railroads and to light and power will be discussed in detail in view of the expected electrification of many of the railroads and the work already accomplished by the Anaconda road.

American Institute of Mining Engineers—The Utah section met at the Alta Club, Salt Lake City, Feb. 25. R. C. Gemmell was toast master at the dinner which was followed by a discussion of the program for the year which will include an excursion to Tintic in July, at which time a paper on the "Economic Geology of the Tintic District" will be given by G. W. Crane and a paper on the "Separation of Zinc," by D. A. Lyon, a joint meeting, in October, with the Utah Society of Engineers at which papers will be presented on "Flotation," by J. M. Callow, and on "Underground Mining as employed at the Utah Copper," by a member of the company's staff. At a joint meeting of these two societies Feb. 19, papers on "Recent Improvements in Metallurgical Practice," by S. S. Arentz and on "Some Improvements in Mining," by R. S. Lewis were presented.

Teknik Club of Denver—Under the auspices of this club a series of lectures is being given by Dr. Lucien I. Blake on the general subject of "Cosmic Physics." Although these lectures are of high scientific import, they are given in nontechnical language and are illustrated by excellent experiments and lantern effects. At the second lecture, March 8, Dr. Blake, with the assistance of Prof. L. F. Miller of the physics department of the Colorado School of Mines, projected upon the screen several direct spectra showing lines produced by various elements and also a few spectra showing the absorption effects of incandescent vapors of the same elements. At the regular monthly dinner of the club, March 9, E. J. Dittus, instructor in metallurgy at the School of Mines, Golden, delivered a paper on "High Temperature Measurements with Thermoelectric and Optical Pyrometers."

INDUSTRIAL NEWS

The Goldfield mining-district map will be issued by Wilkinson, Currie & Anigo hereafter, as that firm has purchased the 1907-copyright of Elmer J. Chute. The map will be revised to date and will sell for $5 for the wall size and $2.50 for the pocket edition.

E. M. Breed, who for the last eight years has been district manager of the Canadian Allis-Chalmers, Ltd., with headquarters at Vancouver, has been appointed district manager of the Pelton Water Wheel Co. He will continue to make his headquarters at Vancouver.

Steam turbine drives for rolling mills are discussed in an illustrated pamphlet distributed by the DeLaval Steam Turbine Co., of Trenton, N. J., which recently installed the geared steam turbine driving an 18-in. three-high roughing mill at the plant of the Carpenter Steel Co., Reading, Penn.

Catalogs of railway equipment, mining machinery, etc., will be filed by the Instituto de Ingenieros de Chile, Santiago, Chile, and the Departmento Technico, Sociedad National de Mineria, Ministerio de Industrias y Obras Públicas, Santiago, Chile, where they will be accessible to the public, according to Commercial Attaché V. L. Havens of Santiago, Chile.

The Sorge-Cochrane hot-process system of softening boiler feed water is described in a 20-page pamphlet lately issued by the Harrison Safety Boiler Works, 3133 N. 17th St., Philadelphia. This process is based upon the fact that chemical reactions are more rapid and complete in hot than in cold water and the precipitates less soluble and coarser, so that they settle more rapidly.

T. A. Bennett, who for the past five years has had charge of the conveyor and elevator-belt sales of the B. F. Goodrich Co., Akron, Ohio, is severing his connection with the Goodrich company on Mar. 1, to become the Assistant to the General Sales Manager of the New Jersey Zinc Co., with offices in New York. Mr. Bennett will be succeeded by J. D. Mooney, formerly special mining representative for the Goodrich company.

The Stark Rolling Mill Co., of Canton, Ohio, announces the appointment of the Dearborn Steel & Iron Co. as its selling agent in Chicago, northern Illinois and Wisconsin. The Dearborn Steel & Iron Co. is a new company, composed of H. C. Perrine and E. L. Lyon, both formerly with Jos. T. Ryerson & Son, and Mr. Perrine more recently with the Fred Gardner Co. The Dearborn company's office will be in the Peoples Gas Building.

The Colorado Iron Works Co. announces the establishment of a down-town office in Denver for the accommodation of its many customers and friends who may find it inconvenient to visit the main office at the works. Suitable quarters have been obtained in the Ideal Building, corner 17th and Champa St. The office is in charge of Hugh B. Lowden, secretary of the company, and Randall P. Akins, sales manager, will make it his headquarters when in the city.

Notwithstanding the general business depression during last fall and early winter, the Broderick & Bascom Rope Co., manufacturer of Yellow Strand Power steel wire rope, arranged matters so that every man and boy on its big payrolls had work. Last spring its big St. Louis plant was running full force, at least 85% of its full time. Later in the year it operated three-fourths time, but kept the entire day and night force. Finally, during part of October and all of November, it ran one-half time, still keeping all the men employed. During December, that the men might have some extra money for Christmas, it ran the entire St. Louis plant full time, day and night, even though that meant piling up large stocks of wire rope. This resulted in no little expense, for increasing one's stock several million pounds is no small matter. Now, with improving conditions, the matter of employment, time, etc., is working itself out naturally.

TRADE CATALOGS

The Atlas Car & Mfg. Co., Cleveland, Ohio. Bulletin No. 1175. Storage Battery Locomotives, Cranes and Cars. 32 pp. illus., 6x9 inches.

Chain Belt Co., Milwaukee, Wis. General Catalog No. 56. Elevating, Conveying and Concrete Machinery. 304 pp., illus. 6x9 inches.

The C. C. Fonts Co., Middletown, Ohio. Catalog. The Fonts Unit System Steel Shelving and Bins. 16 pp., illus. 6x9 inches.

Editorial Correspondence

SAN FRANCISCO—Mar. 10

Mountain Copper Smeltery at Martinez on San Francisco Bay resumed operation on Mar. 1 with the blowing in of No. 3 furnace. This furnace is about one-half the capacity of the full plant. The present demand for copper is sufficient also to warrant the completion of the concentrating plant at Keswick, Shasta County, and resume mining at Iron Mountain in the same county. During the enforced idleness at the mines the company allowed married men to retain the company cottages free of rent and reduced prices and extended credit at the company store. The result is that now the company is ready to resume mining its former men are at hand. This resumption has put about 200 men on the pay rolls.

The Mammoth Copper Co. is again purged of contempt in the U. S. District Court at San Francisco. Judge Van Fleet on Mar. 9 denied the petition of McCoy Fitzgerald and other Shasta County farmers filed last November. It was the old story of fumes affecting the crops and the lands of the farmers whose agricultural prosperity has been directly due to the mining and smelting of copper ores. Not since the Bully Hill and the Balaklala smelteries quit treating copper ores and the Mammoth installed a baghouse have the smelting companies contributed directly to the support of the farmers. Every year since the first ton of ore was smelted about 20 years ago, the horticultural and agricultural crops in Shasta County have increased, but almost every year the farmers have complained that their crops were being destroyed. By and by the farmers will get tired of paying fees to attorneys and wake up to the fact that the courts cannot be fooled. The number of complaining farmers in Shasta County is gradually diminishing, it is encouraging to note.

DENVER—Mar. 11

Dredging Along the Upper Arkansas River channel is contemplated by the Derry Mining & Land Co., a new corporation. The company owns the Derry ranch, southwest of Malta station on the Denver & Rio Grande Ry., in the Leadville district, directly below the mouth of California gulch, famous for its pioneer placering.

Annual Meeting of the El Paso Consolidated, held in the main office, Denver, Mar. 8, required three days to elect directors. So many factions had clamored for proxies owing to contests for offices that there were many instances of duplicate proxies and two days were consumed in arriving at figures on the voting representation. Plain-clothes detectives were on hand but their services as peace-keepers did not become necessary. Stockholders went on record endorsing Burris' attempted merger of Cripple Creek properties, claiming that his failure was due wholly to the financial depression brought about by the European war, and stating that all his expenditures in the effort had been duly authorized at each of the two previous annual meetings.

Prevention of Highgrading is the object of House Bill 326 introduced during present session of Colorado Legislature. It aims to accomplish this by placing an annual license tax of $100 on every person, firm, association and corporation carrying on the "business of milling, sampling, reducing, purchasing or receiving for sale ores, concentrates or amalgams bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens." To engage in such business, application for a license must be made to the secretary of state and must be accompanied by a $5000 bond with sufficient sureties. Further, every such purchasing concern will be required to keep and preserve a record of every receipt of any of the substances enumerated, together with name of party on whose behalf material is delivered, name of party delivering, date of delivery, occupation of party delivering, weight or amount and short description of material, and the name and location of property whence it originated. Violations are to be punishable by fines ranging from $100 to $1000 or by imprisonment for periods varying from 30 days to six months.

BUTTE—Mar. 11

The High Price of Spelter has caused the Butte & Superior company, the Elm Orlu and Timber Butte Milling companies to operate their mines and mills at the limit of their capacities. At the Elm Orlu 837 tons were hoisted per day recently but this output cannot be maintained as the Timber Butte mill treating this ore at present has a capacity of only 450 tons per day. In the mean time the engineers of this company are carrying on experiments with the more refractory zinc ores and as soon as the results, which have been highly satisfactory, have been reduced to a profitable commercial basis, the Timber Butte company contemplates increasing the capacity of its mill which will enable it to treat besides the Elm Orlu ore, the product of other zinc mines in the district.

At the Butte & Superior, the month of February was a record breaker. The output of the Black Rock mine was the largest in the company's history. The payroll and the number of men employed as well as the returns in zinc from the output will be the greatest in the history of the mine. The amount of ore mined and milled was 39,310 tons, more by 2000 tons than in any previous month. The total recovery of concentrates exceeded 12,000 tons. The number of pounds of zinc realized from this will exceed 13,000,000 lb. During the month 1200 men were employed with a payroll of more than $125,000.

SEATTLE—Mar. 10

At Fish Creek, on Yukon River, some distance above the mouth of the Tanana River, a tract 1½ miles square has been withdrawn by a recent executive order for possible government-railway townsite purposes. Withdrawal order also included tract at Fort Gibbon military reservation, at the junction of the Tanana with the Yukon. The fact that the banks of the Yukon are high at Fish Creek and that the river is comparatively narrow indicates that the government railway may cross the Yukon at this point.

On the Creeks of the Fairbanks Section much activity is reported by miners who have made a tour of the district. Owners of claims, which are worked only during the summer months are making preparations for the coming operations and are having thousands of cords of wood delivered on their ground for the season's fuel. Many new paystreaks have been discovered during the winter which are expected to increase the output of the district next summer. The richest finds of the season have been reported from Ester, Vault and Wolf Creeks.

Port Wells District is one of the subjects of favorable report by several miners who have recently returned from there. J. W. Spaulding who formerly had charge of the Sheep Creek for the Alaska-Gastineau is now developing a property in this district and states that much development work will be done this summer. Two ledges have been exposed, one upon which a tunnel is being driven from the beach shows an average of over 6 ft., assaying more than $20 per ton. A crew is now getting out piles, putting in a wharf and erecting mine buildings while the tunnel crew is driving on the orebody.

Winter Prospecting on Chisana has been productive of good results according to those who have just returned from the district for supplies. Good pay was recently found on Wilson creek, one of the main streams of the camp. This find is considered most important as Wilson creek heretofore has shown no pay and by many was considered barren. Since the fall of snow recently, which has made the sledding good, the Chisana has been a busy camp. Many of the prospectors have been engaged in sledding wood to the claims, and are now sinking. Numerous prospect holes have been sunk on Alder, [illegible] and Big Eldorado creeks, with the result that good pay has been uncovered at several points on the various benches. These finds have done much to hearten the prospectors and miners who are now predicting a prosperous season for the camp with a production of practically double that of last year.

GOLDFIELD—Mar. 10

The Goldfield Litigation besides arousing a great deal of interest has cast some gloom over the camp which was relieved only partially by statements issued by the various interests. Most important, is an agreement between the Jumbo Extension and the Booth officials which will permit operation of the Jumbo Extension mine to continue during the pendency of the apex litigation. This agreement requires only the approval of the Court, when normal operation will be immediately resumed. The agreement, besides permitting underground work, allows the defendant company to withdraw funds, tied up by the restraining order, for settlement of indebtedness incurred prior to the order, for professional advice, geological and otherwise, for protection of its interests in litigation, and not over $10,000 monthly for underground operations. It is further agreed that at all reasonable times the engineers, experts, and assistants of both companies shall have the right to enter either property for securing such data as may be deemed necessary by them for use in the litigation.

As a Result of the Restraining Order the disbursement of the Jumbo dividend, for which checks were all ready made out, was prevented.

An Official of the Jumbo Extension states that a difference arose in the directorate of the Merger Mines company over its sale of the Velvet claim to the former company. A receiver was asked for by minority stockholders of the Merger and at a hearing a compromise was suggested by a consolidation of the Merger, Jumbo Ex., Booth and Kewanas. On this occasion the Booth for the first time advanced its Jumbo Ex. apex claim. The Jumbo Ex. refused to join the conference claiming a perfect title to the Velvet and therefore having nothing to compromise and seeing no advantage in a consolidation. The Jumbo Ex. claims that failing in the consolidation scheme, the filing of an apex suit was simply an adroit change of tactics.

The Secretary of the Goldfield Consolidated is quoted as saying, in refutation of a rumor that Booth would bring an apex suit against the Consolidated, that when it became apparent from underground developments that the Booth might have the apex of the vein from which much valuable ore had been mined in the Laguna, Miss Jessie and other Consolidated claims, an agreement between the Booth and Consolidated was consummated, whereby for valuable considerations, release for liability for past ore extractions was secured and vertical boundaries were agreed to, thus preventing any future apex troubles in this connection.

WALLACE—Mar. 8

In the Case of the Ontario Mining Co. against the Stewart Mining Co. a decision of the district court gives the Ontario a verdict for $46,084.91 and interest since July 1, 1914, amounting to $2150.53, making a total for the plaintiff of $48,245.44.

The court holds in its findings that the trespass existed from Jan. 20, to Sept. 2, 1914, and estimates the amount of ore taken out as about 70,000 cu.ft., ten cubic feet to equal a ton. It decided that the trespass was partly innocent and partly willful and divided the ore removed into two groups. The willful trespass was set at 46,662.75 cu.ft., while 24,030 cu.ft. was taken innocently.

SILVERTON—Mar. 11

The North Star Mine on Sultan Mountain which has produced several million dollars' worth of sulphide ore carrying gold and silver and upon which is a large plant of mine and reduction machinery, was sold Feb. 26 to J. H. Slattery of Silverton for $12,000, at sheriff's sale.

The Champion Mine near Silverton is being examined by Z. W. Waybright, a New York attorney, and D. R. Thomas, formerly of Butte, for the American Flotation Co., it is reported. They are also said to have under consideration the Ben Butler property and several others in the Mineral Point country above Animas Forks 13 miles north of Silverton. Machinery is said to have been ordered for the Ben Butler and it is expected that operations will commence the latter part of March.

DEADWOOD—Mar. 11

Possibilities of Low-Grade Mining are exemplified by achievements of the Wasp No. 2 mine, at Flatiron, S. D. This property is equipped with a dry crushing, cyanide leaching plant of 15,000 tons monthly capacity in which a saving of 75 to 80% of the gold is made at a cost of about 60c. per ton. Ore comes from opencut workings, from which 10 to 20 ft of overburden is stripped with a steam shovel. The total cost of mining, including delivery of ore to the mill over a 1500-ft. skipway, is 60 to 70c. per ton. Total costs of operation are $1.25 to $1.30 per ton. In 1910 a new mill was constructed to replace a plant destroyed by fire. It was placed in commission in December, of that year, and since then, to the end of 1914, has treated 623,520 tons of ore recovering $1,083,646, an average yield of $1.738 per ton.

CUYUNA RANGE—Mar. 13

Operations for 1915 are already under way and the outlook is for a better year than last. Armour No. 2 and Kennedy have been steadily stockpiling all winter. Crews are at work preparing the Thompson, Rowe and Pennington pits for operation, the two former to begin in March. Stripping operations are to be conducted on the Armour No. 1, Hill Crest, Cuyuna Iron & Manganese Ore, and Cuyuna-Sultana, the latter's expected product being high manganese iron ore. At present the Range's high-manganese producers are all idle; however, the Iron Mountain shaft at Manganese is being equipped with a new surface plant, its former plant being crude.

On the south range the Wilcox is hoisting such ore as it encounters in opening, about 50 tons daily. The company's entire output is contracted to Canadian consumers and it will be one of the range's substantial operations. At Brainerd the Brainerd-Cuyuna shaft has been anchored in ledge, and two shifts are working. The Adams and Barrows shafts continue idle although drilling on the latter property has recently shown a considerable tonnage of ore said to be superior to any heretofore encountered on the South Range.

MESABI RANGE—Mar. 11

Spring Activity exists at a number of places on the range, although no operator seems to be making strenuous efforts for early production. Very little stockpiling has taken place during the past winter.

HOUGHTON—Mar. 10

No Report on the Michigan Copper Strike will be made by the House Committee, which made an exhaustive inquiry during the past summer. The Chairman of the Committee said that the end of the strike led the Committee not to make a report. A discussion of strike conditions now, it is thought, would only cause recrimination and disturb conditions. Agents of the Department of Labor published a report several months ago.

The Michigan College of Mines is in receipt of some superb mineralogical specimens from the celebrated Shattuck cave, near Bisbee, Arizona. The specimens were shipped to the college at the expense of the Shattuck-Arizona Copper Co. through the courtesy of the superintendent Arthur Houle, brother of Professor A. J. Houle of the department of metallurgy and ore dressing of the college. The specimens consist of pure white growths of calcite and aragonite crystals and are typical of the walls of this wonderful cave.

LORDSBURG—Mar. 10

At Tyrone in the Burro Mountains a new townsite is being laid out, up Mangas draw from the "Pines," by the Burro Mountain Copper Co., and a grade laid out from the site to the railroad. It is understood the company offices and stores will be located here. Work is progressing rapidly at the mill site and steel construction work is under way. A power transmission line was built from the mines to the mill during February. Experimental work has ceased and the experimental plant has been dismantled. There are no other active operations in the Burros at the present time except those of the Phelps-Dodge company.

EDMONTON—Mar. 9

Prospecting Parties from British Columbia for months past have been examining the country near Fond Du Lac on the northeast arm of Lake Athabasca, and are reported to have made an important discovery of high-grade silver ore. The point of embarkation is Athabasca Landing, but the discovery is in Saskatchewan, to reach which now dog trains will be necessary from Fort McMurray. The break up of the ice is usual between the middle and end of April on the Athabasca River and slightly later farther north on the lakes. This has been a mild season and the several parties now hurriedly outfitting to go to the new strike will likely be able to get an early start.

TORONTO—Mar. 13

The Heavy Insurance Rates on silver shipments to England are likely to prove pracfically prohibitive to consignments to London from the Cobalt camp and will probably have the effect of diverting bullion exports to the New York market or inducing the stronger companies to store their output until conditions improve.

A Shortage of Power in Porcupine and Cobalt has been caused by the dry season which prevailed in Northern Ontari last summer and fall. The Northern Ontario Power Co. ha given notice to its customers that commencing with Marc only half the regular quantity of power will be available and it is expected that this condition of affairs will continu until the spring break up occurs. While the shortage i largely due to the low water, the increased demands of th Hollinger and the Dome are also partly responsible. Thes two companies, however, have special arrangements with th power company and are not affected to the same extent a the other mines because the Hollinger people built the Sand Falls plant for their own use and subsequently turned into the Power Co. and the Dome interests were associate with the Waweatin plant and as a consequence secured a ample supply of power. The production of the camp wi probably show decreases for the next few months.

The Mining News

ALABAMA

CENTRAL COAL & IRON CO. (Holt)—Fire caused $10,000 damage at furnaces. Engine room destroyed, blowing engine damaged and waterworks and electric-light system completely out of commission. Furnace will be shut down for 60 days at least.

ALASKA

McWORTER SILVER MINE on Glacier Creek, upper Stewart River district, has vein 4 ft. wide at bottom of 141-ft. shaft. Picked ore shipped to Trail smeltery returned $600 per ton. It is planned to make 1000-ton shipment when navigation opens. Six hundred tons already hauled 30 miles to steamboat landing at Mayo.

DENVER ASSOCIATION (Fairbanks)—Archie McIntosh and others have leased this placer claim and will install a hydraulic plant this spring.

ALASKA MEXICAN (Treadwell)—Operated 120 stamps 30.3 days in January crushing 18,865 tons ore, gross value $41,821, yield $2.21 per ton. Net operating profit $18,209.

ALASKA UNITED (Treadwell)—Operated 120-stamp mill 30.3 days and one 120-stamp mill 28.3 days in January crushing 19,684 and 23,940 tons respectively. Gross production $102,496, yield $2.34 per ton.

ALASKA TREADWELL (Treadwell)—Operated 240-stamp mill 30.75 days and 300-stamp mill 30 days in January crushing 30,688 and 44,800 tons ore respectively, gross value $146,326, yield $1.94 per ton. Net operating profit $61,642.

FAIRBANKS DISCOVERY CLAIM (Fairbanks)—Norwegian Mining Co. has found pay on Discovery claim, Fairbanks Creek, generally supposed to have been worked out years ago. Will prepare ground for summer mining. Contract let for delivery of 400 cords of wood over snow.

GRANITE MINE (Valdez)—Col. B. F. Millard, President, just returned from property reports first installment of new machinery has been delivered and is being installed. Oil tanks with capacity of 24,000 gal., 160-hp. engine and compressor are on the ground. New 10-stamp mill being made in San Francisco will soon be shipped. Ray Millard is Supt.

ARIZONA

Cochise County

LEONARD (Gleeson)—The Leonard copper mine held under option by Shannon Copper Co. is about to resume on same scale as previously.

Mohave County

COLUMBUS (Cerbat)—In a crosscut about 200 ft. from portal of old tunnel 6 ft. of zinc ore has been discovered. Some years ago considerable ore from tunnel was treated in Flores mill for gold, silver and lead. Presence of zinc was not suspected before crosscut was run.

TOM REED (Oatman)—Company recently purchased a Jeffry autotruck and trailer.

Pinal County

COPPER BUTTE (Florence)—Mine being unwatered preparatory to resuming operations. First work will be drifting on the 500-ft. level.

KELVIN-SULTANA (Kelvin) Improvements are being made in mill and power-plant preparatory to resuming operations at both mine and mill.

Yavapai County

CASH (Prescott)—Operations have been resumed at Cash and Snoozer mines controlled by Commercial Mining Company. A 190-ft. winze has been sunk from one of the Cash drifts opening up good ore in the Snoozer ground. Enlargement of the local plant is contemplated.

CALIFORNIA

Amador County

FORTY-NINE FLAT (Volcano)—Gravel mine bonded to James Arditto and others of Amador City. Pay gravel recently encountered.

GRILLO (Volcano)—Inability to secure adjoining claim from J. Garibaldi compels Grillo brothers to suspend operations at gravel mine

TIERAKOFF (Mokelumne Hill)—One ton of ore taken from adjoining claim milled at Tierakoff mill reported to have yielded 15 oz. gold

CENTRAL EUREKA (Sutter Creek)—Ben Govis, Norwegian miner, 22 years old, killed by falling 150 ft. into sump from 3000-ft. station. Cause of fall unknown

KEYSTONE (Amador City)—Have added 20 stamps to former 20-stamp mill Mine began operation in the '50s. Has produced about $14,000,000 When present company took it over about three years ago, inclined shaft was 1100 ft. deep with a 200-ft winze The shaft is now 2100 ft deep and orebodies have been found persisting at depth.

BUNKER HILL CONSOLIDATED MINING CO. (Amador City)—Superior Court jury at Jackson awarded heirs of Richard S Matthews $5000 account of his death by electrocution in pump station on 800-ft. level. Suit was for $30,000. Plaintiffs filed notice of motion for new trial. Defendants claim Matthews entered station at his own risk, had no work there and had been warned to keep away

Eldorado County

MOLYBDENITE discovery reported at Murray Hill on road between Placerville and Grizzly Flat by Thomas A. Murray. As result of chemical determination property was located as a mining claim.

JONES (Placerville)—More than $7000 has been taken out of pockets in this mine recently and indications of permanent ledge found. The flat in this vicinity yielded large amount of gold in the early days of quartz mining in the county

Inyo County

PITTSBURG-LIBERTY (Masonic)—Fine-grinding and cyanide plant and 100-hp gas engine being installed.

WESTERN HYDRATE LIME CO. (Los Angeles)—Installation of plant at Owens Lake contemplated, for treatment of magnesian lime produced by the Natural Soda Products Co. and heretofore shipped to Los Angeles and San Francisco for treatment.

Kern County

SUNSHINE (Randsburg)—Recent cleanup yielded $6250 bullion and $3600 concentrates. Ore is high-grade recently disclosed on 500-ft. level.

BALTIC (Johannesburg)—Mine recently sold at sheriff's sale to Indianapolis men, who are reported to be negotiating for other properties in vicinity.

KING SOLOMON (Randsburg)—Nosser Illingsworth lease has 12 tons of ore ready for milling that is estimated at $65 per ton. This lease has produced $17,000 in less than two years. The last milling, in January, yielded $800 from 10 tons of ore at the Red Dog mill.

STANFORD MINING & REDUCTION CO. (Johannesburg)—Installation of modern cyanide plant at Red Dog mill contemplated. Plant treats ores of Randsburg and other nearby districts and is the only strictly custom mill in this region. Crude method of cyanidation so long maintained and consequent high rates not satisfactory to mine owners and leasers.

Los Angeles County

ALLISON (Azusa)—Reported that property has been taken over by Marcus-Daly interests and that stamp mill and other machinery installed in 1914 will be replaced by modern mill. Mine is situated in San Gabriel cañon six miles north of Azusa. New roads are being constructed.

Nevada County

BRUNSWICK CONSOLIDATED (Grass Valley)—Installation of modern cyanide plant contemplated.

NORTH STAR (Grass Valley)—New 420-hp. compressor recently installed allows operation of three compressors instead of four and reduces the labor costs. Providence shaft will be enlarged to three compartments and will be retimbered entire 1800 ft. Double-reel electric hoist has been ordered and new headframe is under construction.

Placer County

ROUGH AND READY (Dutch Flat)—This old gravel producer in the early days of hydraulic mining, has been taken over by Federal Drift Mining Co. and will be worked by drift methods. Installation of a 250-ton mill for crushing cemented material is contemplated

Trinity County

GLOBE CONSOLIDATED (Dedrick)—Carload of pebbles for tube mill received from Norway reported being carried from Redding to Dedrick by parcel post. The pebbles are sacked in 50-lb. sacks for postal shipment.

COLORADO

Gilpin County

FRONTENAC CONSOLIDATED MINES CO. (Central City)—All this company's holdings have been sold by the sheriff to creditors.

WOOD (Russell Gulch)—This mine, one of the few producers of pitchblende in this state, is being reopened under lease by Harry Willis.

PITTSBURGH EXTENSION (Central City)—H B Cannon, T. H. Reddington and J. G. May are directors of Future Mining Co, which has equipped this mine with new electrical machinery and will immediately begin operations

COEUR d'ALENE (Black Hawk)—This and the Isabella properties have been acquired and will be operated by newly incorporated Coeur d'Alene Mining Co. of which W F Gray, of Goldfield, Nev, is president. Old shaft is being retimbered and shafthouse enlarged for new equipment.

Lake County

PENROSE (Leadville)—Retimbering shaft, preparatory to proposed unwatering of down-town mines, is progressing rapidly. Delivery of pumps from the east considerably behind contract date and entire project correspondingly delayed

BIG FOUR (Leadville)—Resumption of operations delayed pending adjustment of insurance indemnities accruing from recent destruction by fire of surface plant Meanwhile same interests, Big Five Operating Co, have leased and equipped the Fanny Rawlings, a neighboring property

Ouray County

MOUNTAIN TOP (Ouray) Winze has been sunk from adit, following vein 2 ft wide averaging $40 per ton gold and silver

San Miguel County

TOMBOY (Telluride)—Operated 60-stamp mill 28 days in February crushing 11,000 tons ore yielding $83,000 gross, and a profit of $27,000.

Summit County

JUNIATTA (Breckenridge)—Cumbre Mining Co. is installing electrically-driven Imperial Type Ingersoll-Rand compressor. Also a triplex pump in the shaft.

TONOPAH PLACERS CO. (Breckenbridge)—Plan to build a dam for raising the level of Mohawk Lake and conserving the heavy run-off from Spruce Creek during the summer seasons. Reported that company will build half-million dollar hydro-electric plant.

Teller County

JO DANDY (Victor)—Thomas Kavanaugh and C. D. Gurney, operating the mill, are treating 2000 tons of $2 dump material per month.

MIDGET (Cripple Creek)—Shipped 25 cars ore in February. Shaft will be sunk additional 100 ft. from present depth of 950 ft. Surface plant will be enlarged.

DOCTOR-JACKPOT (Anaconda)—Starkweather and Wilson, during February, produced nearly 1500 tons of ore from a 20-ft. body that averaged close to 2 oz. gold per ton without sorting.

EL PASO (Cripple Creek)—New hoisting plant working to capacity handling ore broken and stocked underground during shaft's shut-down due to destruction of shafthouse by fire some months ago. Lessees holding unexpired contracts at time of fire have resumed their operations.

GOLD SOVEREIGN (Cripple Creek)—Shaft will be sunk 100 ft. to 1350-ft. level to bring bottom to elevation of lowest workings in Cresson mine and drift will then be extended to discover continuation of bonanza oreshoot now producing in this neighboring mine. James F. Burns secured control at recent annual meeting.

IDAHO

Custer County

EMPIRE COPPER (Mackay)—Property acquired under escrow agreement by Salt Lake interests headed by E. L. Godbe, of the Prince Consolidated. Empire is successor to White Knob Copper. Has spur connection to main line O. S. L. Ry., complete mine equipment, surface plant and dwellings for crew.

MICHIGAN

Copper

SOUTH LAKE (Houghton)—Passed through the fourth lode with its crosscut and has encountered 16 ft. of profitable stamp rock.

MOHAWK (Mohawk)—Now changing at No. 6, latest and southernmost of its shafts, from old skips of 2½ tons capacity to those able to hoist 7½ tons.

NEW ARCADIAN (Houghton)—Recently put into commission five more drills, making eight now in operation, working day shift. Compressor has capacity of ten drills.

MAYFLOWER (Houghton)—Drill hole No. 41 down about 2000 ft. cut St. Louis conglomerate lode at about 1850 feet. Ought to cut Mayflower lode within next 500 feet.

LAKE (Houghton)—Management considering plans for reopening mine. Former Manager Hitchcock here looking over property. Local shareholders opposed to consolidation with South Lake.

HANCOCK CONSOLIDATED (Hancock)—Adding to its underground forces rapidly. Would be in readiness to ship copper rock now if the mill could handle the product. Shipments will be commenced within 30 days. Working force 250.

QUINCY (Hancock)—Continues to operate but three mines and management has no plans as yet for resumption at Pontiac. Rock tonnage close to 4000 daily. Grade of rock little better than the average. In Mesnard shaft rock at lower levels contains much smaller amount barrel material and mass work.

Iron

ATHENS (Negaunee)—Shaft now down to depth of about 435 ft. Some bad ground encountered made progress slow and required placing concrete lining in 20-ft. sections, whereas it has been customary to treat 40-ft. sections.

OLIVER IRON MINING CO. (Iron Mountain)—On March 22, the Chapin and Argon mines will go on a four-day per week schedule. For the past year these properties have been working only three days per week

MINNESOTA

ISLAND CREEK COAL CO. (Duluth)—Estimates for a 1000-ft addition to company's coal dock in West Duluth, already 1000 ft in length are being considered. Present dock has two Heyl & Patterson coal-carrying bridges; would require at least one additional bridge with increased length of dock. Capacity would increase from 350,000 tons to 700,000 tons. Two present bridges have operating capacity of 6000 tons per hour

HIGGINS LAND CO. (Duluth)—William J. Wallace, timber cruiser and mining engineer, has brought suit in Duluth courts to secure remuneration for services estimated by him to be worth $50,000, for obtaining data advantageously used by company in securing cancellation of certain mining lease given to U. S. Steel Corporation. Higgins Land Co., in which late Gov. Frank W. Higgins of New York was interested, has been in the courts on numerous occasions heretofore. Some months ago its erstwhile attorneys, Spencer & Marshall, secured verdict of $103,300 against it for services rendered in bringing about above mentioned cancellation of lease on Mesabi Range mineral lands

Cuyuna Range

THOMPSON (Crosby)—It is stated unofficially that company will erect washing plant this season at Crosby.

ROWE MINE (Riverton)—Will construct washing plant on west side of Little Rabbit Lake. Trestle across lake now being constructed

Mesabi Range

DEACON (Buhl)—New head frame erected by American Bridge Co. practically completed. Operations started for the season.

BARROWS MINING CO. (Barrows)—Hole being drilled to obtain a shaft location has unexpectedly encountered merchantable ore necessitating location of shaft at another site.

GREAT NORTHERN (Hibbing)—Officials state that efforts will be made to ship 6,000,000 tons this season if possible. Oliver company shipped 6,500,000 tons from these properties last season.

MONTANA

Beaverhead County

BOSTON & MONTANA DEV. CO. (Jackson)—Company has in its treasury total capital stock of Southern Montana Ry., which is to be constructed as soon as arrangements can be completed. Line will run from Divide terminal to Jackson in the Big Hole country with branches to French Gulch mines and Elkhorn district.

Silver Bow County

ANACONDA (Anaconda)—Company has signed contracts for $70,000 worth of steel tanks for flotation plant with penalty and bonus clauses applying to first shipment in 35 days. To be completed in 90 days.

AMERICAN ZINC CO. (Butte)—New organization has taken five-year lease on Emma mine of Butte. This has a zinc vein 300 ft. wide on the 800 level. Property formerly owned by Butte Mining & Development Co. Was developed for copper but turned into zinc and property was abandoned at time zinc mining in Butte was unprofitable.

BUTTE-DULUTH COPPER CO.—This company made a record run during February. Close to 150,000 lb. of copper was produced, of which 120,000 lb. was electrolytic and 30,000 lb. cement copper. Total tonnage handled was 7800 tons, at a total expense per ton, including development work, of about $1.99, equivalent to slightly less than 10c. per lb. of copper produced. The new ore shovel has proved its value and has handled as high as 84 tons of ore per hour, and after a few contemplated improvements is expected to handle 120 tons per hour. This will enable company to mine close to 1000 tons of ore per day, thus supplying the new plant to capacity.

NEVADA

Clark County

MOBILE (Goodsprings)—Negotiations for sale to Mobile Lead & Zinc Co. completed. Terms, $30,000; first payment in one year and balance in 18 months. Property well developed; has 2800-ft. aërial tramway.

Esmeralda County

PITTSBURGH SILVER PEAK (Blair)—Capacity reduced by dropping only 30 stamps in 120-stamp mill, reported to be due to limited amount ore in sight.

DAISY (Goldfield)—Three-foot shoot shipping-grade ore opened in raise from west drift on 265-ft. level; shipping will commence at once. Property operated under lease by Justice Gold Mines Co.

Humboldt County

NEVADA PACKARD (Rochester)—At February meeting of board, directors decided to build stamp mill and cyanide plant. Ore being sent to several testing plants to determine best method. Mill may be built with sufficient capacity to treat custom ore. Telephone connection between mine and main office, at Lovelock, installed.

Lander County

TIN STRIKE NORTH OF BATTLE MOUNTAIN continues to cause excitement. Excellent samples of stream tin on exhibition at Battle Mountain.

Mineral County

AURORA CONSOLIDATED (Aurora)—New machinery to be installed in mill shipped; expected operations will be resumed Apr. 1.

Nye County

TONOPAH PRODUCTION for week ended Mar. 6 was 10,408 tons, estimated gross value $213,304, as follows: Tonopah Belmont, 3847; Tonopah Mining, 2250; Tonopah Extension, 1680; West End, 1231; Jim Butler, 1100; Tonopah Merger, 150; Montana-Tonopah, 150 tons.

TONOPAH EXTENSION (Tonopah)—New oreshoot, 2½ ft. wide, opened recently on 500-ft. level.

TONOPAH VICTOR (Tonopah)—Pumping and bailing being done; 500,000 gal water daily being lifted

TONOPAH MINING CO. (Tonopah)—Stated that complete control of Panama Mining Co., in Nicaragua, has been assumed by this company.

SUNSET MINING & DEVELOPMENT CO. (Bullfrog)—Capacity of 40-ton plant will be doubled. Tunnel will be driven into Denver ground.

NEVADA CINNABAR CO. (Ione)—Shipment 350 flasks quicksilver made recently. Scott furnace operating produces 25 flasks daily. New body rich ore opened recently. Production will be increased.

JOHNNIE MINING & MILLING CO. (Johnnie)—Sold for taxes recently, will be redeemed by receivers, indebtedness liquidated, corporation dissolved and work resumed after reorganization. Mine produced three-quarter million dollars in past

ROUND MOUNTAIN MINING CO. (Round Mountain)—Rapid progress being made delivering eight miles of 15-in. spiral-riveted pipe for its placer operations. Auto trucks used in haul from Tonopah and six to eight 10-horse teams from Austin.

Storey County

YELLOW JACKET (Virginia City)—New pumps for incline shaft received Water will be held below 1500-ft. level.

MEXICAN (Virginia City)—Pumps will be installed in joint Mexican-Ophir winze to lower water 200 ft.; winze will then be changed from three compartments to two. Excavation for hoist completed.

White Pine County

OPHIR (Ely)—Group of 12 claims in Red Hills district purchased by A. R. Shepard for $40,000. First payment of $4000 to be made within 90 days, $18,000 in 12 months, and balance by July 19, 1916. During this period 20% of gross returns from shipments to be applied on purchase price.

NEW MEXICO

Grant County

WARNOCK & WALTERS (White Signal)—New hoist and equipment now ready for work. Operators will go down 300 ft.

Luna County

BI-METALLIC (Sierra Blanca)—Company in receipt of new equipment. Being assembled and tested at Deming before removal to mine. Alamo 25-hp. engine, air compressor and drills in equipment.

Sierra County

EUREKA (Hillsboro)—Contract let by F. W. Moffett for 350-ft. development work. Old shaft will be extended 100 ft. from 105-ft. level and 250 ft. drifting will be done.

OREGON

Baker County

ORO FINO (Alamo)—This mine is to be put in operation again after being idle for a number of years.

GOLDEN GATE (Greenhorn)—Mill started. Development in progress since 1900. Ore oxidized and good milling value at 350-ft. depth.

MAID OF OREGON (Alamo)—Contractors at this property making good headway with development work in crosscut. Vein thought to be near present face of workings.

Josephine County

SISKIYOU MINING & DREDGING CO. (Pleasant Creek)—Prospecting some deep placer ground with Keystone drilling machine.

MONITOR MINE (Susanville)—John Howard is operating this mine under a bond and lease. Property joins Badger mine which is being developed.

ORIOLE MINE (Galice)—Corey Mattison of this mine reports that new vein of high-grade quartz has been struck and some of the samples shown are rich free-gold specimens. Vein said to be 4 ft. wide.

SOUTH DAKOTA

Lawrence County

MOGUL (Terry)—A raise is being driven from Ben Hur to connect with Carstreet at surface which will make possible hoisting ore direct to mill bin.

ANACONDA (Roubaix)—Steam has been turned on at the new shaft. Several months spent in removing equipment to new location. Shaft sinking will now be pushed.

ECHO (Maitland)—Shaft 50 ft. deep. New equipment of electric machinery has been installed. Company intends to sink several hundred feet to open orebodies disclosed in adit workings.

ORO HONDO (Deadwood)—Station being cut at 1550 ft. from which lateral work will be done coincidently with continuation of shaft. Diamond drills will be used from this level. Auxiliary hoist will be located here.

WASP NO. 2 (Flatiron)—Mill and mine are being worked at half capacity permitting greater length of cyanide treatment, resulting in improved mill extraction. M. H. Pilcher appointed mill superintendent, succeeding R. W. Craig, resigned on account of ill health.

HEIDELBERG (Deadwood)—Company considering proposition to extend electric power lines to property, distance of 2½ miles, at cost of $3500. Believed this would be more economical than steam plant considering cost of hauling fuel over several miles of rough mountain road. Company plans to sink 200 to 300 ft. additional; shaft is now 180 ft. deep.

UTAH

Beaver County

MAJESTIC (Milford)—Work is to be resumed at company's Hoosier Boy property.

MOSCOW (Milford)—Drifting from 1100-ft. level, the bottom of the new shaft, has opened continuation of oreshoot from the 800-ft. level.

CEDAR-TALISMAN (Milford)—Ore carrying 32 to 35% zinc is being mined and hauled to Milford. Three cars are ready for shipment.

PALOMA (Milford)—At the property near the Moscow, shaft is down 375 ft. and there is 2 to 3 ft. of ore assaying well in silver and lead.

Juab County

KING WILLIAM (Tintic)—Lease held by U. S. Smelting, Refining & Mining Co. dropped after expenditure of a considerable sum of money. Said to be in line with general orders of company discontinuing much of its prospecting in various sections in the states and Alaska.

Salt Lake County

COLUMBUS EXTENSION (Alta)—Zinc ore is being developed on the contact of limestone and quartzite.

EMMA COPPER (Alta)—Company reorganized recently. F. R. Snow is president. Work is to be started, arrangements being made with Wasatch Mines Co., to work through either the Flagstaff or the Buffalo tunnel.

MONTANA-BINGHAM (Bingham)—Progress of 4 ft. daily being made in tunnel, which is 889 ft. in the clear. Considerable water has been encountered. Siding has been built from D. & R. G. tracks in Bingham cañon to tunnel.

UTAH APEX (Bingham)—Net earnings for January, $22,129; gross receipts, $67,365 from sale of 4082 tons of shipping ore and 3276 tons of concentrates. Ore milled, 9701 tons, at cost of 66c. per ton. Shipping ore produced at cost of $2.70 and milling ore at $3.52 per ton.

Summit County

PARK CITY ORE SHIPMENTS for February, 9096 tons crude ore and concentrates. During week ended Mar. 6, there were shipped 4,212,880 lb. ore from Silver King Coalition, Daly-Judge, Daly West and Silver King Consolidated.

SILVER KING CONSOLIDATED (Park City)—Ore has been opened on 1800-ft. level, lowest in mine.

WASHINGTON

NORMAN LEAD MINING CO. (Northport)—Reported to be about to install new machinery. Sidney Norman, Spokane, is manager.

CANADA

Ontario

SILVER- AND NICKEL-ORE SHIPMENTS over the Temiskaming & Northern Ontario Ry., for February amount to 1032.88 tons and 839.15 tons respectively. All the nickel came from the Alexo mine at Porcupine, and the silver as follows: Cobalt; Beaver, 31.66 tons; Chambers Ferland, 39.99; Cobalt Comet, by Dom. Red. Co., 33.47; Coniagas, 57.53; Crown Reserve, by Dom. Red. Co., 50.77; Kerr Lake, by Dom. Red. Co., 31.16; La Rose, 45.52; McKinley Darragh, 123.37; Mining Corporation of Canada, Ltd., Cobalt Lake Mine 65.05 and Townsite City Mines, 249.13; Nipissing, 30.23; O'Brien, 30.46; Penn Canadian, 50.43; Peterson Lake—Seneca Superior, 31.27; Temiskaming, 98.85; Trethewey, 43.39. From Elk Lake, Miller Làke O'Brien, 20.60.

ACME (Porcupine)—Milling ore in Hollinger mill, using 30 of Hollinger's new 40 stamps.

RIGHT-OF-WAY (Cobalt)—Last year shipped ore of $66,135 gross value. Milling expenses $19,941.

NORTH THOMPSON (Porcupine)—Work has been suspended for the present.

HOLLINGER (Porcupine)—Will use electric locomotives on the main haulage levels which will be 400 ft. apart.

McINTYRE (Porcupine)—Treated 10,900 tons in February averaging $8.77 and recovered bullion to the value of $56,000.

DOME (Porcupine)—In February treated 21,600 tons and recovered $84,412. Mill ran 97% of the time. Average ore was $3.90 per ton.

O'BRIEN (Cobalt)—Production for 1914 was 1,237,345 oz. of which high-grade ore produced 452,772 ounces. Mill treated 41,949 tons. Ore reserves were depleted by 350,000 ounces.

NIPISSING (Cobalt)—During February mined ore estimated at $164,140, and shipped bullion from Nipissing and custom ore estimated net value of $183,646. High-grade mill treated 165 tons and low-grade mill treated 4695 tons.

GIBSON-KIRKLAND LAKE SYNDICATE is name of new company, financed by English capital, which has taken over seven claims in Teck and Lebel townships, about a mile north of the Tough Oakes mine.

CROWS' NEST COAL (Alberta)—Net earnings for 1914 were $263,000, a decrease of $210,000 compared with previous year. Market for coke disappeared with closing down of copper smelteries. General business for coal throughout west was poor.

TEMISKAMING (Cobalt)—Annual report shows operating loss for past year $81,422. Production 278,961 ounces from which was realized $136,334, total income was $146,649. Total expenses were $228,071. New vein from the Beaver for 100 ft. shows high grade most of distance. There are 6000 tons of low-grade ore broken in mine.

MEXICO

San Blas—Sinaloa

ORDER HAS NOT BEEN RESTORED and the only companies that have tried to work of late are the Lluvia de Oro in Chihuahua and the Potrero in the Mocorito district. An engineer operating a gold-copper property writes: "We have been in the thick of the war and for six months have had from 500 to 4000 soldiers in the vicinity, one side having the place at times and the other side at other times. Nevertheless have been able to keep our mine near here going due to luckily having gotten in a year's supply of ammunition just before the fracas began."

Sonora

CARNEGIE LEAD & ZINC CO.—Organized by interests identified with Calumet & Sonora M. & M. Co., to take over and operate latter's property undergoing foreclosure proceedings. R. P. Burgan, President, Pittsburgh, bid in for $82,000 at trustee's sale the 2500 shares of Cananea Mining Co., held by the Calumet & Sonora. This stock was held by the trustees to guarantee interest payment on a $100,000 bond issue floated when the company undertook the development of Mexican property. Stock of original company held largely by Duluth interests.

AFRICA

Rhodesia

GOLD PRODUCTION in January was 70,082 oz., being 807 oz. less than December, but 10,635 oz. more than in January, 1914. Other mineral production in January included 13,802 oz. silver, 249 tons copper, 1 ton lead, 26 tons asbestos, 8176 tons chrome ore and 30,470 tons coal.

Transvaal

GOLD PRODUCTION IN FEBRUARY is reported by cable at 676,221 oz. fine, which is 38,763 oz. less than January, but 19,960 oz. more than February, 1914. For two months ended Feb. 28 total gold reported was 1,278,014 oz. in 1914, and 1,391,205 oz., or $28,756,207, in 1915; an increase of 113,191 oz., or 8.8%, this year.

The Market Report

METAL MARKETS

NEW YORK—March 17

Copper has been stronger without much increase of business. Tin experienced a spectacular rise because of the shortage in spot supply. Lead advanced sharply on large buying for export. Spelter has not yet recovered from the collapse and the market is still but nominal.

Copper, Tin, Lead and Zinc

Copper—In the early part of the week some business was done with domestic consumers at 14¾c., regular terms. On Mar. 15 a little increase in demand caused an advance. Some small sales were reported even at 15c., regular terms, and that price was also received by certain sellers in non-competitive markets. There was not, however, any important buying at that figure, copper being freely offered at 14¾@14⅞c., regular terms, while those who were asking the higher price reported their inability to realize it. The condition seems to be that the market is strong on account of its excellent statistical position, but at the moment there is relatively little buying. The foreign markets are now wholly out of joint with the American, and for the time being the ordinary situation of international parity does not exist. For example, copper actually in London may be sold there at prices considerably above the New York price. With respect to sales for export, there are all kinds of uncertainties as to exchange, insurance and freights, and even of freight room at all, and a shipper can seldom figure out what he is going to realize until the business is completed.

Copper sheets show no change in the base price, which is 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 15¾@16c. per lb., carload lots at mill.

Copper exports from the United States for the week ended March 6 are reported by the Department of Commerce at 11,829,000 lb. The larger items were 7,861,000 lb. to France, 4,209,000 lb. to Great Britain, 224,000 lb. to Italy and 110,000 lb. to Australia. Imports for the week were: Metal 5,448,000 lb., in ore and matte, 1,$62,000 lb.; total 6,510,000 lb. The imports were from Spain, Peru, Chile and Canada.

Exports from Baltimore for the past week included 2,689,496 lb. copper to Stockholm, Sweden.

Brass Prices have been again advanced about ½c. the latest base prices being given out by the American Brass Co. as follows, to date from March 3: Sheets, high brass, 17¾c. net per lb.; low brass, 18⅞c. Wire, high brass, 17½c.; low brass, 18⅞c. Rods, high brass, 17½c.; low brass, 19⅝c. Tubes, brazed, 21⅜c.; open seam, 21⅜c. Angles and channels, 21⅜c. Scrap allowances are 12¼c. net per lb. for high brass; 12⅞c. for low brass.

Tin—The difficulty in arranging shipments from London hither has produced a condition threatening complete shortage of spot supply here. At the beginning of March the spot supply was only 2046 tons, and since then only 80 tons have come in. The conditions are similar to what existed last August, except that consumers are not obsessed by the panic that they experienced then. The existing conditions have, however, produced a large advance in price upon only small business.

Tin ore arrivals in Great Britain in February were three tons of bars from Bolivia; 4801 tons concentrates from Bolivia, 621 tons from Nigeria and 66 tons from South Africa; in all 5488 tons concentrates and 3 tons bars, equivalent to 2365 tons fine tin.

Tin output of Federated Malay States two months ended Feb. 28 was 8538 tons in 1914, and 7379 in 1915; decrease 11.59 tons.

Lead—In the early part of the week the market was strong and advancing, especially in St. Louis where important sales for export began as early as Friday. On Mar. 15, very large sales for export were made, and on Mar. 16, the A. S. & R. Co. was led thereby to advance its price to 4.10c. at noon, no sales having been made from that quarter in the morning. Independent producers, however, had been large sellers. The situation is perplexing, there being nothing in the domestic trade justifying an advance in lead, and during the last week the same producers sold to domestic consumers at five to ten points below what they got for shipment abroad. On Mar. 16, round lots were sold to domestic consumers at 3.90c., St. Louis, while we quote for that day 3.95@4.05, in order to represent the average of all business, domestic and foreign. Sales were made for shipment from St. Louis to Europe through Gulf ports, which explains the contraction of the normal differential between New York and St. Louis.

The spot price of lead in London is far above our parity, but the difficulty of finding freight room keeps the English and American markets apart. Some of the export sales made last week were for delivery abroad, while others were f.o.b. New York and St. Louis, the buyer taking the responsibility of delivery. The total volume of the export business consummated during the last week must have been 15,000 to 20,000 tons. There were large sales to Russia. An unex-

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Mar.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb
11	4.8000	51½	14.55 @14.60	45	3.95 @4.00	3.87½ @3.92½	*7.92½ @8.17½	*7.75 @8.00
12	4.8013	51⅛	14.55 @14.60	49	3.95 @4.00	3.90 @3.95	*7.92½ @8.17½	*7.75 @8.00
13	4.7950	51⅛	14.55 @14.60	49	3.95 @4.00	3.90 @4.00	*7.92½ @8.17½	*7.75 @8.00
15	4.8025	51½	14.55 @14.75	51	3.95 @4.05	3.90 @4.00	*7.92½ @8.17½	*7.75 @8.00
16	4.8025	51⅛	14.55 @14.75	52	4.05 @4.10	3.95 @4.05	*7.92½ @8.17½	*7.75 @8.00
17	4.8000	50¾	14.55 @14.75	52 @53	4.10 @4.15	4.00 @4.10	*7.92½ @8.17½	*7.75 @8.00

* Nominal.

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business and 0.25 to 0.37½c. on European. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.-Mar.	Silver	£ per Ton	Cts. per Lb	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
11	24 5/16	64¼	14.07	65⅛		189	165½	21	4.56	44½	9.67
12	24 3/16	64¼	14.07	65¼		189½	167½	21⅜	4.64	44½	9.67
13	24 3/16										
15	24¼	65¼	14.18	65½		190	166½	22 3/16	4.82	44½	9.67
16	24¼	66	14.34	66½		188	168½	23	5.00	44½	9.67
17	23 13/16	66	14.34	67		190	170¾	23	5.00	44½	9.67

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c.; £20 = 4.35c.; £30 = 6.52c.; £60 = 13.05c. Variations, £1 = 0.21¾c.

planned interruption of England's supply of lead from Spain seems also to have played a part in creating the large demand for lead from here.

The Missouri lead producers have increased their production. The St. Joseph Lead Co. went upon a 90% basis on Mar. 15. The Cœur d'Alene producers have not yet inaugurated any increase or shown any tendency so to do.

Spelter—This market has not yet settled following the shock of the previous week, and still may be quoted only as nominal, the business reported as actually done having been very small. Consumers apparently no longer want to buy. At the beginning of our week of record, resale offers from several consumers, in certain cases of considerable quantities, promised to be a disturbing factor, but the news of a strike among the smelters in Oklahoma on March 13, called a halt pending observation as to what this would amount to. The smelters demanded 50c. per day advance in wages all around. At one of the works at Collinsville the men went out and the furnaces were dead-fired. At Bartlesville, Caney and Dearing, there was no interruption of work, the men remaining on duty pending consideration of their demands. On Mar. 17, it was reported that a compromise had been effected and labor trouble is probably averted. While the spot price of spelter in London has been above our parity, it has been impossible to sell for later delivery in England.

Zinc sheets are quoted today at $13.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Other Metals

NEW YORK—March 17

Aluminum remains quiet but rather steady. Quotations are unchanged at 19@19¼c. per lb. for No. 1 ingots, New York.—**Antimony** is in short supply and prices are strong, though business has been on a small scale. Ordinary brands are 21½@23c. per lb. Cookson's is nominal in the absence of supplies, but 27@29c. per lb. has been offered—**Nickel** is unchanged, ordinary forms being 40@45c. per lb. according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** has been strong and excited. Supplies for spot delivery are very scarce here, and for small lots as high as $75@80 per flask has been paid. For large lots dealers will not quote, having none to deliver. London price is £12 10s. per flask, with £12@12¼ named from second hands.

Gold, Silver and Platinum

NEW YORK—March 17

Gold—A total of $1,250,000 gold is reported on its way to New York from Japan. A shipment of $2,500,000 gold from Ottawa to New York was made this week.

Silver—The market has not been maintained the last few days owing to smaller inquiry. No shipments of bullion were made from New York to London last week, owing to the non-sailing of steamers. This week two steamers sailing under the American flag will probably carry silver.

Platinum—Nothing new has developed in the platinum market, which remains quiet with small sales. The chief demand just now is for hard metal, which seems to hold its price better than refined platinum. Most of the large producers, however are covered by contracts. Prices are a little variable, and we continue to quote $38@42 per oz. for refined platinum and $44@49 per oz. for hard metal.

JOPLIN, MO.—Mar. 13

Blende, high price $7[illegible], assay base 60% zinc, low in lead $73@70, high in lead, $69@65; metal base suspended; calamine base 40% zinc, $40@38; average, all grades of zinc, $6[illegible] per ton. Lead, high price $49.90; base, $48 per ton of 80% metal content; average, all grades of lead, $47.55 per ton.

General decline in all zinc prices at the week end.

SHIPMENTS WEEK ENDED MAR. 13

	Blende	Calamine	Lead	Values
Totals this week	9,006,710	277,590	1,340,870	$353,440
Totals this year	108,078,530	9,973,760	16,211,910	3,846,860

Blende value, the week, $310,740; 11 weeks, $3,283,010.

Calamine value, the week, $6,080; 11 weeks, $181,700.

Lead value, the week, $36,620; 11 weeks, $382,150.

PLATTEVILLE, WIS.—Mar. 13

The base price paid this week for 60% zinc ore was $70@71. The base price paid for 80% lead ore was $48 per ton.

SHIPMENTS WEEK ENDED MAR. 13

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	5,003,010	118,290	168,700
Year	16,343,760	618,390	3,728,660

Shipped during week to separating plants, 3,500,220 lb. zinc ore.

Iron Trade Review

NEW YORK—March 17

The iron and steel trades hold fairly well to the increased working schedules. New business has been a little uneven but the total reported is considerable.

Structural orders are improving, and there is a good demand for plates and shapes for shipbuilding, which is active on the seaboard.

Pig iron is less active, but a better demand is expected in the second half of the month. More orders are reported for export, especially of Alabama iron.

The ferromanganese situation is rather serious. Stocks are getting low and the imports from England are coming very slowly indeed.

The United States Steel Corporation reports the unfilled orders on its books on Feb. 28 at 4,345,371 tons of material. This is 96,800 tons more than on Jan. 31, 508,723 tons more than on Dec. 31, 1914, and 1,020,779 tons more than on Nov. 30, which was the lowest point reached last year.

PITTSBURGH—Mar. 16

The increase of 96,800 tons in the Steel Corporation's unfilled obligations during February, against increases of 411,928 tons in January and 512,051 tons in December, is not to be regarded as making an unfavorable showing for February, since the compilation is affected chiefly by contract tonnage, and February, falling in the middle of the quarter, naturally witnessed relatively little contracting.

The steel mills are now operating at an average of not less than 65% of their steel ingot capacity, approximately double the rate of last December, and showing a slight increase since the first of the month. Apparently business is being booked at a rate sufficient to maintain the present output. It is generally believed that the current production is all being shipped and is passing into actual consumption, so that heavier demands upon the mills are to be expected as the weather permits of more extensive outdoor operations.

Steel prices are steady to firm, but are not subjected to any severe tests as most of the shipping orders being booked are against old contracts.

Pig Iron—The market is practically stagnant, and the situation is disappointing, as a distinct contracting movement, at least in foundry pig iron, was expected by this time. Contracts closed late last year for the first quarter have not been specified against very well, and the quarter will end with considerable tonnages still due. Prices remain quotable as follows: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—There are no new developments. The contract price remains at $78, Baltimore, as recently advanced. Prompt lots command about $100.

Steel—There is nothing being done in billets and sheet bars, consumers' requirements being fully met under old contracts. Billets are $18.25@18.50 and sheet bars $18.75@19, Youngstown, and $1 a ton higher at Pittsburgh. Rods are $25, Pittsburgh.

COKE

Connellsville—The Perry Iron Co., Erie, Penn., has closed a contract with the Orient Coke Co. for 10,000 to 12,000 tons of furnace coke monthly to the end of the year, at $1.75 or a trifle less, this being the only contract closed for a long time. Spot coke is very quiet. Prices are quotable as follows, though the quotations are largely nominal: Prompt furnace, $1.50; contract furnace to July 1, $1.60; to Dec. 31, $1.75; prompt foundry, $2@2.35; contract foundry, $2.15@2.30, per net ton at ovens.

Anthracite shipments in February are reported at 4,275,107 long tons, which is 159,478 tons less than in January, but 153,656 tons more than in February, 1914. For the two months ended Feb. 28 the total shipments were 9,297,193 tons in 1914, and 9,009,692 tons in 1915, a decrease of 287,501 tons this year.

Chemicals

NEW YORK—March 17

Arsenic—The market remains quiet, and no large business is forward. Prices are steady at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is about as usual. Quotations are unchanged at $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller orders.

Nitrate of Soda—Business is a little irregular, but prices hold well. Quotations are 2.20c. per lb. for spot and up to July 1, and 2.17½c. for later deliveries.

Assessments

Company	Delinq	Sale	Amt
Caledonia, Nev	Mar. 8	Mar. 31	$0 05
Challenge, Nev	Mar. 31	Apr. 21	0 05
Confidence, Nev	Mar. 11	Mar. 31	0 10
Con. Virginia, Nev	Feb. 24	Mar 18	0 10
Copper King, Ida	Mar 1	Apr. 1	0 005
East Hercules, Ida, (post.)		Apr. 7	0.001
Eastern Star, Ida	Mar 25	Apr. 25	0 002
Emerald, Utah (three instal.)		June 9	0 01
Enterprise, Ida	Mar. 20	Apr. 20	0 002
Galena King, Utah	Mar. 25	Apr. 25	0 0075
Idaho-Nevada, Ida	Mar 10	Apr. 2	0 002
Index, Ida	Feb. 27	Mar. 27	0.005
Indiana, Mich	Feb. 4		1 00
Iron King, Ida	Feb. 18	Mar. 19	0.001
Jack Waite, Ida	Mar 1	Mar 24	0 01
Kentuck, Nev	Mar 18	Apr. 7	0 02
Keystone, Utah, (post)	Feb. 23	Mar. 23	0 02
King Pine Crk., Ida	Feb 12	Mar. 13	0 002
Laclede, Ida	Mar 20	Apr 6	0 003
Majestic-Idol, Nev.	Dec 15	Jul. 20	0.005
Nabob, Ida	Mar 18	Apr. 12	0 005
Neva, Utah,	Mar 18	Apr. 12	0 002
Oreano, Ida	Mar. 25	Apr 26	0 0015
Overman, Nev	Mar 8	Mar. 26	0.05
Pioche Metals	Mar 20	Apr 20	0 0025
Rescue-Eula, Nev	Feb 11	Mar. 22	0 01
Rio Grande, Utah	Mar. 25	Apr. 17	0.003
Saltese, Ida.	Mar 1	Apr 1	0.002
Selma, Utah.	Mar. 20	Apr. 6	0 0025
Silver Cliff, Ida	Apr. 3	Apr. 24	0 0025
Snowstorm Ex, Ida	Feb. 19	Mar. 22	0 003
Sonora, Ida	Mar. 15	Apr. 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Syndicate, Ida (post)		Jan. 28	0 001
Tarbox, Ida (post.)		Mar 25	0 0025
Tar Baby, Utah	Mar. 5	Apr. 5	0 005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Torino, Ida	Feb 20	Mar 20	0 001
Union Chief, Utah	Feb 18	Mar 15	0.01
Utah, Nev	Mar 25	Apr 15	0 02
Utah-United, Utah	Feb 20	Mar. 15	0.01
Wanlass	Jan 30	Mar 20	0 00375
Wolf Mountain, Utah	Mar 15	Apr 14	0 0015

Stock Quotations

Copper stocks have continued strong. The decline in spelter prices was reflected in the zinc stocks.

COLO. SPRINGS Mar 16 Name of Comp	Bid.	SALT LAKE Mar 16 Name of Comp	Bid
Acacia	05¾	Beck Tunnel	06
Banner	01⅛	Black Jack	10
Cripple Cr'k Con.	007	Colorado Mining	10½
C. K & N	.06½	Crown Point	01¾
Doctor Jack Pot	08½	Daly-Judge	5 25
Elkton Con.	44⅜	Gold Chain	08½
El Paso	1 37	Grand Central	56
Findlay	.03½	Iron Blossom	99
Gold Dollar	04	Little Bell	14
Gold Sovereign	06½	Lower Mammoth	05½
Isabella	16⅛	Mason Valley	1 10
Jack Pot	06	May Day	13
Jennie Sample	02	Opohongo	‡ 01½
Jerry Johnson	03	Prince Con	37
Lexington	0075	Seven Troughs	01½
Mary McKinney	32	Silver King Coal'n	3 12½
Pharmacist	01	Silver King Con	1 85
Portland	1 14	Sioux Con.	‡ 05½
Raven B. H	03	Uncle Sam	04½
Vindicator	1 49½	Yankee	05

TORONTO Mar 16			
Bailey	02	Dome Exten	08
Coniagas	4 50	Foley O'Brien	18
Peterson Lake	23	Hollinger	22 25
Right of Way	02	Imperial	01
Seneca Superior	1 25	Jupiter	09
Silver Queen	02	McIntyre	35
T. & Hudson Bay	24 00	Pearl Lake	02
Timiskaming	22½	Porcu. Gold	‡ 25
Wettlaufer-Lor.	05	Preston E. D	01
Big Dome	7 50	Rea	12

SAN FRANCISCO Mar 17 Comstock Stocks		[illegible]	
Alta	04	Belmont	[illegible]
Belcher	[illegible]	Jim Butler	75
Best & Belcher	06	Lone Star	06
Caledonia	28	MacNamara	04
Challenge Con	03	Midway	16
Confidence	20	Mont.-Tonopah	15
Con. Virginia	13	North Star	15
Crown Point (Nev	‡ 32	Rescue Eula	10
Gould & Curry	03	West End Con	53
Hale & Norcross	04	Atlanta	47
Julia	‡ 01	Booth	28
Mexican	38	C. O. D. Con	06
Occidental	.79	Comb. Frac	07
Ophir	09	Jumbo Extension	05
Overman	.10	Pitts.-Silver Peak	10
[illegible]	‡ 02	Round Mountain	37
[illegible]	04	Sandstorm Kendall	09
Sierra Nevada	.07	Silver Pick	08
Union Con	08	Central Eureka	‡ 25
Yellow Jacket	17	So. Eureka	‡2 25

N. Y. EXCH. Mar 16 Name of Comp.	Clg.
Amalgamated	54¾
Am Sm.&Ref.,com	64
Am. Sm. & Ref., pf.	102½
Am. Sm. Sec., pf. B.	‡78
Anaconda	26⅛
Batopilas Min	50
Bethlehem Steel	57½
Bethlehem Steel, pf.	103
Chino	35¼
Colo. Fuel & Iron	23⅛
Federal M. & S., pf.	‡ 4¾
Great Nor., ore., ctf.	31⅛
Guggen. Exp.	49¾
Homestake	115¾
Inspiration Con.	21⅛
Mex. Petroleum	66¾
Miami Copper	21¼
Nat'l Lead, com.	52
National Lead, pf.	106
Nev. Consol.	11⅞
Ontario Min.	2
Phelps Dodge	‡175
Quicksilver, pf.	1⅛
Ray Con.	17½
Republic I&S, com.	19¾
Republic I&S, pf.	76
SlossSheff'd, com.	25
Tennessee Copper	27½
Utah Copper	52½
U. S. Steel, com	45
U. S. Steel, pf.	104¾

N. Y. CURB Mar 16 Name of Comp	Clg.
Beaver Con	24
Big Four.	06
Blue Bell.	06
Braden Copper	7
Buffalo Mines	65
Can. Cop. Corpn.	‡1
Can. G. & S	03
Caribou.	‡ 45
Chambers Ferland	14
Con. Ariz. Sm	$\frac{5}{16}$
Coppermines Cons	‡1¼
Davis-Daly	88
Diam'field-Daisy.	07½
Dia. Black B	03½
Ely Con	‡ 01
Florence	60
Goldfield Con	1¼
Goldfield Merger.	24
Greene Cananea	26
Kerr Lake	4¼
La Rose	⅜
McKinley-Dar-Sa	45
Mines of Am	2
Mutual Min., pf	‡2½
Nevada Hills	23
New Utah Bingham	42
Nipissing Mines.	5¾
Ohio Copper	08
Oro.	13
Pacific Smelt	‡$\frac{1}{32}$
South Utah	8
Stand'd Oil of N.J	395
Standard S. L.	1⅜
Stewart	1⅛
Tonopah	$7\frac{9}{16}$
Tonopah Ex.	2⅜
Tonopah Merger	40
Tularosa	¼
West End Ex.	03
Yukon Gold	2⅜

LONDON Mar 5	£	s	d
Alaska Tre'dwell	£7	2s	6d
Camp Bird	0	6	9
El Oro.	0	9	0
Esperanza.	0	10	0
Mexico Mines	3	17	6
Oroville	0	11	9
Philippine Dr.	1	0	0
Santa Gert'dis	0	11	3
Tomboy	1	3	1
Tough Oakes	0	13	9

BOSTON EXCH Mar 16 Name of Comp	Clg
Adventure	1¼
Ahmeek.	295
Alaska Gold M.	33¼
Algomah	50
Allouez	41½
Am. Zinc	26¼
Ariz. Com., ctfs.	3¾
Bonanza	32
Butte-Ballaklava	2¾
Butte & Superior	47¼
Calumet & Ariz.	53¾
Calumet & Hecla	393
Centennial	17¼
Copper Range	34½
Daly West	2¼
East Butte	9½
Franklin	5
Granby	67½
Hancock	11¼
Hedley	27⅜
Helvetia	30
Indiana	3½
Island Cr'k, com.	42½
Island Cr'k, pfd.	86½
Isle Royale	20½
Keweenaw	2
Lake.	7⅛
La Salle.	3¼
Mass	4¾
Mayflower	4
Michigan.	80
Mohawk	58½
New Arcadian	5
New Idria Quick.	‡3½
North Butte.	24⅜
North Lake	‡1
Ojibway.	.75
Old Colony	3¾
Old Dominion	40
Osceola	73
Quincy.	55½
Santa Fe	$1\frac{5}{16}$
Shannon	5
Shattuck-Ariz.	21½
Superior	27
Superior & Bost.	1
Tamarack.	30½
Trinity	4
Tuolumne.	.25
U. S. Smelting	21
U. S. Smelt'g, pf.	40¼
Utah Apex.	2⅛
Utah Con.	9¾
Victoria.	1⅛
Winona.	2¼
Wolverine.	42½
Wyandot.	50

BOSTON CURB Mar 16 Name of Comp	Bid
Alvarado	70
Bingham Mines.	3½
Boston Ely	14
Butte & Lon'n Dev	21
Calaveras	1¼
Calumet-Corbin	16
Chief Con	85
Corbin	‡ 50
Cortez	15
Crown Reserve	80
Eagle & Blue Bell	80
First Nat. Cop.	1⅛
Houghton Copper	$1\frac{9}{16}$
Iron Cap Cop., pf	3
Majestic	.12
Mexican Metals.	19
Nevada-Douglas	37
New Baltic.	1½
Oneco	45
Raven Copper	07
Smokey Dev.	10
So. Lake	1¼
Tonopah Victor	‡ 17
Trethewey	13
United Verde Ext	$3\frac{5}{16}$

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62 938	57 572	48 855	28 983	26 553	22 731
February	61 642	57 506	48 477	28 357	26 573	22 753
March	57 870	58 067		26 669	26 788	
April	59 490	58 519		27 416	26 958	
May	60 361	58 175		27 825	26 704	
June	58 990	56 471		27 199	25 948	
July	58 721	54 678		27 074	25 219	
August	59 293	54 344		27 335	25 979	
September	60 640	53 290		27 986	24 260	
October	60 793	50 654		28 083	23 199	
November	58 995	49 082		27 263	22 703	
December	57 760	49 375		26 720	22 900	
Year	59 791	54 811		27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14 223	13.641	64. 304	60. 756	69 488	65.719
February	14 491	14 394	65. 259	63.494	70 188	*
March	14.131		64. 76		69 170	
April	14.211		64. 747		69 313	
May	13.996		63. 18		67 786	
June	13.603		61. 336		66 274	
July	13.223		60 540		64 955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11 739		53. 227		*	
December	12 801		56. 841		*	
Year					.....	

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37 779	34 260	171.905	156.550
February	39.830	37 415	181.556	176.925
March	38.038		173.619	
April	36.154		163.963	
May	33 360		150.702	
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34 301			

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4 048	3.827	3 937	3.718	19 606	19.122
March	3 970		3 850		19.651	
April	3.810		3 688		18 225	
May	3.900		3 808		18.503	
June	3.900		3 810		19.411	
July	3.891		3 738		19 051	
August	3.875		3 715		‡	
September	3.828		3 658		‡	
October	3.528		3 384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19 097	
Year	3 862		3 737		..	

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5 262	6.386	5.112	6.211	21 533	30.844
February	5 377	8.436	5 228	8 255	21 413	39 819
March	5 250		5 100		21 460	
April	5.113		4 96		21 569	
May	5 074		4 924		21 393	
June	5 000		4 850		21 345	
July	4 920		4 770		21 568	
August	5 568		5 418		‡	
September	5 380		5 230		‡	
October	4.909		4 750		‡	
November	5.112		4 962		25 016	
December	5.592		5 430		27 369	
Year	5.213		5 06			

New York and St Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14 59	$13. 23	$13 45	$13 99	$13 90
February	15.06	14 55	14 12	13 45	14 08	13.90
March	15 07		13 91		14 10	
April	14.90		13 90		14 13	
May	14 90		13 90		14 27	
June	14 90		13.90		13 96	
July	14 90		13.90		13 90	
August	14.90		13.90		14 08	
September	14 90		13 90		14 03	
October	14.84		13 75		13.97	
November	14 59		13 43		13 83	
December	14 70		13.45		13 83	
Year	$14 88		$13 78		$14 01	

The Engineering and Mining Journal

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Magnetic-Concentration Mill at Mt. Hope, N. J.

By Samuel Shapira*

SYNOPSIS—This mill, owned and operated by the Empire Steel & Iron Co. of Catasauqua, Penn., and equipped to concentrate northern New Jersey iron ores, has lately been redesigned and improved so that it now is thoroughly uptodate and efficient. Ball and Norton magnetic-separating machines of the belt, drum and pulley types are used, and finished concentrates, middlings for retreatment and tailings are made. An improved type of tower dryer is a feature. The mill has a capacity of 60 tons per hour.

The Empire Steel & Iron Co.'s mines and plant are at Mt. Hope, three miles north of Wharton, N. J. The Mt. Hope Mineral R.R. runs from the mines to Wharton and there connects with the main line of the Lackawanna R.R. and the Central R.R. of New Jersey. The road is standard gage and has a grade for its entire length in favor of the load.

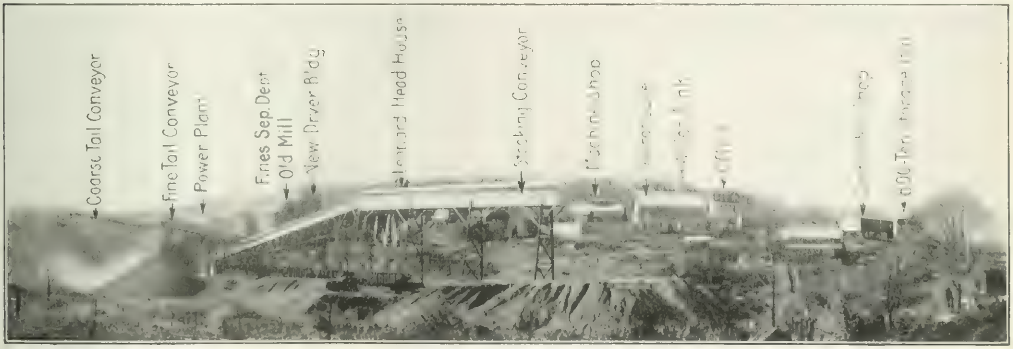
During the last 2½ years the company has successfully carried out a policy of development and improvement which has placed it in a position to mine and mill 1000 tons of ore a day. The old mill, built in 1908, was originally designed to treat the high-grade ores from the Elizabeth vein. It was changed to meet the requirements of greater capacity and of the lower grade ores coming from the Taylor, Finley and Leonard veins. Additional improvements include a separate building for the treatment of fines, a new dryer building and a system for stocking and reclaiming 30,000 tons of concentrates.

Preliminary Crushing and Storage

Formerly all ores were hoisted through the Leonard shaft and delivered by means of a Hunt automatic railway, about 75 ft. long, to the crude-ore bin at the head of the mill. The three-compartment Brown shaft, about 1000 ft. north of the mill, is now the main hoisting shaft and it is here that the preliminary crushing is done.

The ore hoisted through the Brown shaft is dumped into a 100-ton steel ore bin which discharges on a 48-in. pan conveyor. The discharge from the bin is regulated by a rack-and-pinion hand-operated ore-bin gate. The pan conveyor rises at an angle of 14°, is 20 ft. 9 in. between centers and can be driven at a speed of 3, 5 or 7 ft. per minute. The ore carried by the pan conveyor is received by a 36x24-in. Farrel-Bacon jaw crusher, which has a capacity of 85 tons per hour, crushing to 5 in. From the crusher the ore passes to the No. 14 conveyor belt, which is 24 in. wide, with four-ply center and six-ply edges. This is a Robins conveyor, 204 ft. 8 in. between centers, having a slope of 20° for 121 ft. 8 in. and traveling level for 83 ft. This level part is 10 ft. 8 in. above the loading track, is provided with a hand-propelled tripper and is directly over an 800-ton storage bin. The conveyor has a speed of 200 ft. per minute.

The storage bin, built entirely of wood, is lined on all sides and bottom with a double thickness of 3x8-in. spruce planks. The wear is taken by 20-lb. rails spaced at 1-in. centers and laid on the 3x8-in. planks, the spaces between



A Panoramic View of the Mt. Hope Plant

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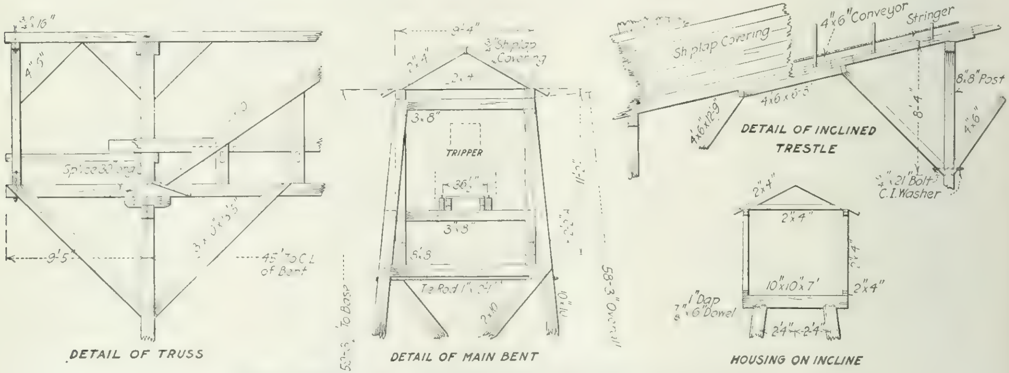
*Mining engineer, Mines Management Co., 60 Broadway, New York City the rails being filled with hardwood wearing strips. The bin has a 45° bottom: the inside dimensions are 70 ft. 1 in. by 14 ft. by 20 ft. 4 in. A partition divides the bin into two sections, each provided with three 24x30-in. hand-operated rack-and-pinion gates.

The crusher, pan conveyor and transmission machinery are housed in a frame building covered with corrugated iron. The 100-hp. Westinghouse motor driving the installation is housed in a separate and adjoining room. The trestle containing the 24-in. conveyor is housed, as is also the top of the storage bin. These housings are covered with corrugated iron.

SECONDARY CRUSHING AND STORAGE

From the 800-ton storage bin the ore is loaded by means of steel chutes into 110,000-lb. capacity steel hopper-bottom gondolas and hauled by a small locomotive to the trestle and ore bin at the head of the mill.

The bin is rectangular, 13 ft. 3 in. by 18 ft. by 24 ft. 6½ in. deep with 24-in. stone and concrete walls, and has a flat bottom. The bottom and ends are kept permanently filled with broken ore and owing to the discharge gate being to one side of the center line of the bin only a 100-ton working capacity is obtained. To make up for this loss of storage at this point, four loaded gondolas are constantly kept on the trestle and are dumped into the bin as required.



DETAIL OF TRUSS

DETAIL OF MAIN BENT

DETAIL OF INCLINED TRESTLE

HOUSING ON INCLINE

SOME DETAILS OF THE CONCENTRATES-STORAGE CONVEYOR

The ore is drawn from the bin through an air-operated gate by a shaking grizzly. This grizzly is 6 ft. long by 3 ft. 4 in. wide with 12-in. sides. It is hung from overhead by two adjustable suspension arms on the back end and is supported in front by two eccentric bearings on a 3-in. steel driving shaft. Power to drive the grizzly is obtained by belt and pulleys from the countershaft of crusher No. 1. When first installed the grizzly was made up of 11 manganese-steel bars with 2-in. spaces. Owing to serious clogging these bars were later replaced by a ¾-in. thick manganese-steel plate, 57x39-in., with 2-in. round holes, and no further trouble was experienced. The shaking grizzly discharges into crusher No. 1, the throughs bypassing and entering the boot of bucket elevator No. 1 by means of a gravity chute and a feed hopper.

In the operation of the ore-bin gate, which runs in angle-iron guides, a 12-in. diameter by 4-ft. stroke Curtis double-acting air cylinder is used. This cylinder is hung on the concrete wall of the bin and above the gate.

Crusher No. 1 is a No. 7½K Gates gyratory of Allis-Chalmers make and runs at a speed of 345 r.p.m. and crushes to a maximum of 4 in. From this gyratory crusher the ore falls through a gravity chute to a feed hopper, which in turn delivers it to the 16-in. bucket elevator No. 1. This elevator is a No. 5, style "B," Gates type, of Allis-Chalmers make, has an inclination of 69½° and is 58 ft. long between head and foot pulleys. The buckets are made of steel plate and are 16 in. wide, 11 in. on the belt, and have an 8-in. lip. They are bolted at 14-in. centers to an 18-in., 10-ply belt having a speed of 188 ft. per min. This gives the elevator a maximum capacity of 205 tons per hour or 1640 tons per shift of eight hours. Due to intermittent feeding the elevator is never called upon to convey this amount of ore.

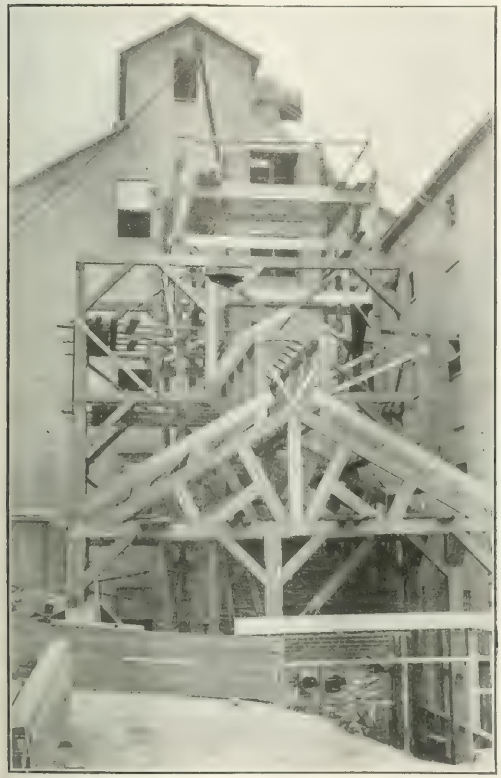
From this elevator the ore is discharged into the No. 5 trommel screen where the first sizing is done. This screen makes two sizes: on 2 in. and through 2 in. The screen, which is of the Gates patent "iron-frame" type, is made up of one section 6 ft. long by 32 in. diameter, $\frac{5}{16}$-in. steel with 2-in. round holes, and has an inclination of 1¼ in. per ft. The oversize passes through a gravity chute to the No. 2 crusher, which is a No. 4K Gates gyratory, crushing to 2 in. maximum and discharging to the boot of elevator No. 1. The throughs from this screen pass to a feed hopper over conveyor No. 11, which is directly underneath the screen and delivers the ore to the new tower dryer No. 2. Conveyor No. 11 is 26 ft. between centers, has a slope of 18° and is 18 in. wide.

ROWAND TYPE TOWER DRYER

Invariably the Mt. Hope ore is wet, being especially so in the spring of the year. The dry magnetic-separation process is used in the Mt. Hope mill, and it is essential that the ore be dry before being sent to the magnetic-separating machines.

The drying is done in a tower dryer of new design, and all ore through 2 in. from screen No. 5 is conveyed to the top of the dryer. After drying, the ore is returned to the mill for further sizing, crushing and separation.

The tower dryer, with its furnace and accessory conveying machinery, is housed in a separate building of mill-type design. The dryer itself is simply a vertical square stack laid up of three courses of red brick and lined for a height of 11 ft. 10 in. with one course of firebrick. The stack is 5 ft. square inside by 45 ft. 1¼ in. high and rests upon a block of concrete 10x10x10 ft. A framework of structural iron encases the stack for its entire height. The stack serves as the flue for the fire as well as the drying space for the descending ore. Baffle bars are placed in the stack in order that the ore may drop slowly through it and receive a thorough drying. The method of supporting these baffle bars differs from any heretofore used in tower dryers of this type. The dryer is made up of 10 sections or groups of tiers of baffle bars. Each section consists of four corner columns 6 in. square by 40 in. high, having sets of lugs on two adjoining sides. The columns are hollow and are independent of the brickwork of the stack and have a square recess at the lower end and a square shoulder at the upper end. The columns rest one on top of another, the shoulder of one fitting into the recess of the other, allowing the columns to be built up the same as a sectional bookcase. The four bottom columns rest upon base plates set into the brickwork of the stack. The columns, at two places in the stack, have projecting arms setting in the brickwork and are designed so that they do not rest upon the columns immediately below. This allows at these sections a 2-in. space for expansion. The lugs on the adjoining sides of these corner columns are spaced to take end bearing bars which at the same time act as spreaders. The bearing bars are slotted to take the baffle bars. The first seven sections of the dryer, beginning at the bottom, are laid up as follows: Each section consists of five tiers of baffle bars, with five bars per tier, the clear space being 6 in. between the bars horizontally and 8 in. vertically. The tiers of bars in each succeeding section are at right angles to those in the preceding section. In section No. 8, the third from the top, there are four tiers with four bars per tier, the clear space being 7 in. between the bars horizontally and 10 in. vertically. In section No. 9 the arrangement is three tiers high with three and four bars per tier and with 10- and 10½-in. spaces horizontally and 12-in. spaces vertically. In section No. 10, the top, the arrangement is two tiers high with three and four bars per tier, and with 10- and 10½-in. spaces horizontally and 15-in. spaces vertically. The graded spacing of the bars in the upper sections allows a greater freedom for the falling ore than would otherwise be the case, the idea being not to retard the velocity of the ore too quickly in the upper and colder sections of the dryer. The baffle bars for the three upper sections are 4 ft. 8 in. long by 9 in. wide by 1 in. thick. The bars for the lower sections are 4 ft. 8 in. long by 6 in. wide by ¾ in. thick. The bearing or spreader bars for all sections are 4 ft. long by 6 in. wide by ¾ in. thick. All bars have a T cross-section. Each section of the dryer is provided with doors for access to the bars in case of renewal or a block in the dryer.



NEW DRYER AND BUILDING DURING CONSTRUCTION

The furnace attached to the dryer stack has a firebox 6 ft. 9 in. by 7 ft. 6 in. which is filled with "Tread-kill" dumping grates for burning No. 2 buckwheat coal under forced draft. The forced draft is obtained from a motor-driven Buffalo Forge Co.'s 45-in. steel-plate fan. This fan also provides air, which is made to pass first over and then under the arch of the firebox. This preheated air along with the hot gases from the furnace acts as the drying agent for the descending ore in the dryer. A motor-driven American Blower Co. No. 80 steel-plate exhaust fan placed at the top of the dryer helps to draw up the gases through the falling stream of ore. To the top of the dryer is fixed a steel-plate hood having a 20x12-in. opening for the ore and two outlets for the gases. One outlet is connected with the exhaust fan and the other with a 30-in. diameter by 20-ft. steel-plate stack. Each outlet has a damper so that the gases may be sent through the fan or up the stack, as desired.

The bottom of the dryer is provided with an outlet chute with a controlling rack-and-pinion gate through which the ore is delivered by means of a gravity chute and a feed-box to bucket elevator No. 4. This is a vertical double-chain elevator, 77 ft. 9 in. between centers, having two chains, each 162 ft. long, made up of steel inside and outside links, ⅜x2½x12 in. by 9 in. pitch. To these chains are attached 108 No. 10 steel-plate elevator buckets on 18-in. centers. The buckets have the following dimensions: 17¾ in. long by 10 in. wide by 10 in. projection. The head and boot shafts of this elevator are each provided with two manganese-steel sprocket wheels. The elevator has a speed of 131 ft. per minute and a capacity of 75 tons per hour.

From the elevator the ore is delivered by means of a gravity chute to the No. 12 belt conveyor. This belt is 18 in. wide by 26 ft. between centers, has a slope of 4°, and delivers the dried ore to trommel screen No. 1 in the old mill.

COARSE SCREENING, CRUSHING AND SEPARATING

Trommel screen No. 1, which is at the top of the old mill building, is 32 in. diameter by 8 ft. long. It has a dust jacket of ¼-in. steel plate 48 in. diameter by 54 in. long with ½-in. round holes, and inside section of $\frac{5}{16}$-in. steel plate, 32 in. diameter by 4 ft. long with 1-in. round holes, and an end section 32 in. diameter by 4 ft. long with 1½-in. round holes. Three sizes are made—namely, through ½-in., which goes, by means of 16-in. belt conveyor No. 1, to screen No. 2 or to the old tower dryer, if desired; through 1-in. and 1½-in., which goes by means of a gravity chute to drum separator No. 1; and the oversize, on 1½ in., which goes by way of a gravity chute to drum separator No. 2.

Old dryer No. 1, which is housed in an annex to the old mill building, is a vertical brick stack with a 3-ft. square inside space filled with baffle bars. This dryer will now be used only in case of a breakdown of the new dryer.

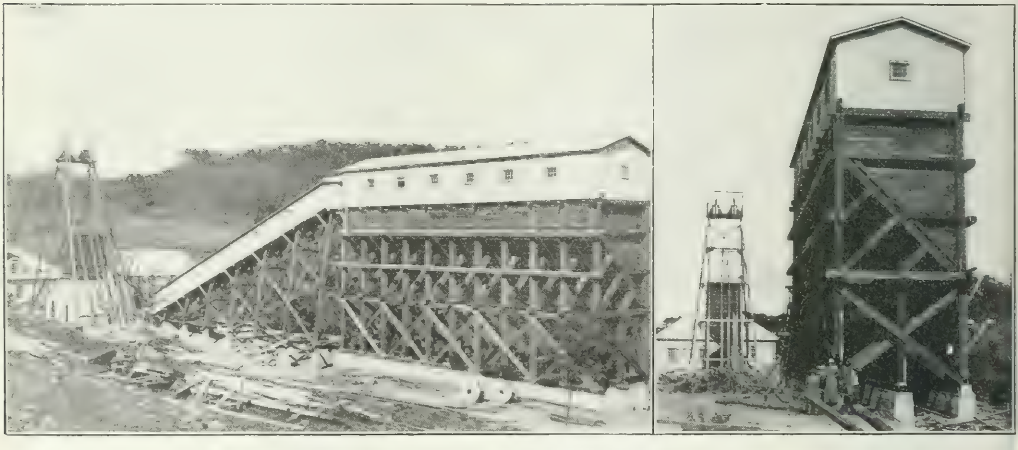
All magnetic separators are Ball and Norton machines. With the exception of drum separators Nos. 1 and 2, all the machines are on one floor level, the belt-type machines being in the fines-separating department. Each size of ore is treated on machines best adapted to handle it. Reference to the accompanying flow sheet will give a good idea of the arrangement of the machines and the flow of material.

Drum separator No. 1, which is 30 in. diameter by 24 in. face, has a stationary yoke to which is attached a double row of magnets, each row consisting of 15 magnets. This machine carries 4.5 amp. at 250 volts and will handle from 20 to 30 tons per hr. Formerly all drum machines were provided with brass drums, but these have been replaced by manganese-steel drums, ⅛ in. thick, which have a life approximately four times that of the brass drums and cost one-fourth as much. Drum separator No. 1 makes a finished concentrate, which is sent by means of gravity chutes to concentrate belt conveyor No. 1, thence to the shipping bin. A middlings product is also made which goes by way of a gravity chute to pulley separator No. 1.

Drum separator No. 2, which is 36 in. diameter by 28 in. face, is equipped with a single row of 14 magnets connected in series. This machine carries 6 amp. at 250 volts and will handle from 20 to 30 tons per hr. The finished concentrates from this machine join the stream from drum No. 1, while the middlings pass through a gravity chute to pulley separator No. 2.

The pulley machines are short conveyors with 4-ft. centers, the head pulley of which is an electromagnet of the pulley-machine type. In this type of machine there is also a drum with an inside yoke to which are attached 24 magnets, but these, instead of being stationary, revolve with the shaft. These machines carry 12.5 amp. at 250 volts. They make tailings which will average 11% in iron. The middlings from these machines pass by way of gravity chutes to 40x15-in. Anaconda rolls for further crushing. The principal advantage of the pulley machine is that it will make clean rock, which is discarded before fine crushing commences, and only the sized middlings product is fed to the rolls. Thus excess separator and roll capacity is obtained.

The tailings from pulley separators Nos. 1, 2, 3 and 4 pass through gravity chutes to No. 2 conveyor. This is an 18-in. belt conveyor, 114-ft. centers, having a 12° slope and a speed of 309 ft. per min. The discharge end of this conveyor is fitted with a two-way chute so that the tailings may be sent to the rock screen No. 3 over th rock bin or, if desired, to 18-in. belt conveyor No. 6 whic discharges on to the coarse-tailings dump.



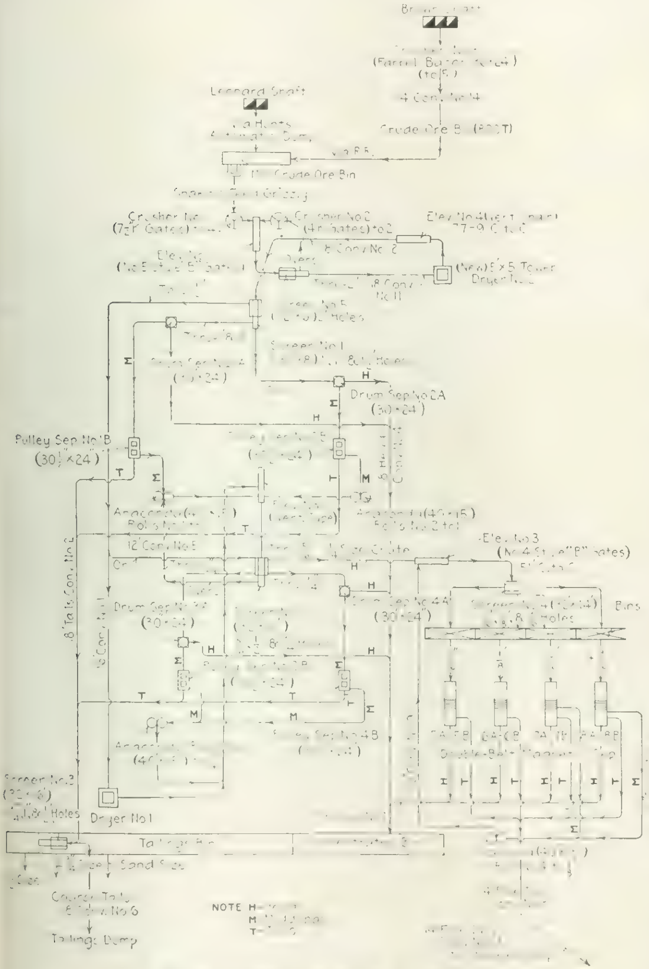
THE 800-TON ORE BIN, SIDE AND END VIEWS

The middlings from pulley machines Nos. 1, 2, 3 an 4 are crushed in 40x15-in. Anaconda rolls Nos. 1, 2 an 3, set to ½ in., 1 in., and ¼ in. respectively, and pas from these rolls to the boot of elevator No. 2.

Elevator No. 2, which is vertical, being 45 ft. betwee head and foot wheels, is made up of one strand of No. 13 special combination chain fitted with K_2 attachment every second link. To these K_2 attachments are bolte 16x8x11¾-in. elevator buckets made of No. 8-gage stee plate. The head and foot shafts are provided with smoot traction wheels over which the chain rides. The elevato has a speed of 200 ft. per minute and a maximum capacit of about 200 tons per hr., but is never called upon t handle this amount of ore.

From this elevator the ore is discharged into tromm screen No. 2. This screen is 32 in. diameter by 12 ft. lon and is made up of a dust jacket 48 in. diameter by 6 f long with $\frac{5}{16}$-in. round holes, an inside section 32 i diameter by 6 ft. long with ½-in. round holes and an end section 32 in. diameter by 6 ft. long with ¾-in. round holes. Four sizes are made by this screen as follows: Through $\frac{5}{16}$ in., which passes through a gravity chute to the boot of elevator No. 3 in the fines-separating department: through ½ in. on $\frac{5}{16}$ in., which goes to drum separator No. 3; through ¾ in. on ½ in., which goes to drum separator No. 4; and the oversize, on ¾ in., which goes by way of 12-in. belt conveyor No. 5 to rolls No. 1.

Drum machines Nos. 3 and 4, which are similar to drum separator No. 1, work, each, in combination with a pulley-type separator. The drum machine is located in each case above the tail pulley of a pulley-type separator, and makes a finished concentrate which is delivered by means of a gravity chute to the 18-in. belt conveyor No. 4. The middlings from the drum fall directly on the conveying belt of the pulley machine which makes a middlings product which is sent to rolls No. 3 and a tailings product which is delivered by a gravity chute to tailings conveyor No. 2. Drum machines Nos. 3 and 4 carry, each, 3.75 amp. at 250 volts, and the pulley machines Nos. 3 and 4 carry 12.5 amp. at 250 volts.



Flow Sheet of the Mt. Hope Mill

Fines-Separating Department

The fines-separating department is housed in a new five-story wooden building whose dimensions are 24x39 ft. by 55 ft. high. This building forms an annex to the old mill and was designed so that the main floors of each building would be at the same elevation. In structural design this annex is similar to the old mill building.

All ore finer than $\frac{5}{16}$ in. is received by elevator No. 3, which is located in the new annex. This is a No. 4, style B, geared-head elevator of Allis-Chalmers make. It is 52 ft. 4 in. between centers, and has an inclination of 84½°. The buckets, which are 13x10x7 in., are bolted to a 14-in. eight-ply belt which has a speed of 200 ft. per minute.

The elevator discharges into a 32-in. by 14-ft. screen. The screen is made up as follows: A dust jacket of No. 16 gage steel plate, 18 in. diameter by 4 ft. long, having $\frac{1}{2}$x$\frac{1}{16}$-in. slotted holes; an inside section 32 in. diameter by 7 ft. long with ⅛-in. round holes; and an end section 32 in. diameter by 7 ft. long with $\frac{3}{16}$-in. round holes. This screen makes four sizes, namely, through $\frac{1}{16}$ in., through ⅛ in., through $\frac{3}{16}$ in., and an oversize through $\frac{5}{16}$ in. on $\frac{3}{16}$ in. There is a wooden storage bin situated on the floor below. The bin has four compartments, one for each size product from the screen. These compartments are each 4½x7½x7 ft. inside and will hold, when full, sufficient ore to run the fines department for 1 hour.

On the floor below the bin are four double-belt magnetic-separating machines. Three of these machines are of the series type and one is of the parallel type. The finest size, through $\frac{1}{16}$ in., goes to the parallel machine, while the other sizes are treated on the series machines.

The parallel machine consists of two belt separators placed one above the other and operating in parallel. This machine makes concentrates and tailings but no middlings, as at through $\frac{1}{16}$-in. size there is not enough combined material to pay for further crushing. The parallel machine has about double the capacity of a series machine. Each belt separator is made up of 12 magnets connected in series and carries 4 amp. at 250 volts.

The series machines consist of two belt-type separators, one above the other. The top machines deliver clean concentrates and carry a current of about 5 to 5.75 amp. at 250 volts. The bottom machines carry 8.25 amp. and treat the rejected material from the top machines, making middlings and tailings. Each belt separator is made up of 12 magnets connected in series.

The concentrates from the four double-belt machines are collected on 12-in. belt conveyor No. 7 which delivers its load to the main concentrates conveyor No. 4. The middlings from the three series machines are collected on 12-in. belt conveyor No. 10, which discharges into a set of 40x15-in. Anaconda rolls No. 4, set to ⅛-in. opening. The tailings from all four machines go through gravity chutes to 14-in. belt conveyor No. 8. This conveyor in turn delivers the fine tailings to the 14-in., motor-driven belt conveyor No. 13, which has a length of 200 ft. between head and tail pulleys. This latter conveyor discharges the tailings on the fine-tails storage dump. The product through rolls No. 4 is sent by means of 12-in. belt conveyor No. 9 to the boot of elevator No. 3.

Storage of Concentrates

All of the concentrates from the coarse and fine departments are collected by 18-in. belt conveyor No. 4. This conveyor is 107½ ft. long between head and tail pulleys and has a slope of 12° and a speed of 309 ft. per min. The concentrates are discharged into a 500-ton wooden storage and shipping bin, the inside dimensions of which are 15½ ft. wide by 30½ ft. long by 20 ft. high. The bin has a 45° bottom and joins the rock bin, which has the same dimensions.

To guard against the lack of storage for concentrates when shipments are not heavy and when it is still desired to keep the mine and mill working at either one or two shifts, a stocking conveyor and trestle with arrangements for reclaiming the ore were designed and erected. This conveyor is 18 in. wide and 360 ft. long between head and tail pulleys. It rises at an angle of 14° for 225 ft. and then is level for 135 ft. The level part is about 55 ft. above the ground, and is equipped with a hand-propelled, double-discharge tripper.

The inclined part of the conveyor is supported by a wooden trestle with bents spaced at 21-ft. centers. The level part is supported by a truss laid on four main bents at 45-ft. centers. All bents rest on concrete piers or sills. The machinery for the conveyor was supplied by the Stephens-Adamson Manufacturing Co. The belt used is an 18-in., five-ply, ⅛-in. rubber-covered "Maxecon," furnished by the B. F. Goodrich Co. The conveyor is driven through a set of spur gears at the foot pulley by means of a 15-hp. stationary steam-driven engine.

The method of operating is to allow the concentrates bin to fill and when the ore is at a fixed elevation the surplus passes through a gravity chute to the tail end of the conveyor and from this point on out to the storage pile.

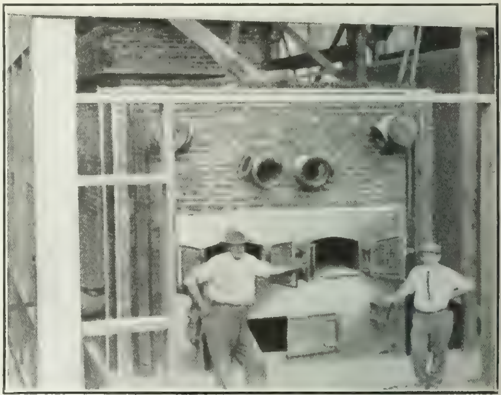
Reclaiming tracks are laid on both sides of the conveyor, with a spur for empties. In the course of stocking ore these tracks are covered up and in reclaiming ore use is made of a 1-yd. Hayward grab bucket. This bucket is attached to a 55 ft. boom, the latter with the hoist engine carried by a strong, home made flat car having extra-heavy trucks. This car is pushed by the yard locomotive to any part of the pile. The maximum content of this stock pile is 30,000 tons.

Equipment and Power Summarized

The total crushing equipment is one Farrel-Bacon jaw crusher, 36x24 in.; one No. 7½K gyratory, one No. 4K gyratory and four sets of 40x15-in. Anaconda rolls. The separating equipment consists of four drum machines, four pulley machines and four double-belt machines.

The power equipment consists of one right-hand 16x36-in. heavy-duty Corliss engine rated at 300 continuous hp. at 140 lb. steam pressure, 100° superheat, and 100 r.p.m. This engine is belted to the 4$\frac{15}{16}$-in. main mill shaft from which most of the machines in the old mill and those in the new dryer building are driven. The Brown shaft-crusher installation is driven by a Westinghouse motor rated at 100 hp., 550 volts, 850 r.p.m. The fines-separating department, as well as a few machines in the old mill, is driven by a Westinghouse motor rated at 100 hp., 550 volts, 333 r.p.m. The fine-tails conveyor is driven by a Westinghouse motor rated at 5 hp., 550 volts, 850 r.p.m. The exhaust fan at the top of the new dryer is driven by a motor rated at 5 hp., 550 volts, 400 r.p.m. The blower at the bottom of the new dryer is driven by a Peerless motor rated at 3 hp., 220 volts, 665 revolutions.

Direct current for the motors, as well as for the separators, lights and other power purposes, is obtained from a 550-kw. d.c. Westinghouse mixed-pressure turbogenerator. Through an interconnecting switchboard current may be obtained, if desired, for the magnetic separators and lights from a 35-kw. d.c. Bullock generator, direct-connected to a 9x10-in. simple automatic Ideal engine.



The New Dryer Furnace

The Corliss engine and the generators are in th engine room of the power plant, which is situated only a short distance to the west of the mill.

The switchboard controlling the magnetic separators is in a dust-proof room on the same floor as the machines and is thus easily accessible to the mill foreman. This board is made up of three panels, and consists of a rheo stat and switch for each machine. The board was de signed with only two ammeters, thus doing away with th usual practice of having an ammeter for each magneti separator. The 100-hp. mill motor with its starting pane is situated in a dust-proof room on the main separato floor.

As a precaution against fire, dry-pipe Grinnel aut matic sprinklers have been installed in all the mill buil ings and conveyor housings. A 2500-gal. storage wate tank with a 20-ft. head above the top of the mill is con nected by a 6-in. cast-iron pipe line to the sprinkler sys tem. The system was furnished and installed by the General Fire Extinguisher Company.

In accordance with its policy of safety the company has equipped the main mill shaft with a No. 230 solid Smith-type Hill friction-clutch coupling. This coupling is operated from three floors of the mill through a double-geared clutch operator. All dangerous places in the mill have guard rails or other devices to make the work as safe as possible.

OPERATING

The mill is operated for one or two eight-hour shifts per day, depending upon the demand for concentrates.

HEADFRAME AT THE BROWN SHAFT

The mill treats about 500 tons per shift, the actual capacity being about 60 tons per hour when running on 10% ore. The richer the crude ore the greater the capacity, due to the smaller proportion of middlings returned for treatment.

Each shift employs 12 men as follows: One foreman, one feeder, one crusherman, two men on rolls, two men on separators, one man on screen floor, one man on new dryer, one fireman and two loaders. In addition to these men there are three others in the repair crew who make all repairs at the end of each day shift. At the Brown shaft crusher house there are two men.

Samples of crude, concentrates and tailings are taken and analyzed each day. The crude ore averages 40 to 48% iron; the concentrates average 58 to 60% iron; the tailings average 10% iron.

A complete analysis of average concentrates as shipped Mar. 1, 1915, is shown in the accompanying table:

ANALYSIS OF CONCENTRATES PRODUCED

Metallic iron, dried at 212° F	58.000	to	60.000%
Phosphorus	0.550	to	0.650%
Sulphur	0.042	to	0.055%
Manganese	0.025	to	0.050%
Silica	8.000	to	10.000%
Alumina	1.250	to	2.000%
Lime	2.500	to	3.000%
Magnesia	1.500	to	2.000%
Copper	0.000	to	0.000%
Titanium	trace	to	0.350%
Vanadium	0.035	to	0.075%

The construction of the new plant and redesign of the old mill were under the direction of the Mines Management Co., 60 Broadway, New York City; H. M. Roche, Superintendent for the Empire Steel & Iron Co.; and the writer, who was designing and metallurgical engineer.

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Lake Superior Ore Shipments

The rail shipments from Lake Superior iron mines in 1914, as completely reported, were 707,829 long tons. Added to the water shipments this makes a total of 32,729,726 tons, a decrease of 17,217,290 tons from 1913. The division of the shipments by ranges, as compiled by the *Iron Trade Review,* was as follows, the table also giving the total shipped from each from its opening up to the end of 1914:

Range	Date Opened	Shipments 1914	Shipments Total	Shipments P.C.
Marquette	1850	2,491,857	109,790,676	17.0
Menominee	1877	3,221,258	83,266,269	12.9
Gogebic	1884	3,568,482	80,835,693	12.5
Vermillion	1884	1,016,993	35,846,066	5.5
Mesabi	1892	21,465,967	334,550,745	51.6
Cuyuna	1911	859,404	2,044,967	0.3
Baraboo	1903	105,765	1,442,744	0.2
Total		32,729,726	647,777,160	100.0

The total shipments in 1914 were lowest in any year since 1904, with the exception of 1908. The decline was on all the ranges with the exception of the new Cuyuna range. It was most marked on the Marquette and the Menominee.

For the third successive year the independent ore-mining companies shipped over half the tonnage, their total proportion being 50.99%, while the United States Steel Corporation had 49.01%. The total shipments of the Oliver Iron Mining Co. in 1914 were 16,039,654 tons. Of this 6,013,758 tons were from the Hill leases, which terminated with 1914. This quantity was just over the agreed minimum for the year.

Only four mines shipped over a million tons in 1914, the Leonard, Mahoning, Sauntry-Alpena and Canisteo. The Hull-Rust, which was the leading shipper for several years, reporting 3,457,608 tons in 1913, shipped only 158,468 tons in 1914. The change was not due to any exhaustion, but to the diversion of work to the Hill leases. The Leonard was the leading shipper last year, with 2,686,685 tons.

There were 16 new mines shipping in 1914. Ten of these were on the Mesabi, four on the Menominee, one each on the Gogebic and the Cuyuna range. There were in all 196 mines from which shipments were made last year.

Canadian shipments, not included above, were 80,860 tons from the Helen mine on the Michipicoten range; 98,070 tons from the Magpie, and 29,457 tons from the Moose Mountain—a total of 208,387 tons.

Carnotite near Mauch Chunk

By W. B. Richards*

Carnotite was first discovered in the anthracite region in 1902, at Mauch Chunk, Carbon County, Penn., within seven miles of the point at Summit Hill where coal was first discovered in Carbon County by Philip Ginter in 1791. This carnotite was discovered on a ledge of conglomerate rocks in the transition strata between the Mauch Chunk red shale and the Pottsville conglomerate, at a point about one-half mile west of the bridge crossing the Lehigh River to East Mauch Chunk and on the south side of the Eastern Pennsylvania R.R. where a railroad cut was made by blasting away the mountain side.

It appears in green and canary-yellow daubs or splashes on the rock, and in the crevices where foreign matter was deposited such matter is thoroughly impregnated with it. Unfortunately these crevices are only from 1 to 2 ft. long and not more than an inch wide.

By drilling in this formation in the anthracite region, crevices filled with foreign matter and impregnated with carnotite may be discovered in sufficient quantity to pay to develop. To be profitable it is required that the rock in which carnotite is found should contain about 2%. Samples of this ore were sent to R. B. Moore, Physical Chemist, Bureau of Mines, Experiment Station in Colorado. He analyzed it and reported that not only was the yellow material carnotite, but the ore also carried apparently some vanadium which is usually associated with carnotite in addition to the actual vanadium in the yellow material itself.

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Alaska-Ebner

Unless an extension is secured, the Alaska-Ebner property at Juneau is to be sold under foreclosure on Mar. 31, to cover advances amounting to about $500,000, made by the U. S. Smelting, Refining & Mining Co., during the life of its option. On Dec. 14, 1914, the Smelting company notified the bondholders protective and reorganization committee (generally known as the Chapman committee) that to justify proceeding with the plan of reorganization it would be necessary to find ore in sufficient quantity to show a recoverable value of $15,000,000, that such amount had not been found at that date and that the Smelting company desired the return of its money, with interest, on Feb. 15. This date was extended first to Mar. 10 and then to Mar. 31. The Chapman committee has not been able to secure a satisfactory promise from the bondholders regarding the raising of the necessary $500,000, and two propositions have been suggested: First, to pay the Smelting company $100,000 for an extension until July 10, 1915, and an option on 49% of the property for the amount of its obligation, i.e., $500,000; or to pay $200,000 for the extension to July 10, 1915, and have the option on the entire property upon the repayment of all advances. Thus the Smelting company would, under the first proposition, receive a profit of $100,000 for its advances and $200,000 in the case of the second proposition. The bondholders, in order to recover the property, must pay approximately $500,000 on Mar. 31; or $100,000 on Mar. 31, and $500,000 on July 10, 1915, for 49% of the property; or $200,000 on Mar. 31 and $500,000 on July 10, 1915, for the entire property. The committee hopes to secure an extension of four months in order to determine the present value of property. In the recent circular to bondholders, no statements are made as to what value has been disclosed by the developments of the Smelting company.

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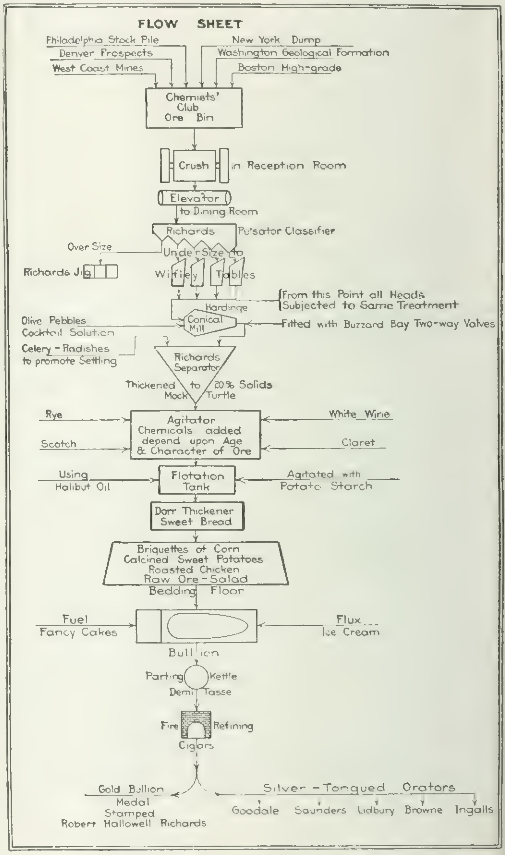
The Richards Dinner

The annual presentation of the gold medal of the Mining and Metallurgical Society of America took place at the Chemists' Club in New York on Thursday, Mar. 18. The award this year was made to Robert Hallowell Richards for distinguished service in the advancement of the art of ore dressing. A poem, written by Berton Braley for the occasion, runs as follows:



Richards Dinner Flow Sheet

Here's to you, Bobby, O sage metallurgical,
You who have taught us much wisdom of yore,
Doctor of Dressing—not salad or surgical—
But of the dressing of every old ore.
Long may you flourish in all your variety,
You whom we're proud to be honoring now!
Robert H. Richards, this mining society
Slips you the laurel to wear on your brow!

Tickle the harp with pulsations harmonious,
Jig-time pulsations, for jigs are his forte;
Lift up your voices in noises euphonious,
Praising the man we call "Bobby" for short.

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*Mining engineer, Lansford, Penn.

Teacher and author of top-notch ability,
  Chief patriarch of the ore-working clan,
Mighty inventor of great versatility,
  Thinker, and dreamer and Regular Man'

Gladly we boost you in accents vociferous,
  Robert H Richards, for clearly we know
You are of ore which is purely auriferous;
  Tests by the hundreds have proven you so.
Up with the glasses, we drink to you merrily;
  Long may you wave' -like the Red, White and Blue,
There's a warm spot in our hearts for you, verily,
  Bobby, oh, Bobby—here's looking at you'

After the dinner—flow sheet of which is herewith shown—presided over by Mr. Ingalls, there were speeches by W. L. Saunders, F. A. Lidbury, Charles W. Goodale, David H. Browne, a presentation speech by W. R. Ingalls, and the response by Robert H. Richards. Mr. Saunders, as president of the A. I. M. E., represented the miners; F. A. Lidbury, president of the American Electrochemical Society, represented the allies called in by the old-fashioned metallurgist; Mr. Goodale represented the ore dressers and smelters, while David H. Browne spoke as the man who had taken a fall out of the blast furnaces and rendered the reverberatory supreme.

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Phelps, Dodge & Co.

The report for 1914 shows that the constituent companies controlled by Phelps, Dodge & Co. produced 140,231,384 lb. of copper, of which 8,569,060 were made from the Miami Copper Co.'s ores, and the resulting blister copper delivered to Miami. Including copper received from outside sources, Phelps, Dodge & Co. marketed 188,687,387 lb. of copper at an average price of 13.57c. per lb. net cash f.o.b. New York. Of this amount over two-thirds was delivered in the first seven months of the year.

During the year Phelps, Dodge & Co. purchased the Tombstone Consolidated Mines Co. and other properties in the Tombstone district, which will be operated in future as one of the Phelps-Dodge constituents under the name of Bunker Hill Mines Co. The total copper ore extracted from all of the company's mines was 1,777,243 tons, of which 1,046,728 tons were concentrated and 730,515 tons smelted direct. The total amount of copper-bearing materials smelted, including ore, concentrates, old slag and cement copper, was 917,204 tons. The bullion produced carried 26,259 oz. of gold and 1,405,301 oz. of silver. In addition there were produced and sold 23,930 tons of lead ore from the Copper Queen mine, yielding 399,106 lb. of copper, 8,889,175 lb. of lead, 332,137 oz. of silver and 1822 oz. of gold, and from the newly acquired properties at Tombstone, 1937 tons of ore yielding 1586 lb. of copper, 46,899 lb. of lead, 32,188 oz. of silver and 137 oz. of gold. Of the ore and concentrates smelted, 855,594 tons was derived from the company's property and 61,610 tons was custom ore.

The Stag Cañon Fuel Co. mined 1,355,938 tons of coal, of which 495,127 tons were consumed in the manufacture of 239,966 tons of coke.

The total production from the Copper Queen mine was 732,829 tons of ore, carrying 8,889,175 lb. of lead, 86,066,113 lb. of copper, 1,036,672 oz. of silver and 15,769 oz. of gold. The Copper Queen reduction works treated 835,016 tons of ore, carrying 119,957,017 lb. copper, 1,405,301 oz. of silver and 26,259 oz. of gold. This reduction works increased its stock of ore on hand by 27,359 tons during the year. The development of several million tons of concentrating ore in Sacramento Hill necessitates erecting a concentrator by the Copper Queen company. A small test mill of 90 tons capacity per day has been constructed. The best results were obtained by combining hydraulic and flotation methods, flotation increasing the recovery by about 12% and making a total saving of about 87%. Experiments are also under way for the treatment of the slimes produced by the various concentrators of the Phelps-Dodge company.

The Morenci works of the Detroit Copper Mining Co. treated a total of 477,582 tons of material producing 20,274,367 lb. of copper. The average grade of all the ore mined during the year was 2.92% of copper. The milling ore averaged 2.79% copper.

No figures are given as to the ore mined by the Moctezuma Copper Co., but the concentrates, slimes and small miscellaneous shipments of gold ore came to a total of 122,764 tons, carrying 32,229,211 lb. of copper, 435,482 oz. silver and 1006 oz. of gold. The operations of the railroad have been interfered with several times during the year for the movement of troops, but relations with the various factions in Mexico have been uniformly pleasant.

The Burro Mountain Copper Co. has continued experiments on the treatment of its ores. The erection of the mill was suspended, but the experiments have proved sufficiently encouraging to justify the resumption of the construction of a mill with a capacity of 1000 tons per day. The results at the experimental mill show a gradual improvement in extraction from 53.90% in May to 79.8% in December. During the year the first 1000-hp. internal-combustion unit (Diesel type) was started. A second engine is now being erected.

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Funds for the U. S. Geological Survey

The sundry civil act as passed by the last session of Congress contained appropriations of $1,355,520 for the U. S. Geological Survey. Most of the appropriations for the Survey are included in this great Government supply bill, but in addition to the above-stated amount $40,000 was appropriated in the legislative bill for rents, so that the total amount appropriated is $1,395,520. The principal items in the appropriations for the Geological Survey for the fiscal year ending June 30, 1916, are as follows:

Topographic surveys	$350,000
Geologic surveys	350,000
Mineral resources of Alaska	100,000
Mineral resources of the United States	75,000
Chemical and physical researches	10,000
Geologic maps of the United States	110,000
Gaging streams, etc	150,000
Surveying national forests	75,000

The bill also appropriates $175,000 for printing and binding Survey reports, to be expended by the Public Printer, and $1,500,000 for the new Interior Department building, which is to accommodate the Office of the Secretary of the Interior, the Geological Survey, the Reclamation Service, the Land Office, the Indian Office, and the Bureau of Mines, all bureaus of the Interior Department whose work is closely related to that of the Survey and among all of which there is more or less constant coöperation. The total cost of the new building has been fixed at $2,596,000.

Aluminum Precipitation at Nipissing

By E. M. Hamilton*

SYNOPSIS—A discussion of the method of precipitation in use at the Nipissing low-grade mill, which has been the subject of some criticism. The difficulties attendant upon the use of zinc are shown, and the economies—metallurgical and monetary—are explained in detail.

This article is offered as a continuation of the discussion on the paper by James Johnston, presented at the New York meeting of the A. I. M. E., February, 1914, on the mill and metallurgical practice of the Nipissing Mines Co. at Cobalt, Ont., and deals with the review of that paper made by Prof. G. H. Clevenger at the Salt Lake meeting in August, 1914. I shall, moreover, confine my remarks to that part of the review dealing with aluminum precipitation.

Aluminum Dust to Replace Zinc Dust

Starting with the reasons that led to the adoption of this process at the Nipissing, I do not think there was any statement in my article published in the Journal of May 10, 1913, necessarily inconsistent with the views expressed by Mr. Clevenger, that "zinc precipitation *under proper conditions*" (the italics are mine) "would not have been impossible in the cyanidation of Nipissing low-grade ore." I would point out that the particular difficulties connected with the use of zinc as a precipitant, which I explained in detail, only began to be apparent a few weeks before the new mill was expected to start crushing. Finding an alternative method at hand in the aluminum dust, which we proved to be free from the objections attaching to zinc and only slightly more expensive to work, it seemed the obvious course to install that method, rather than consume time and money in the careful investigation which Mr. Clevenger admits would have been required in order to find some way to get around the drawbacks attendant on zinc, an investigation, moreover, which did not appear to us to promise success.

Zinc Prejudicial in Some Cases

That the presence of zinc in stock solutions has been found to affect extraction adversely in the case of other ores than those of Cobalt, I can testify from personal experience. At one mill in Mexico I found that the activity of the stock solution could be improved so as to yield several per cent. increase in silver extraction by precipitating as much as possible of the zinc with sodium sulphide. This series of experiments was not carried beyond the laboratory stage, but at another mill I visited we found it a substantial aid to the extraction of silver from certain kinds of ore to treat the whole of the barren solution periodically with sodium sulphide, so as to keep the zinc content down below a certain figure. I may remark that neither of these results was due to an unrecorded increase in free-cyanide strength arising out of a regeneration of free cyanide from the zinc compound (an increase which might well escape observation under the KI method of titrating), because in every case solution strengths were maintained constant in terms of free cyanide, as determined without the use of KI indicator.

The most notable instance I have come across, however (with the exception of the Nipissing), was in the early part of 1912, in the case of some ore from the state of Oaxaca, containing, among other refractory minerals, arsenic and antimony compounds.

The experiment made to investigate the effect of reusing the solution from the precipitation of the silver by zinc dust showed a drop of nearly 10% in extraction. The solution was used over six times, although after the third time the deleterious effect appeared to have reached its maximum.

RESULT OF USING OLD SOLUTION
Head Assay of Ore, 803 Grams per Metric Ton
Residue Assays

	Residue	Extraction
Using new solution................	127 grams	84.1%
Using old solution..	202 grams	74.8%

It may be objected that in this experiment the deterioration is not proved to be due to zinc because I did not try the effect of the same old solution after throwing down the zinc. As the time available was limited, and as I did not then know about the aluminum-dust process, I contented myself with suggesting that after the mill was running experiments should be made with a view to throwing out the zinc with sodium sulphide, because, in the light of my previous experiences, I had no doubt then, nor have I now, especially with the added evidence derived from Nipissing, that the loss of 10% in extractive power of the solution was due to the use of zinc as a precipitant in the presence of deleterious substances dissolved out of the ore.

It is worthy of note that in most cases where zinc in solution appears to be detrimental I have found that lead also has a similar effect, and that it is impossible to use it as an aid to extraction of such ores.

Zinc Usually Used without Bad Results

Notwithstanding the special instances mentioned, however, I am prepared to admit that in regard to the great majority of ores I have had to do with, zinc in solution is not in any way detrimental, and that tests made between plant stock-solution and freshly made solution show no difference whatever in extraction. It is thus apparent that in discussing the advantages or otherwise of aluminum over zinc as a precipitant the question of differences in extraction will not, in most cases, enter, and that if the former is to take the place of the latter in the treatment of ordinary ores the reason must be sought on other grounds. Although the idea of aluminum precipitation was evolved over 20 years ago, so little work has been done on it that it is only during the last few years that it has been recognized as possessing any special advantages. How far those advantages may warrant a more extended application of the process is a matter that can only be determined by time and experiment.

Relative Cost of Aluminum and Zinc Processes

In seeking to answer this question, Clevenger puts forward three points for inquiry. He asks: "First, is aluminum-dust precipitation cheaper than zinc? (Of course, in this connection we must give due consideration to all factors, even those having an indirect bearing on the subject.) Second, is there any function which it would not perform and which zinc does? Third, is it as effective for dilute solutions containing a small proportion of metal, such as is often encountered in treating low-grade gold ores?" I will try to answer these queries and will discuss them in the reverse order.

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Aluminum as a precipitant is not so effective as zinc for solutions very low in metal, such as may be derived from gold ores; in fact, my experiments would tend to show that where solutions contain only gold in ordinary proportions precipitation is imperfect, unless a prohibitive quantity of the reagent is used. In my opinion it is doubtful whether there is any field for the method in the treatment of all-gold ores.

It is true that in cases where lead compounds have been found an aid to dissolution of the silver—though this is by no means a universal rule—such addition is often rendered unnecessary by the use of zinc as a precipitant, so that this question resolves itself principally into one of costs, except in such extremely rare instances as that quoted from Mexico. In considering the relative costs of the two processes at individual plants there will, no doubt, arise instances where the zinc process will have to be credited with a saving in lead salts.

Ultimate Profit the Deciding Factor

The whole discussion really turns on the answer to query No. 1: Is the use of aluminum-dust precipitation likely to result in a greater final profit than the use of zinc, at other mines than the Nipissing? At the latter mill under conditions there obtaining, and in the present state of our knowledge of the subject, Mr. Clevenger will, no doubt, agree that the use of the process is justified. There are also, I think, more than a few silver ores in other parts of the world whose behavior would approach, in a greater or less degree, to that of the Nipissing, and where, pending the discovery of "the conditions governing the separation of undesirable impurities from solution during and after precipitation," looked for by him, it may confidently be predicted that the use of aluminum as a precipitant will show a large margin of profit over zinc. Such instances we will therefore have on one side. We will also rule out of the discussion those ores containing only or principally gold, in the precipitation of whose solution I do not think aluminum is destined to find a field. There remains, then, the large class of silver and silver-gold ores with silver contents ranging from 8 or 10 oz. up to 20 or 30 oz. in the cyaniding of which the presence of zinc in solution is not detrimental to extraction. The two main factors to be considered are the operating costs and the savings, if any.

Operating Costs

As the zinc process was never used in the Nipissing low-grade ore mill, we cannot say positively what the zinc consumption would have been. I note that my estimate of 0.1 lb. per oz. of silver is a little higher than the figure given by Clevenger for practice in the Pachuca district—viz., 1 lb. of zinc dust per lb. of fine bullion, or 0.07 lb. per troy oz.; but I am quite willing to accept the lower figure. For aluminum dust we must continue to take the consumption I gave in my paper, 0.02 lb. per oz. of fine silver, for lack of definite figures showing an improvement over this consumption elsewhere.

I must, however, question the validity of the generalizations on the cost of the process derived from the stated charge for aluminum dust at the time my paper was written. First of all, there is the Canadian duty of 15% *ad valorem,* which would not apply outside that country, the deduction of which would reduce the price at that time to 30c. to 35c. per lb. Since early 1913, however, the price has dropped, and at the beginning of 1914 many tons were bought for shipment abroad at 25c. Should the demand increase, there is no reason why we may not look for a further reduction. As an example, take the price of cyanide. When I began working with the cyanide process it was somewhere around 50c. per lb. Anyone who had then tried to define the future scope and general applicability of the process on the basis of 50c. per lb. for cyanide would today be a long way from the truth. Nevertheless, since 25c. is about the lowest that aluminum dust has hitherto reached, we must, for the present, assume that figure, giving the following comparison:

Aluminum	0.02 lb at 25c	—	$0.005 per oz. Ag
Zinc	0.07 lb at 7c.		$0.0049 per oz. Ag

This on a 10-oz. silver ore would give a difference of only 1 mill per ton in favor of zinc.

In addition to the cost of aluminum, we have a charge for caustic soda which does not apply to the zinc process. At the Nipissing this has been estimated at $0.0016 per fine oz. of silver; but under other conditions the consumption would be far lower. Mr. Clevenger is under a misapprehension when he states that it is necessary to add caustic just prior to precipitation. At the Nipissing no addition of caustic is made at any stage of the cyanide treatment. The only caustic present at the time of precipitation is that carried over mechanically from the desulphurizing process and the small amount that may be derived from decomposition of cyanide during treatment. The amount so carried over is far more than sufficient for precipitation purposes, averaging, as it does, about 0.15% NaOH. I have found in my work at another mine that 0.05% NaOH is amply sufficient to give good results and allows of better control than a higher strength. This will cut down the consumption of caustic probably nearly two-thirds, but to be on the safe side we will say one-half. Thus, one estimate for its consumption will stand at $0.0008 per fine oz., or for a 10-oz. ore 8 mills per ton.

The extra cost of aluminum over zinc precipitation will now stand as follows for a 10-oz. ore:

Extra cost of precipitant	$0.001
Cost of caustic soda. .	0.008
Total . . .	$0.009

or, roughly, 1c. per ton.

Stearinized Aluminum Dust

As regards the power used, the principal item is the pumping of the solution into the press, which will be the same for both processes. The additional power for the two little agitators to mix the aluminum dust is so small as to be negligible. I may here remark that Mr. Clevenger exaggerates the difficulty of mixing this dust. With the apparatus worked out at the Nipissing there is no trouble whatever on this score. Moreover, the coating of stearin does not appear to be a detriment, as supposed by him, but rather an advantage. It is possible to obtain unburnished dust almost entirely free from stearine, and such was tried at the Nipissing as long ago as the summer of 1913; but Mr. Johnston informed me that while it is more rapidly wetted than the other, it tends to pack in the feeder, necessitating more attention and resulting in an irregular feed and higher consumption, so that its use was discontinued in favor of the stearinized product.

Sources of Economy in Aluminum Dust

There are two avenues for saving in expense due to this process. There is a saving in fluxes and fuel in melting the precipitate, which, working with a clean ore is usually so fine that it can be melted direct in an oil-fired furnace without any flux and without any preliminary acid or other refining. I am not prepared to estimate the amount of this saving, but it will usually be sufficiently important to have a bearing on the question we are discussing. There is also a saving in cyanide. This is the point opposed most strongly by Clevenger; but on the debit side of the account we have only 1c. per ton against aluminum, so anything we can show on the credit side over 1c. per ton will represent profit for the new process.

Regarding the estimate of the cyanide recovered in the case of aluminum, he is right in supposing that this was based on head-and-tail titrations, and I fail to see any objection to this method. The titration is not open to the variations and inaccuracies that arise when zinc is present, and the results so obtained check almost exactly with the theoretical figures based on the amount of silver liberated. Nor do I see why one need assume that the cyanide shown in this way to be freed from combination is any less effective than the original cyanide. He suggests, it is true, that the amount shown may not be all gain, quoting Julian to the effect that alumina (referring, of course, to the hydroxide of the metal), when precipitated out of a cyanide solution, carries down a large proportion of the cyanide present. Those experiments were made many years ago and conditions have changed so much since then that one would need some definite evidence from various observers under modern working conditions before assuming that such a tendency would be sufficiently marked to constitute an appreciably interfering factor. Secondly, he assumes that alumina in such circumstances is bound to be precipitated, but I fail to see the necessity, because in the presence of sufficient free alkali it will remain in solution as sodium aluminate, and the amount of aluminate so held in solution would never increase beyond a certain point, owing to a part of the stock each day being lost in the form of moisture in residues. Thirdly, aluminum compounds if precipitated out of such solution, are not necessarily—and as a rule probably are not at all—precipitated as aluminum hydroxide, because we know that when they come in contact with fresh lime they are thrown down as calcium aluminate, a white, earthy substance entirely different from the hydroxide. I note that Mr. Clevenger questions Kirkpatrick's conclusions that the use of dust overcomes most of the difficulties experienced by the early experiments; but in so doing he seems to have missed the point of Julian's crucial difficulty, which was not so much the fact that alumina was thrown down as that it was deposited on the metallic precipitating surface and stopped further action. The use of dust instead of plates or shavings would obviously overcome Julian's main trouble, because any given particle of dust would have done its work and become dissolved long before it could accumulate a coating of alumina sufficient to prevent further action.

Loss of Cyanide through Alumina

Regarding the important question as to whether, in practice, any appreciable quantity of cyanide is actually carried down mechanically by precipitated alumina and thus lost, investigation is difficult in the case of an individual ore charge, but a guess may be made by surveying general conditions of cyanide consumption over a considerable period, and I think that, at the Nipissing at any rate, the question may reasonably be answered in the negative. In the large-scale tests Mr. Clevenger made there, his average head assay was 40 oz. of silver; he recovered 44.2% by amalgamation, leaving only 47.9% or 19 oz. actually extracted by cyanide. His cyanide consumption averaged 8.5 lb. per ton, chemical loss—that is, without allowing for mechanical loss in the form of moisture in residues. (These figures are all stated in terms of 99% cyanide.)

In J. J. Denny's experiments on the desulphurizing process the cyanide consumption on similar ore, after having undergone the preliminary treatment, averaged 7 lb. per ton chemical loss. His experiments were carried out without removing the metallics, which were ground up with the pulp prior to desulphurizing, and conditions corresponded closely with those that obtain in the present low-grade mill, except that aluminum precipitation was not used.

Now turning to the actual cyanide consumption under working conditions we find that with a head assay of 29 oz. and a strength of 0.25% the average amount of cyanide used during the last 12 months (and it was almost the same when I was there two years ago) was only 5 lb. per ton, including loss in residues. This mechanical loss is stated by Mr. Johnston to be about 1 lb. per ton of dry ore, so we are left with a total chemical consumption of 4 lb. per ton, as against 7 lb. in Denny's preliminary experiments and 8.5 lb. in Clevenger's. The difference between the last two may probably be accounted for by the fact of the preliminary desulphurizing, though this process usually involves sending over a quantity of aluminum salts into the cyanide treatment, which according to the theory propounded ought to result in a heavy loss of cyanide. The difference, however, between Mr. Denny's preliminary tests and the actual working-plant figures cannot be accounted for in the same way, and moreover in the latter we have a considerable increase in aluminum compounds in solution, derived from precipitation, which ought by this theory to militate against a low cyanide loss. The decrease in cyanide consumption shown on a working scale is probably due to several causes, and I am not trying to attribute it entirely to aluminum precipitation; but my point is that the facts being what they are, there is not much margin for any very heavy loss of cyanide by absorption, as suggested by Mr. Clevenger.

Regeneration of Cyanide through Zinc

Coming now to the matter of zinc precipitation and the possible regeneration of part of the combined zinc double cyanide, I want to say before I go any further that when I based my estimated saving of cyanide on an assumption of the total loss of all cyanide that had once entered into combination with zinc I went beyond what was warranted by the facts, and that Clevenger's criticism of this position was perfectly justifiable. It was more of an oversight on my part than anything else, because I have always contended (against those who deny it) that there is, or may be, a considerable amount of regeneration, or at least temporary dissociation of free cyanide from the double zinc compound, due to addition of free alkali. As a matter of fact, the sentence from my article quoted by him was expressly worded so as to meet his objection and allow for a partial regeneration, when I said, not "cyanide combined with zinc," as he quoted me in his next paragraph, but, "the cyanide that remains combined with zinc," meaning that which remains in combination after the regenerating effect has reached its maximum and emphasizing my belief that the double zinc cyanide, so long as its members remain locked in combination, has almost no solvent action on silver compounds.

It is for this latter reason that, for estimating the dissolving efficiency of a solution, I prefer the titration without KI indicator. I do not agree with Mr. Clevenger that the KI indicator method is just as good, provided that one knows the usual ratio of free to total cyanide on a particular mill, because that ratio is not constant, either between mine and mine or even from day to day on the same mine, as I have had occasion to observe. Neither do I agree with him that the first faint opalescence without KI is any more difficult to determine than the yellow end point of KI. I will even go further and say that I have known mills where, owing to more than ordinary amount of zinc in solution, it was much more difficult to get a consistent and uniform end point by the use of KI than it was without it. I believe that the instances one hears of now and again of the treatment going wrong in certain plants without any apparent reason might often be accounted for by this habit of titrating to yellow opalescence with KI indicator.

FALLACY OF THE RESULTS WITH IODIDE INDICATOR

To illustrate the point I am trying to make, let us take an extreme case. Let us suppose that we are treating an ore carrying traces of zinc; the proportion of the latter remains constant for a month or two, and consequently the ratio of free to total cyanide in the stock solutions is also fairly constant, and extraction is uniformly good. Suppose that one day a certain stope in the mine runs into a pocket of ore containing an appreciable amount of zinc soluble in cyanide. The metallurgist has always controlled his solutions by the KI titration, and he has found that a working solution of total cyanide strength of, say, 0.3% has given him his maximum extraction. Such a solution may contain only 0.15% of free cyanide, but he does not care anything about that. He may have ascertained the ratio at some time or other, or he may not; anyhow, he does not check it day by day. As soon as the bunch of zinky ore is run in on him (usually without a word of warning from the mine boss), what happens? His ordinary titration shows that his solutions are well up to 0.3% total cyanide, and therefore ought to do the same work as usual; but unknown to him the free cyanide has dropped to 0.1%, or 0.05%, or even down to nothing. After a few days he begins to get residue assays which show that his extraction has dropped appreciably. He is mystified and starts a hunt for trouble. Perhaps it takes him several days or weeks to find the reason, and then several more days to put it right. He finally straightens it all out—but at what a cost to his company! If he had been titrating in terms of free instead of total[1] cyanide he would have known in the first 12 hours that something abnormal had happened, and would have taken steps to put it right, and thus saved his company many thousands of dollars.

I have already admitted the fact of the recovery of part of the cyanide apparently lost in zinc precipitation, but, as Clevenger allows, the proportion that becomes available for further work by coming in contact with fresh alkali or other reagents and being dissociated is difficult to trace and must vary considerably according to circumstances. I am sure, however, that even he would not maintain that it is all thus recoverable, because if so, the head solutions to precipitation would never contain the zinc double cyanide, whereas in my experience, even where the alkalinity is maintained at over 0.1%, the double compound is always present in considerable amount, often being equal to the percentage of free cyanide. If, then, it is conceded, as I think it must be, that in the case of zinc precipitation not all of the cyanide entering into combination with the zinc is subsequently liberated and rendered available, we have here an opportunity of effecting a saving in cyanide by the substitution of aluminum.

I admit that in the present state of our knowledge of the process the advantage of its application in the case of low- and medium-grade nonrefractory silver ores is more or less hypothetical, and I fully agree with the dictum that the only way to know definitely is to run a competitive test against zinc precipitation on a working scale and over a fair period of time; but I submit that the chances of such a test being made are not assisted by smothering the new process, before trial, with objections which are, after all, mainly theoretical.

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Refractories in the Glass Industry

Resistance of tank blocks and glass pots to the action of fluxes depends more upon physical structure than on chemical composition, says **C. W. Berry** (*Trans. Am. Ceram. Soc.*, abstr. by *Journ. Soc. Chem. Ind.*). A block should possess sufficient density to prevent the penetration of fluxes. It should dissolve slowly in the glass without causing "stones," and the wearing surface should remain smooth. Pure nonplastic clays which are attacked only slightly by fluxes must be introduced in a very fine condition, as otherwise the plastic binding clay will dissolve, allowing the refractory clay to enter the glass and form "stones." Blocks high in silica—e.g., where free silica has been added to obtain 77% SiO_2 in the finished product—are quickly destroyed, as also are mixings high in alumina. High silica also tends to increase porosity. It is not advisable to introduce "grog" made from used pots, as the material has absorbed fluxes which will cause a honeycombed surface. The greatest wear on a pot occurs during the first four melts; after the fifth, the action diminishes, as the pot becomes nearly vitrified. A pot which is suitable in composition for plate glass may not answer for lead and other glasses made in closed pots.

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[1] I have treated the result of titrating with KI indicator as giving "total" cyanide because when the protective alkalinity is over 0.05% or thereabouts the reading so obtained coincides exactly with the standard test for total cyanide.

Details of Practical Mining

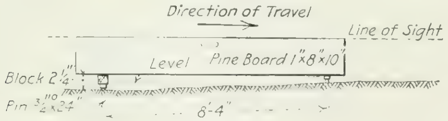
Grade-Board for Steam-Shovel Use

By L. B. Pringle*

The illustration shows a grade-board used extensively in steam-shovel mining around Hibbing, Minn. The novel feature of the device consists in the fact that the measurements are so adjusted that the terms "per cent." and "inches" are interchangeable.

The necessary equipment consists of a board, 1x8 in. by 10 ft., having its two edges carefully planed and parallel; of one small carpenter's spirit level, of two round iron pins ¾x24 in., having standard flat bolt heads, and of a supply of wood suitable to cut into small blocks of various thicknesses. A handle 1x1½x5 in. may be cut in the board to facilitate carrying.

The pins are spaced exactly 8 ft. 4 in. apart, parallel to the direction of travel of the shovel, and are driven close to the ground. By means of the board and level the pins are brought to the same elevation. Then for down grades a grade block is placed under the board on top of the rear pin; for up grades, under the board on top of the front pin. The following table will show how simple is the cutting of the blocks:



Grade-Board for Steam-Shovel Use

For 1.0% grade use 1-in. block;
For 1.5% grade use 1½-in block;
For 1.75% grade use 1¾-in. block;
For 9.0% grade use 9-in. block;
For 0.5% grade use ½-in. block.

The illustration shows the application of the method in running a 2.25% down grade. The shovel runner sights along the upper edge of the board at a graduated stick or rule held upright by a helper at various points along the line, and knowing the depth below grade he is to carry throughout the course, and the height of the top of the board above the ground, he can readily ascertain the depth of cut needed at any point.

The percentage of error increases with the length of sight taken from a set-up; but I have found that by making two and sometimes three set-ups a day the error found by checking with the engineer's leveling is so small that it can be disregarded.

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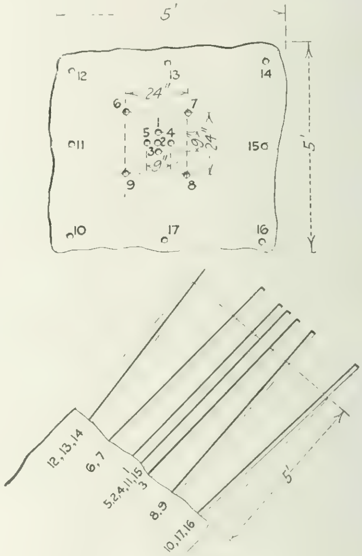
The Present Shortage of Mine Timber in England appears to be having one beneficial effect in that it is now possible profitably to thin certain forests to their great advantage, while this could not be done before remuneratively, owing to the competition of foreign timbers.

Five-Hole-Cut Raising Method

H. H. Hodgkinson*

The five-hole-cut method here described has proved to be the best and most economical method for both drifting and raising at the New Jersey Zinc Co.'s mines at Franklin Furnace, N. J., where the ore and limestone as a rule are soft.

Although this method necessitates drilling a few more holes than either the draw- or the V-cut method used in the West where the ground is hard and brittle, yet it can be depended upon to break a good clean heading in either ore or limestone. These other methods fail unless an excessive number of holes are drilled, which takes more powder, for due to the soft nature of the ground the holes when fired do not break the ground but simply chamber and blow off a little of the collars.



Five-Hole-Cut for Raises

In drilling up a round in a raise 17 holes are put in, as shown in the accompanying sketch, to a depth of 6 ft. The ground is easily drilled, the machines averaging 14 to 20 ft. per hr. When the round is fired a heading 5x5 ft. is broken with an advance of not less than 5 ft. This is accomplished in an eight-hour shift.

About 92 sticks of 1x8-in. 50% gelatin dynamite are required to a round. Hole No. 2 is loaded with eight sticks of dynamite and fired; this breaks through the other four cut holes Nos. 1, 3, 4 and 5 as shown. Holes Nos. 6, 7, 8 and 9 are then loaded with seven sticks each and fired after the muck is cleaned out of the space made in firing hole No. 2. The remaining eight holes are loaded with seven sticks of dynamite each and fired. At least two bags of tamping is used in each hole and pressed in firmly.

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*Mining engineer, Franklin Furnace, N. J.

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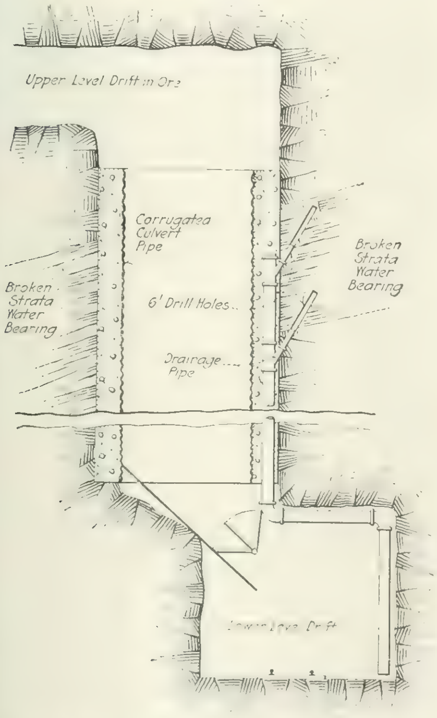
Draining Watercourses in Chutes

By Edward P. Scallon*

In raising, watercourses are frequently encountered. If the raise is to be used as a chute, much delay and annoyance in the subsequent handling of the product are occasioned by an admixture of the water and ore in the chute, and in most cases it is essential that this condition be remedied. At the Lincoln mine of the Inter-State Iron Co., at Virginia, Minn., the form of chute construction shown in the accompanying drawing is employed successfully to overcome the difficulty. After the raise is driven several 6-ft. drill holes are placed in its side, so as to cut the water-bearing strata transversely at different elevations. Pipes are then cemented into the collars of these holes and extended, close to the side of the raise, to the level below. Air lines and any other necessary pipes are placed along the walls, and the entire raise is lined with concrete, corrugated culvert pipe being used as a form.



Type of Chute Construction in Water Courses

All the pipes will of course be embedded in the concrete; the small drainage pipes from the drill holes will now collect all the water and carry it to the level below. This prevents the exertion of any water pressure on the concrete while setting or subsequently, and also allows proceeding with the drainage of the area tributary to the raise.

By the use of these drainage pipes it is found at the Lincoln mine that almost all watercourses can be sealed off with oakum and dry cement. In this case, if desirable, a form of plank chute providing protection to the pipes and cement can be substituted for the more permanent concrete and metal-lined construction described above. The water collected in the pipes from such a raise is used to supply tanks feeding Leyner drills on the lower levels.

⁂

How the Drill Bit Breaks the Rock*

When rock is excavated by a drill bit three applications of forces seem to be involved—by abrasion, by crushing, and by severing or chipping. Although all of these must take place to a certain degree, the greatest amount of useful work is performed when the percentage of force applied to chip reaches a maximum. But in rock it appears that chips can be produced in radically different ways: first, by the severing of molecules, and, second, by the reflex forces produced in an elastic medium. To illustrate this, consider the chipping of a comparatively inelastic substance such as lead. With a hammer and a chisel whose axis is inclined considerably from the normal to the surface of a lead block it is possible to sever the lead and roll up chips, but if the chisel is normal to the surface of a thick block only an indentation can be made and there probably will be a raised area about the indentation to accommodate a certain percentage of the displaced metal. On the other hand, with a highly elastic material such as glass, the forces impressed by a normally positioned chisel will cause a compression of the molecules, whose elasticity will cause their expansion toward a free, unresisted surface. Since the greatest forces are developed at the surface, since the penetration of the chisel carries some forces to a depth below the surface, and since the chisel surface itself applies some forces at an angle to its axis and impedes the reëxpansion of molecules to the space it occupies, therefore, the reflex forces produce more or less cone-shaped chips or flakes and leave a corresponding crater in the block of glass. Now if the chisel is placed near the edge of a block of glass, the blow upon it will induce stresses to another free face and a correspondingly larger chip will be produced because of the tendency of the forces to seek relief in the shortest direction, as well as because of the severing effect. The method of cutting of a drill bit is commonly shown as taking place in this last way with the progressive chipping of a series of benches or steps, but it is doubtful whether such a procedure exists, except in rare instances, for the speed and latitude of rotation between consecutive blows of the drill piston or hammer cannot be controlled with sufficient precision nor adjusted to the various rocks; and an inspection of the cuttings from a drill hole shows them to be flakes or a crushed and abraded powder.

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*Mining captain, Lincoln mine, Virginia, Minn.

*Excerpt from a paper by Benjamin F. Tillson "The Testing and Application of Hammer Drills," published in the "Bulletin of the American Institute of Mining Engineers," February, 1915.

In the formation of these flaky chips there may be a limiting force of blow for each velocity of impression in order to gain the most useful work (i.e., in the production of flakes), for it appears that beyond certain limits the blows increase the percentage of crushed material and the drilling speed does not vary with the force applied, so that some heavy-hitting drills accomplish more in medium-soft ground when a portion of their blows is absorbed by a tappet at the shank end of the steel or by a cushion of water intervening between the bit and the rock. If the force of the blows were decreased by a reduction in air pressure the speed of the piston would be slowed up and the drilling would suffer from the fewer number of blows per minute.

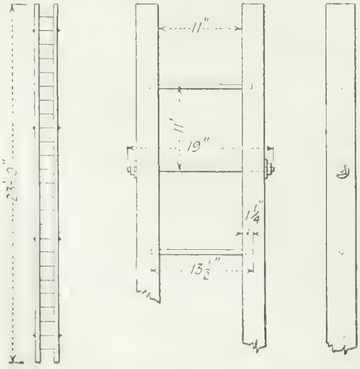
The use of an anvil block is considered by some drill designers to necessitate a loss of from 20 to 30% of the power of a drill, but actual tests do not always indicate such a condition when the identical steel is tested in the same drill with and without a tappet. The results probably depend upon how frequently the tappet is struck when away from the shank of the steel, and also upon the suitability of the machine to the rock; for if its blows are too heavy the intervention of a loose tappet might reduce their force, with a benefit in drilling speed. The use of water at the bottom of the hole ordinarily consumes about 10% of the cutting speed if there is no tendency for the drill bits to lose their temper, and compressed air for cleaning the holes encourages a greater drilling speed, providing the cushion of water in the bottom of the hole does not have a benign influence in reducing too powerful a blow upon the rock.

⁂

Steel and Wood Ladder

By Harold A. Linke*

The accompanying illustration shows a substantial and inexpensive mine ladder, the sides of which are constructed of 3x4-in. stuff, S2S1E‡, and the rungs of ½-in. round mild steel. The bill of material is as follows:



Ladder of 3x4-In. Uprights and ½-In. Steel Rungs

Two pieces 3x4-in. by 21 ft. S2S1E.

Thirty feet ½-in. round mild steel, cut into 21 rungs 13½ in. long and four 19-in. lengths, the latter threaded 2 in. both ends.

Eight ½-in. cut washers.

Eight ½-in. square nuts.

After the ladder is made and the bolts tightened it is well to rivet the ends of the tie bolts or burr the exposed threads to prevent the nuts from working off.

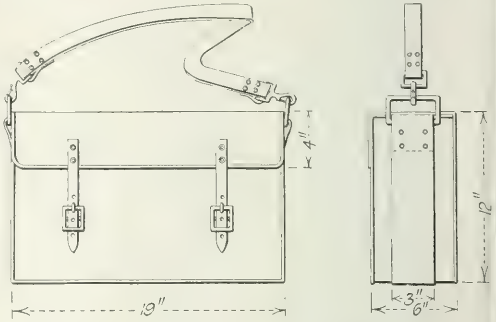
⁂

Bag for Carrying Dynamite

By W. R. Hodge*

A dynamite box in a manway is a stubborn and painful thing to deal with. In the Burra Burra mine of the Tennessee Copper Co. it is often necessary to carry a box of powder up or down 150 ft. of ladders to get it into a back stope. The bag illustrated here has been devised to make easier the transportation of dynamite through the manways.

The bag is of canvas, reinforced by a double strip of the same material on the bottom and ends. At the top of each end the strip is doubled over and riveted about an iron ring to which is snapped the shoulder strap. Thi strap is of leather 2 in. wide and 3 ft. long, provided witl a harness snap at each end. The bag is divided by a canva partition down the middle, making compartments a littl longer than a stick of dynamite. A canvas flap secure by two straps and buckles covers the top of the bag All seams and edges are leather bound. The capacit of the bag is about one case of dynamite. By its use th hands are left free for the ladders, while (in the stope) th powder is readily accessible for distribution. These bag have been in service about four months, and so far no on has coveted the leather straps—a rather remarkable fac



Bag for Carrying Dynamite

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Block System on Haulageways

In the main underground haulageway maintained b the Bunker Hill & Sullivan mine, through the Kellog tunnel, two miles long to the shaft, an electric bloc signal system has been installed and has been in succes ful operation. This consists of a special circuit of colore lights strung along the tunnel throughout its ma haulage length in one-mile sections, operated by the moto man through a lever that can be thrown conveniently the end of each block. Red lights are used in o direction and green lights in the other, and the motorm are prohibited from entering a block carrying the opposi colored light until it is extinguished and shown to gi them a clear track for a mile in length.

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*Mining engineer, 401 Sixth St., Calumet, Mich.

‡Surfaced two sides and one edge.

*Mining engineer, Ducktown, Tenn.

Details of Milling and Smelting

A Chart for Determining Tailings Value

By W. J. McCauley*

In all cyanide mills it is necessary to know the dissolved value discharged with the tailings. It is convenient to know this in terms of cents per ton of dry pulp.

Many methods are in use for the determination of this value, a common one being to filter a portion of the pulp and assay the filtrate, after which the following formula or a similar one is used:

$$\frac{aw}{d\,(1 - a)} = W$$

Where

a = Percentage of water in the tailings, expressed as a decimal.
d = Number of assay tons of solution assayed.
w = Weight of gold found in d assay tons (in milligrams).
W = Ounces gold per ton of dry pulp.

This method is not always practical, however, especially on very thick pulps, filter cakes, etc. A method commonly used for such cases is to take a known weight of the wet tailings, to which a known weight or volume of water is added. After thoroughly mixing, the slime is allowed to settle and a known amount of the clear solution is decanted and assayed. The following formula may then be used, in which b is the weight of wet slime taken and c the weight of water added:

$$\frac{(ab + c)\,w}{bd\,(1 - a)} = W$$

The accompanying chart gives a quick and ready solution of this equation. The chart shown is figured for the case where b = 2000 grams, c = 1000 grams and d = 30 assay tons. OA are values of w and OB values of Wv or V—i.e., cents per ton of dry pulp, gold being figured at $20 per oz. ($v$ = $20).

To use the table follow up the line representing the value of w found by assay until it crosses the diagonal line representing the percentage of moisture found in the original tailings; then go to the left on the horizontal line nearest this intersection, to OB where the value in cents per dry ton of pulp is found.

The chart is constructed as follows: Divide OA, to a convenient scale, into values of w, and OB into values of W or V as desired. Select two points C and D, one on OB and one on OA, such that they represent the same value, one in ounces per ton of dry pulp and the other in ounces per ton of solution—i.e., $\frac{V}{v}$ and $\frac{w}{d}$. Draw the line CD and divide it into two parts, DE and EC, such that $DE : EC :: c : b$, and through the point of division E draw the line 00. This is the line of 0% water.

Now divide EC into 100 equal parts and through each point of division draw lines to 0, producing them to the limits of the drawing. These lines represent all values from 0% to 100% of water.

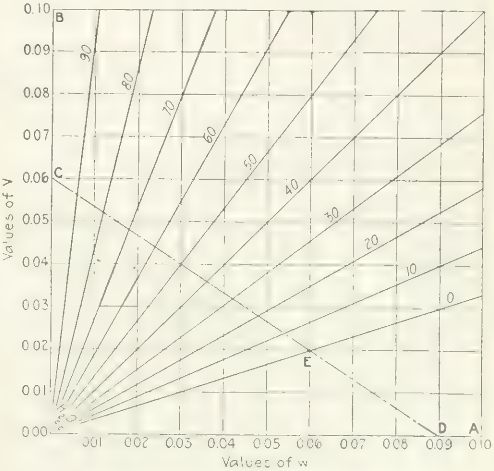

Chart for Finding Tailings Value

If the assay is conducted according to the first method mentioned, where the wet tailings sample is filtered and the filtrate assayed, c and b drop out and the formula becomes:

$$\frac{aw}{d\,(1 - a)} = W$$

In this case the line 00 coincides with OA and the chart is much more easy of construction. This general form of chart may be used for the determination of cyanide in pounds per ton of dry pulp, and is useful in many other pulp problems.

⁂

Considerations Which Govern Leaching-Plant Operation*

These experiments were made on about 300 tons of oxidized ore shipped from the various shafts and test pits and during the development of the property.

The ore was charged dry into the vats. The lixiviants were admitted on top of the ore but at one side of the vat, and no faster than could be absorbed by the charge. By making a little dam on top of the charge, the lixiviant passed immediately to the bottom of the vat and saturated the charge from below, thus permitting the escape of air and gas.

The soluble copper in the tailing was determined by boiling the laboratory sample (100 mesh) in 10% sulphuric acid. The copper not soluble by this treatment must exist as sulphide or as other minerals in the ore, not capable of being extracted by sulphuric acid and therefore is not available by this metallurgical process.

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*Assayer, Mogul Mining Co., Terry, S. D.

*Excerpt from a paper by Stuart Croasdale, read before the Utah meeting of the A. I. M. E.

Lot 3 was crushed to ½-in. mesh.

Lot 4 under similar conditions was crushed almost to ¼-in. mesh, as shown by the following screen analyses:

Mesh	Lot 3 Per cent.	Lot 4 Per cent.
— 2 + 4	16	6
— 4 + 8	27	27
— 8 + 16	17	21
— 16 and fines	40	46

	Dry Wt. Lb.	Cu %	Cu Sol.	SiO_2 %	Fe %	Al_2O_3 %	CaO Sol.	S total	S sulphate
Lot 3	111,230	1.48	1.32	64.00	4.20	14.30	0.45	0.20	0.04
Lot 4	89,670	1.44	1.30	63.30	4.20	15.10	0.60	0.20	0.06

The results from these tests are shown on the following table:

	Test 1	Test 2
Pounds ore leached	90,533	80,458
Per cent. copper	1.44	1.43
Average hours acid leaching	70	100
Average hours washing	7.0	23.0
Final tailing, per cent. total copper	0.27	0.40
Final tailing, per cent. soluble copper	0.23	0.38
Pounds copper extracted per ton of ore	23.3	20.6
Percentage of copper extracted	81.2	71.8
Total per cent. of material extracted from ore	3.0	3.9
Actual percentage of copper extracted	81.8	72.7
Percentage of available copper extracted	83.5	73.0
Gallons lixiviant used per ton of ore	123	137
Average per cent. acid in lixiviant	9.5	7.0
Pounds acid consumed per pound copper dissolved	3.5	3.3
Gallons wash water used per ton of ore	135	177
Rate of percolation in inches per hour, measured in inches of solution above the ore in vat	43.0	11.0
Average value of nearly neutralized lixivium sent to precipitating vats:		
Copper, per cent.	2.41	2.90
Iron, per cent.	0.56	0.70
Alumina, per cent.	0.53	0.73

These results show clearly the effect of finer crushing on the same grade and character of ore. Both of these lots were substantially the same character of ore in every respect. They were much altered by oxidation and contained practically no insoluble copper in the tailings, although the ore itself showed 0.08 to 0.10%, probably as cuprite, which dissolved in the ferric salts extracted from the ore.

The extraction on the four-mesh material was 9.4% lower, and the rate of percolation dropped to one-quarter of that on the two-mesh material. Hence much more time was consumed in leaching and washing the ore, with poorer results.

The difficulty in extracting this copper led to a more detailed analysis of the tailings to determine whether the copper was retained by the coarse material alone or whether the colloidal slime also had a tendency to absorb and retain copper even after it had gone into solution. The latter was found to be the case.

These results are interesting, since they show that the colloidal slime absorbs, or retains mechanically, as much copper as is held in the coarse material. As anticipated, there is also an increase in the percentage of alumina in the fine material.

This retention of the copper by the slime was also noticeable in washing the ore. Although the charges in Lot 4, Test 3, were washed a much longer time and with 50% more water than those in the previous tests, the analyses of the wash waters showed a very slow removal of the copper. When the percolation was slow and the tailings high, even the tenth volume of wash water contained a high percentage of copper while the acid was removed as readily as in the other tests. This confirms the well known properties of colloidal or argillaceous material for retaining mineral salts. In this test, partly neutralized lixiviants were used on new ore in every charge, which could not always be done in the other tests. This had a tendency to lessen the consumption of acid, and neutral or nearly neutral solutions could be sent to the precipitating tanks. As stated before, if the acid contents of these lixiviants are too low and they become completey neutralized, part of the copper is reprecipitated in the ore. It would therefore be advisable to send the lixivium to the precipitating tanks slightly acid. Lixiviums containing relatively high percentages of ferric sulphate, and perhaps aluminum sulphate in the form of alum, show an acid reaction that corresponds to 0.2% to 0.5% of sulphuric acid.

Other similar tests were run, varying conditions somewhat, of which we abstract only the conclusions or the important features.

In treating different grades of similar ore, the value of the tailings is practically a constant. Consequently, with two ores of 2% and 1%, respectively, recovery on a percentage basis will usually be much lower on the lower-grade ore.

Several charges of the leached ore were washed with as much as 1500 gal. of water per ton, or until the final wash water showed no copper or acid. This extra and complete washing had absolutely no effect on the soluble copper in the tailings, which remained as high as in charges washed with one-tenth of the water.

This fact points to the importance of studying carefully the gangue of an ore, even if it may not be acid consuming. The ability of argillaceous and some colloidal material to absorb and retain mineral salts is well known, and these experiments have shown it to be quite a factor in leaching raw oxidized porphyry ores with sulphuric acid.

It was found inadvisable to saturate the ore with water before applying the first lixiviant. This water must, of course, be replaced by the acid before the copper can be dissolved, and the interchange takes place but slowly through the pores of the ore. The acid lixiviants should be applied to the dry ore.

There was usually very little increase and sometimes a considerable decrease in the copper contents of the first lixiviant if the free acid and ferric sulphate in solution were not sufficient to destroy the alkalinity of the ore. Therefore it is a waste of time and expense to use lixiviants too weak to accomplish this purpose.

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Cactus as a Binder

The U. S. Patent Office has recently granted a patent to F. Meyer, of Denver, Colo., on a new binder for briquetting coal dust, coke breeze, flue dust and fine ores.

The new binder is the liquid extract of cactus, and its wide occurrence in all the southwestern states and its almost absolute uselessness for other purposes ought, according to the patentee, to furnish a binder cheaper than any other mentioned in the various publications of the Bureau of Mines on the subject of briquetting of fuel.

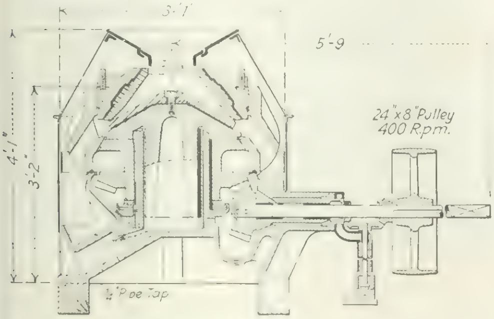
There can be no doubt that cactus has excellent binding qualities. Any one who has ever had the misfortune to experiment with cactus knows that its pulp is as sticky as glue, and we also know that the extract of *Cactus opuntia* is often used as a substitute for tragacanth by confectioners.

Mining & Metallurgical Machinery

Smith Crushing Machine

A new applicant for honors in the ore-crushing field is the Intercone machine, shown in the accompanying illustration. It is probably applicable, in mining work, to operate between the coarse breakers and the machines which make a 20-mesh or finer product.

The feed is vertical, lessening the probability of bridging, and crushing is performed between the mantle head and the hollow cone, both of which revolve in the same direction and at the same speed, but upon slightly different centers. The discharge is assisted by centrifugal force, which tends to avoid clogging, and the machine may be driven in either direction. It is said to be compact, may be placed in any position and the crushing motion is horizontal. It is made by the T. L. Smith Co., of Milwaukee, Wis.



THE SMITH INTERCONE CRUSHER

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The Largest Rock Breaker

The Traylor Engineering & Manufacturing Co. is now building for the Rockland Lake Trap Rock Co. a crusher with jaw opening 66x86 in., which will be used for crushing the hardest known trap rock. The machine will be installed just outside of New York City and will weigh over 520,000 lb. The notable feature in its manufacture is that practically the whole machine is constructed of cast steel, thoroughly annealed, to eliminate internal strains.

The machine is approximately 26 ft. long, 18 ft. high and 20 ft. wide; the crushing plates are made of manganese steel, as are also the cheek plates and toggle seats, giving these wearing parts the longest possible life. The pitman is of cast steel, of the box-section type, and fitted with internal ribs and a removable cap to facilitate handling. The pitman is also fitted with removable bushings, babbitted and water-cooled. The installation of bushings in this part greatly facilitates the rebabbitting of the eccentric or pitman whenever necessary, and eliminates the necessity of shutting down the crusher for two or three days, which would be the case if the babbitt were poured in place in the pitman.

The bearings on the side frame are fitted with removable bushings, water-cooled and babbitted, allowing quick rebabbitting. Under normal operating conditions, however, the babbitt should not be touched in a whole year's operation; in fact, in the large crushers which are running the babbitt is not touched except when the plant is shut down for two weeks in the winter time for over-hauling. It is not necessary, however, to do this, as it has been found at the end of the year that the babbitt was in as good condition as when the crusher started.

The water-cooling features on these large crushers make it possible to run the crushers continuously without heating, and the lubricating expense is greatly reduced, for the reason that only about one-third of the lubricant necessary under ordinary conditions is used with water-cooled bearings. The water-cooling device has worked so satisfactorily that the Traylor company has adopted the design for all of its jaw crushers.

The Rockland Lake crusher will have a capacity of 400 tons per hour, crushing down to about 10 in., and will use from 180 to 240 hp. The estimated power is based on operating conditions of other large crushers in use.

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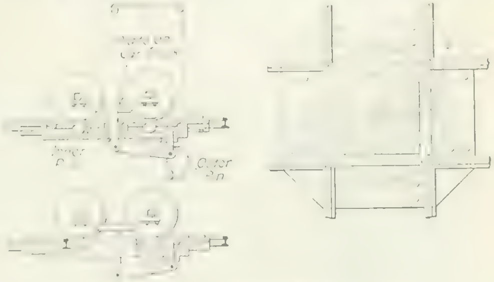
Ball-Bearing Turntable with Latch

The Simmonds Engineering Co., of Iola, Kan., has recently put on the market a new type of turntable for small vehicles, such as mine cars. The turntable is of the ball-bearing type and has a novel feature in the form of a latch which locks it in position so that its tracks register with the tracks leading up to it. The operation of this latch is shown in the illustration. It consists of two pins at opposite ends of a lever set underneath the turntable and attached to the fixed portion of the apparatus. The larger of these pins operates vertically through the center of the turntable and is engaged by a lug on a plate carried by the mine car itself. The upper pin moves vertically near the outside of the turntable and engages a hole in the upper rotating part of the apparatus when the



BALL-BEARING TURNTABLE WITH LATCH

table is in any one of its several registering positions. The inside pin is heavier and keeps the latch always in operation unless it is released by some means.

Suppose the turntable locked and a car about to be run on it. When the car is centered, the operator by some suitable mechanism depresses the small outer pin and by this means thrusts up the large inner pin so that it enters the hole in the plate under the car. If the turntable is now swung slightly, the outside pin is brought out of register with the hole in the upper plate of the turntable and is thus kept depressed, at the same time keeping the inner pin lifted. The inner pin then serves to hold the car in place on the platform. When the turntable is swung so that the tracks are again in alignment as desired, the weight of the inner pin depresses it and forces the outer pin up, since it now registers with another hole. The car is then released and can be pushed off the turntable.

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Some Useful Adjuncts to Mining

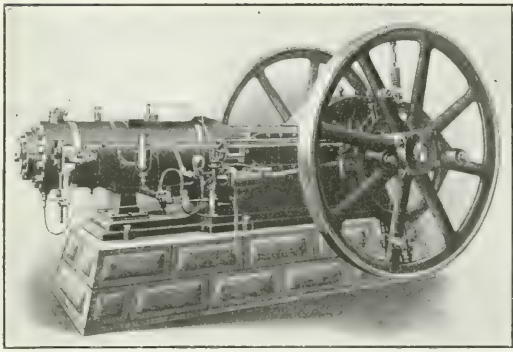


Fig. 1.

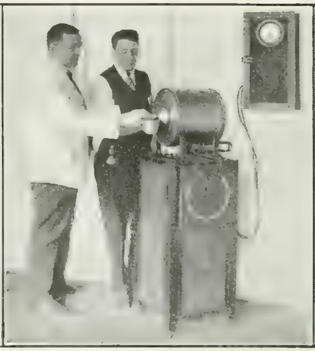


Fig. 2.

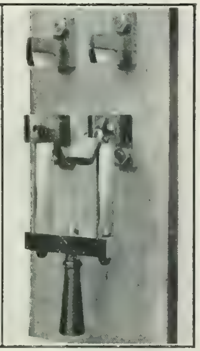


Fig. 3.

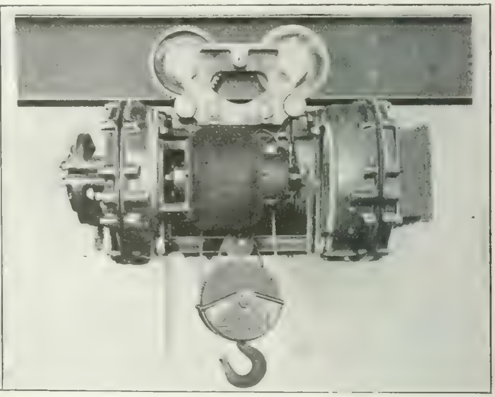
Fig. 1. The Bessemer Oil Engine—A two-cycle engine with driving parts fully inclosed and running in an oil bath. The scavenging air does not pass through the crank case, but is taken directly into the crank end of the cylinder. There are no valves, the fuel being injected at the end of the compression. The engine is manufactured by the Bessemer Gas Engine Co., Grove City, Penn.

Fig. 2. A Powerful Electromagnet for Hospital Use—The Westinghouse Electric & Manufacturing Co. has just installed this extremely powerful electromagnet in its relief department at East Pittsburgh for extracting splinters of steel from workmen injured by flying fragments. It is similar to that used by the allied armies for extracting pieces of shrapnel shell.

Fig. 3. A Safety Knife Switch—The hinge clips of the switch extend beyond the blade and the switch can be locked against closure by means of a padlock, to which only the man working on the line has a key. This is manufactured by the Cutler-Hammer Manufacturing Co., of Milwaukee.

The Slick Mine Tie

From a photograph taken in a Pennsylvania coal mine showing the Carnegie Steel Co.'s slick mine tie. The use of this tie gives about [illegible] in. more room between car top and roof, thus facilitating loading.



Link-Belt Trolley Hoist

A new type of hoist manufactured by the Link-Belt Co., of Chicago. The hoist has a dynamic-braking system, the descending load driving the motor as a generator. Very little headroom is required by this hoist

Correspondence and Discussion

Failure of Hollow Drill-Steel

From time to time there have appeared in the technical press articles relating to the failure of hollow drill-steel. The cause has been attributed to many different reasons, principal among which were too rapid a movement of the hammer, a flaw or node in the steel and the development of the hammer machine beyond that of the steel. As one who has had a wide experience in the field as well as in the manufacture of hammer drills, I wish to present some observations of my own which may be interesting.

The McKiernan-Terry Drill Co., with which I am associated, has been a manufacturer of hammer drills since 1904 and has used hollow steel since 1905, when it was first offered to the trade in this country. Since then, and until now, I do not recall a complaint from a customer with regard to the breakage of steel, and have not had occasion to complain to the manufacturers of the steel, except as to its carbon content. With our drills I have found that the steel giving the best service should not be larger than 1-in. hexagon with a $\frac{3}{16}$-in. hole, although the standard size we use is $\frac{7}{8}$-in. quarter-octagon with a $\frac{3}{16}$-in. hole. We have used, too, with good results $\frac{7}{8}$-in. hexagon and drilled holes with it to a depth of 12 ft., finished to $1\frac{1}{4}$-in. diameter. In one case with $\frac{7}{8}$-in. hexagon hollow steel I recall that there was but one drill steel broken in a two weeks' run. Occasionally there will be failures of hollow steel, but not more than would be looked for or expected with a 3-in. or $3\frac{1}{4}$-in. piston machine drilling holes to the same depth and using $1\frac{1}{8}$-in. or $1\frac{1}{4}$-in. solid steel.

The reason we have had no complaints of hollow-steel breakage with our hammer drills is no doubt due to the fact that the valve motion of our drill is such that the hammer acts as a solid mass with the steel in cutting the rock. In addition to this, in our rotating hammer drills, the impact of the hammer on the shank takes place when there is no torsional strain upon the steel. Failure of the steel will generally be found when the stress of impact takes place during the stress of rotation. These stresses occurring simultaneously cause a compound strain in the steel, resulting in its failure far below the breaking point for either stress applied separately.

When examined broken steel often shows an oxidized spot. Many of these are of crescent form with the points of the crescent converging at the central hole through the drill steel. These spots or oxidized surfaces are by some considered to be the indication of an original fault in the steel, but a close inspection shows a shading of the oxidized surfaces, and at times two or more crescents will be visible. In my opinion, this would indicate that the fracture has occurred in successive stages until the steel has become so weakened that a break occurs, and this will show a bright surface. The appearance of the oxidized spot does not necessarily indicate that there was a flaw in the steel, but rather that it was caused by an undue strain which developed the fracture. I am also led to believe that such steel is of good quality, for if it were otherwise it would have been completely severed at the first fracture. The position of the fracture may be the result of striation in the hole of the hollow steel as suggested by E. G. Spilsbury.

These observations have no reference to failures that occur at the bit or near it, since breakage of this character is largely due to the workmanship and heat treatment of the steel.

It is most desirable that the hammer-drill manufacturer be able to procure the best steel that can be produced, and in order that the steel maker may be able to meet our demands he should have as complete data on the subject as it is possible for us to give him. Hammer-drill users are also interested in the matter, and it would seem that any views along the line mentioned would be of much assistance to the manufacturer of hollow steel who is desirous of improving the quality of his product.

New York, Feb. 11. T. E. STURTEVANT.

Metallurgical Residues as Insecticides

The note on the use of zinc-retort residues for prevention of hog cholera in the JOURNAL of Feb. 13, 1915, reminds me that many years ago at an iron furnace in the South there was a little zinc in the ore: the zinc oxide (or perhaps blue powder, as it was blue in color) became concentrated at certain points in the gas mains and constituted a considerable precentage of the flue dust at those points. This material was found by the local gardeners to be an absolute "specific" for the Colorado beetle or potato bug and became extensively used locally for the purpose. A small quantity of the dry dust was sprinkled in the vines and the bugs quickly died. The discovery damaged the local market for paris green, but did not help the iron company for the quantity used was inappreciable in comparison with that produced. It would seem as though zinc must have some insecticide property not fully understood, at least among metallurgists.

New York, Feb. 13, 1915. SUBSCRIBER.

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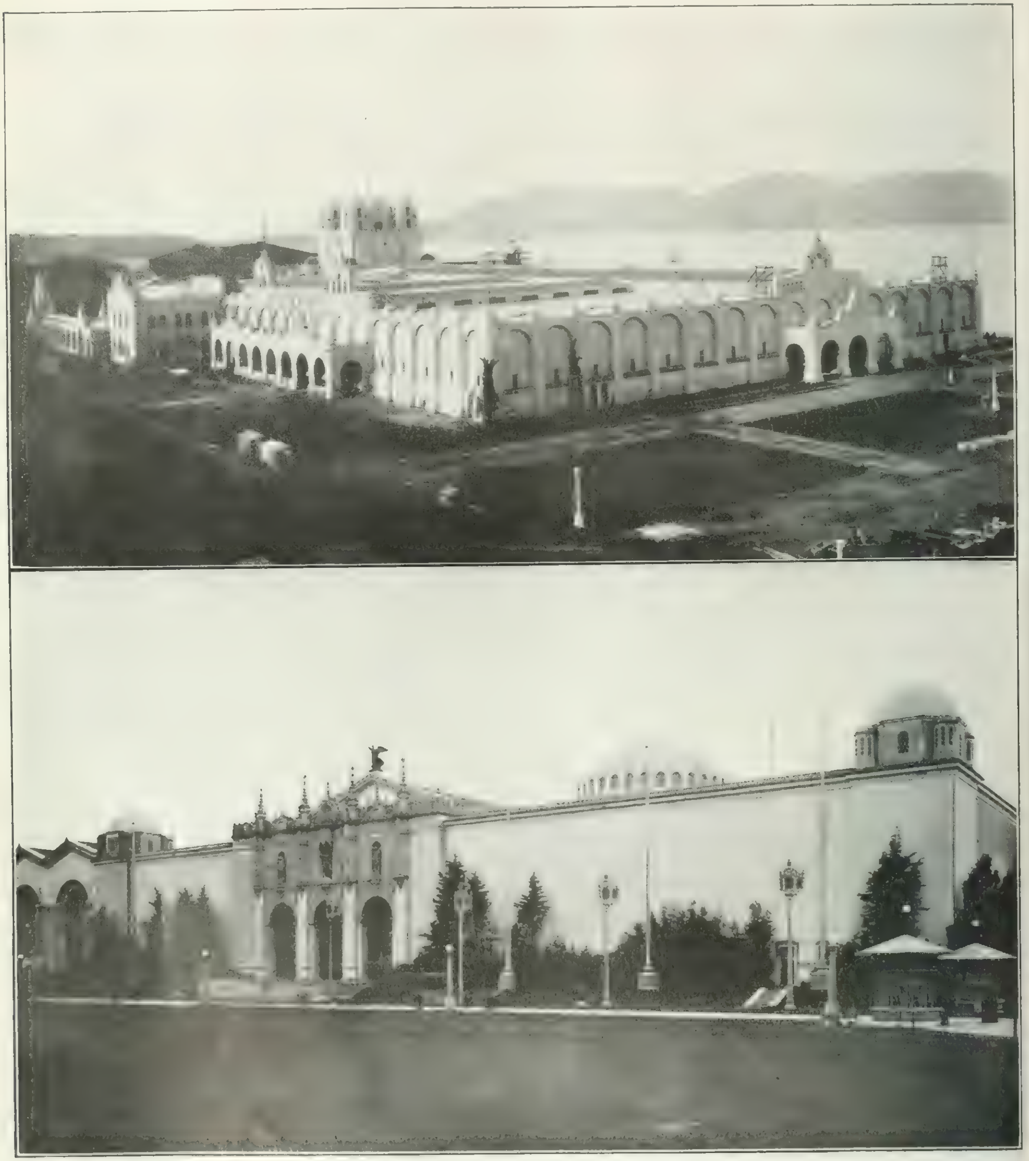
First-Aid Teams

Misther Editor:

I have bin an enthussyastic supporther av th' safety first movemint, but I have had an unplisant ixpirience on me subway job, which makes me fale a thrifle doubtful. We have had a foine rescue team. Given a practice run on a wop who has bruk his arrum and sprained the medallion obbligato (as the docthor boy puts it) we cud carry off ivery prize. And yet, th' other day, whin I had a rale cave-in an' we dug th' man out, the team fixed him up for a confound fracshun of the femure (docthor boy agin) an' whin the rale docthor came he says, "Begorra, it's an illigant job you did, but his ribs is bruk." An' his woife busted up the group wid a rollin' pin and said it was a lemon-aid team. Now, pwhat does a first-aid team do whin nobody tells thim in advance pwhat is wrong wid their victim?

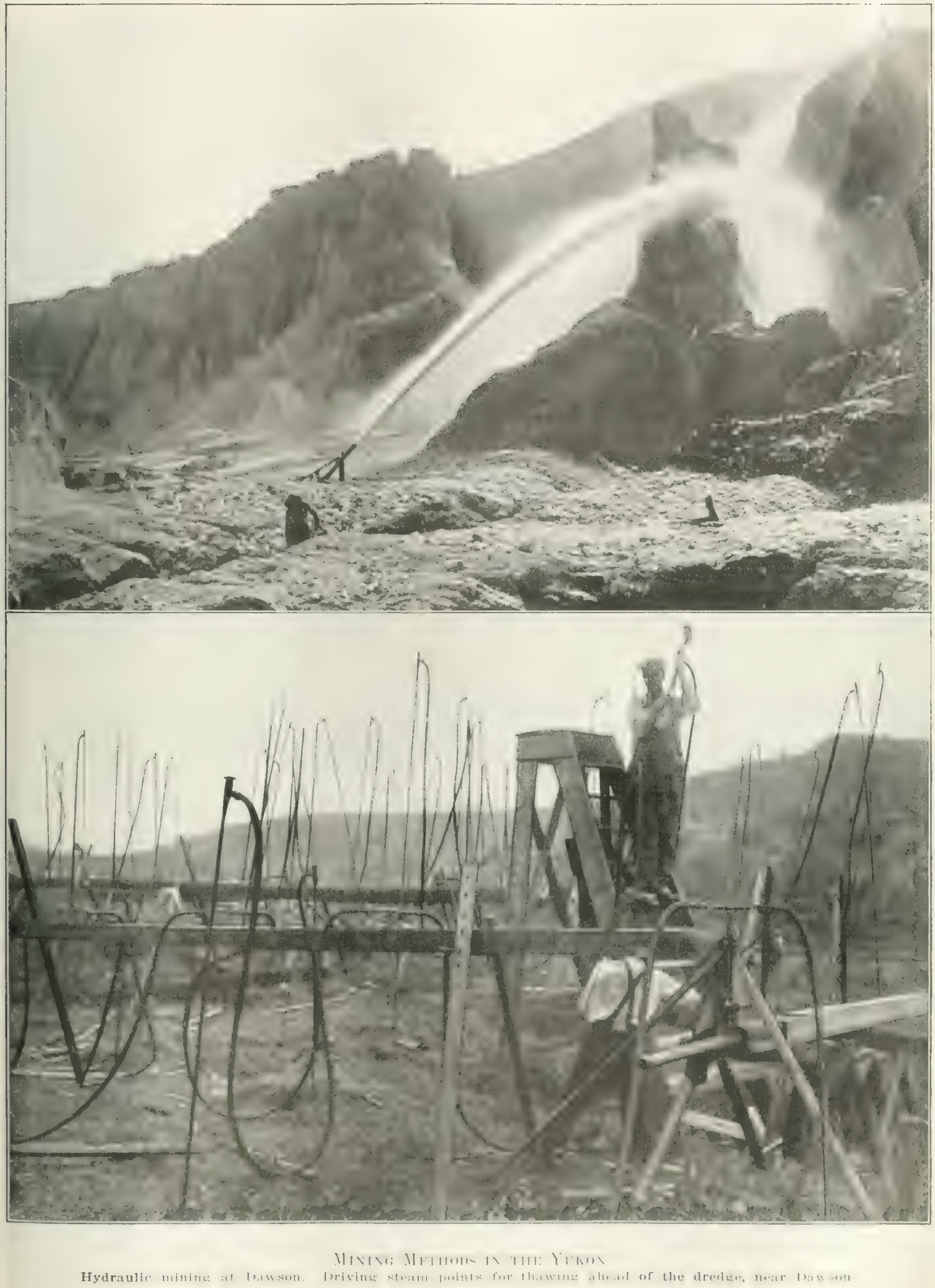
Brooklyn, Mar. 18, 1915. BILL MCGINTY.

Photographs from the Field



At the Panama-Pacific Exposition

The California State Building, presenting a general idea of the situation. The Mines and Metallurgy Building, the focus of professional interest at the present time



MINING METHODS IN THE YUKON

Hydraulic mining at Dawson. Driving steam points for thawing ahead of the dredge, near Dawson

American Smelting & Refining Co.

SYNOPSIS—Abstract of the annual report of the American Smelting & Refining Co. The report is much more complete than those of previous years, and shows amounts received from the sale of each separate metal, separate mining and smelting profits, etc.

The total earnings of the company in 1914, after deducting all expenses, fixed charges and a proper allowance for the Federal income tax payable on 1914 earnings, aggregated $10,811,915. From this amount was deducted for depreciation $1,540,350, and for losses incident to the Mexican and European wars, $240,000, leaving $9,031,565 net earnings applicable to dividends. After paying the dividends the sum of $1,014,115 was carried to profit and loss account.

The combined profit and loss account of the company and its subsidiaries since its organization in 1899 shows: Net gain after paying fixed charges, $144,702,115; depreciation, $20,869,888; dividends paid, $104,322,169; surplus, $19,510,058.

The total net gain for 1914 was but $710,143 less than in 1913, which again illustrates the regularity of the earning power of this company. When the internal national difficulties began in Mexico the directors declared to the stockholders that the operation of the company's properties outside of Mexico had an earning capacity more than equal to the dividend requirements. Large expenditures, extending over many years, on the plants of the company in the United States and in the purchase of new properties have increased the operating capacity and have reduced the cost of smelting and refining. So long as conditions remained normal these improvements continued to show their effect in increased net earnings in all directions except in Mexico, but the war in Europe brought about, temporarily, an absolute cessation of buying in virtually all of the metal markets of the world. After Aug. 1 and up to the end of 1914 the company suffered from a large reduction in the output of the principal lead and copper producing mines, but since the opening of 1915 the demand has shown such satisfactory improvement that these principal mines are now increasing their output.

The condition of affairs in Mexico continues to cause the directors anxiety. About Aug. 1 it seemed that most of the company's plants and mines in Mexico would soon be able to resume operations, at least to a limited extent. The resumption of operations, however, proved to be only temporary.

During 1914 the property at all the plants and mines was kept in good physical condition by the expenditure of $1,879,125, which has been charged in the regular operating expense accounts. In addition, there was expended for improved facilities and new properties $1,275,772, which was charged to the property account. This account has also been credited with a depreciation charge of $1,540,350, so that the property account shows a decrease from the report of last year of $264,578.

On account of the reduced ore receipts, the several plants were able to work up many accumulations of ores and furnace byproducts. At the end of 1914 the total value of metals on hand, in process of treatment or refined and ready for the market, aggregated $24,660,942, a decrease during the year of $1,820,060. The ore on hand produced from mines belonging to the company is valued in the inventory at its cost of production. All other metals on hand are valued at the same quotations as have been used for several years.

During 1914 there was added to the cash working capital of the company the sum of $904,343, derived as follows: From net earnings (before deducting depreciation to property) less fixed charges and dividends, $2,554,465; less amount expended on the property of the company, for investments and for bonds and stocks purchased for retirement, $1,650,122; net increase in working capital, $904,343. Metal stocks and other net current assets were converted into cash to the amount of $3,086,769; so that at the end of 1914 the total cash on hand and subject to check was increased to $8,034,778.

The strong position of the company as to cash on hand at the beginning of the European war, when for a time there were no quotations for silver, lead or copper, permitted the management to advance cash against ore shipments of the mines, although for a considerable period of time the products could not be sold, nor was there a basis upon which to fix the value of the ore. The directors believe that the various miners whose product is under contract to the company were eminently pleased and satisfied with the accommodation given them.

VOLUME OF BUSINESS

The following condensed statement of the cash receipts of the company for 1914, together with the application thereof, and a few operating statistics will give the stockholders some conception of the extent of the company's operations:

Cash Receipts—		
Cash on hand and in bank subject to check on January 1, 1914		$4,043,666.41
From sales of metals*		
Gold	$52,094,016.24	
Silver	41,209,569.90	
Lead	23,125,635.89	
Copper	61,619,487.35	
Other metals	2,431,409.82	
Total	$180,480,119.20	
From mining properties	3,135,809.21	
From manufactured products	2,665,957.61	
From miscellaneous income, rents, interest, commissions, etc.	1,223,514.39	
Total from sales and miscellaneous income	$187,504,400.41	
From quick assets of Jan. 1, 1915, demand loans and foreign bills of exchange	1,991,622.21	
Accounts collectible	993,829.14	
Total cash receipts		190,489,851.76
Total cash to be accounted for		$194,533,518.17
Cash payments—		
For ore and bullion purchased and administration expenses and taxes	$173,864,673.45	
For expenditure on property	1,275,772.01	
For miscellaneous investments	20,850.00	
For interest on bonds	808,064.46	
For dividends to stockholders	8,017,450.00	
For company's debenture bonds purchased	183,500.00	
For company's preferred "A" stock purchased	170,000.00	
For advances to affiliated companies	101,802.49	
For transfer to special funds	115,063.90	
For reduction of current liabilities, etc.	1,941,563.73	
		186,498,740.05
Balance cash on hand and in bank subject to check Dec. 31, 1914		$8,034,778.12

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*Does not include value of toll metals not delivered for cash aggregating $6,253,643.95.

A. S & R. METAL PRODUCTION

	Value
Metal produced –	
Gold	$52,515,548.55
Silver	42,690,226.10
Lead	24,551,632.05
Copper	71,712,527.40
Other metals	2,431,409.82
Value of products of mines	3,135,809.21
Value of manufactured products	2,665,957.61
Miscellaneous income	1,222,514.39
Total volume of year's business	**$200,925,625.13**
Net earnings available for dividends	**$9,031,565.10**
Per cent. of net earnings to volume of business, 4.49+.	
Employees—	
Total number of men employed (excluding Mexico)	12,179
Total wages and salaries paid (excluding Mexico)	**$10,212,591.40**
Average wages per employee per 8-hr. day	$2.33
Tons of ore mined	1,266,702
Tons of coal mined	257,942
Tons of charge smelted	4,171,258
Tons of bullion refined	588,718
Tons of coke produced	129,650
Tons of coal used	544,619
Tons of coke used	447,761
Barrels of oil used	976,528
Cubic feet of gas used	7,430,300
Ounces of gold refined	2,540,911
Ounces of silver refined	77,604,483
Tons of lead refined	316,591
Pounds of copper refined	529,686,000
Pounds of metal products manufactured	40,122,817

Many years ago the company decided that it was advantageous to introduce, in connection with all 24-hr. work, the three-shift system, giving to all men eight hours' work, instead of 10 and 12, as had previously been the custom. At the present time less than 6% of its labor works 12 hr. daily, and even this unimportant proportion is being eliminated. There is no doubt as to the desirability of instituting 8-hr. labor in place of longer hours for the health and welfare of the men. In most cases the company had been obliged to pay the same wages for 8 hr. work as it had previously paid for 12 hr., and the company has sought to offset the increase in the cost of operation by labor-saving devices. The two changes have gone hand in hand, so that the company is not able to decide as to the comparative efficiency of men working a shorter number of hours. The capital expenditure, however, in connection with these labor-saving devices has been large, but undoubtedly it has been a profitable investment. In one of the works where these devices have been installed to the greatest possible extent the same amount of work is done with one-third the number of men as in another plant doing the same class and amount of work but where labor-saving devices have been introduced only to a limited extent.

In conclusion, Daniel Guggenheim, the president, says: "At the request of the U. S. Commission of Industrial Relations your president recently appeared before that body and testified fully as to the conduct of the operations of your company and as to its relations with its employees.

"The stockholders may rest assured that the directors of the company are fully alive to all subjects of public and corporate welfare touched upon in these investigations, and since nearly all of them are officers of the company in charge of its various operations, they are brought into daily contact with all these matters.

"Careful consideration has been given to the subject of unreasonable profits, unduly long hours of labor, the payment of less than living wages, and unfair methods of competition as affecting the prices of either raw or finished products.

"The company purposely keeps its treatment charges as low as possible, in order to encourage the maximum production of ore, and it endeavors to make sales of its metals at the same prices at which they were purchased, and therefore it is not financially interested in the market price of its products. Your company pays cash for the metal oftentimes of hardly appreciable quantities per ton of ore. This all must suffer more or less loss and great risk in each of the many metallurgical processes through which it passes, and on the average the resulting fine metal is not converted into cash in less than four months after the purchase. The buying, smelting, transporting, refining and selling, with all of the innumerable risks, of the vast sum of two hundred millions of value is, as already stated, effected for a profit of less than 4½% of the annual turnover.

"Even these profits, however, cannot be obtained from smelting and refining alone, but are secured through the ownership of producing mines, the production of coal and coke, the manufacture of many metal products, the production of sulphuric acid from formerly wasted fumes and the saving of various products from the dust of flue chambers of too infinitesimal quantities to be discovered in the original ore, all of which is obtained through the expenditure of large amounts of capital and the command of the best metallurgical talent."

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Bauxite Deposits in Dutch Guiana

By F. B. Percival*

Dutch Guiana is on the lookout for capital to operate some extensive bauxite deposits recently discovered on the Saramacca River.

Bauxite, which is hydrated aluminum oxide mixed with certain impurities, such as silica, iron oxide, titanic acid and carbonate of lime, occurs in numerous varieties even within limited areas. The two principal varieties in Dutch Guiana are red and white. The red is rather compact and of a granular nature. The white bauxite is very siliceous and is found in compact masses which break away easily.

Bauxite Deposit on the Saramacca River, Dutch Guiana

The discovery was made in September, 1914, by Mr. Pay, an engineer. He found the mineral in a chain of hills bordering the Saramacca River. The deposit is easily operated, since the transportation of the mineral is facilitated by the passage of vessels of light draft. The mineral can be loaded into the ship's hold alongside the bank of the river. The analysis of the material shows a large percentage of aluminum.

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*Paramaribo, Dutch Guiana

The United States Steel Corporation in 1914

The report of the United States Steel Corporation covering 1914 gives the usual full statement of the financial and other transactions for the year. Limited space compels us to present most of the details in tabular form. The first table is a condensed statement of the general balance sheet as of Dec. 31, 1914.

CAPITAL ACCOUNT

Common stock	$508,302,500
Preferred stock	360,281,100
Subsidiary Co. stocks	589,043
Bonded debt........	627,045,112
Notes for future mining royalties	26,976,001
Mortgages, etc...	6,492,218
Current liabilities............	41,867,829
Reserve funds	30,475,218
Surplus appropriated to capital accounts	55,000,000
Undivided surplus..	135,204,472
Total liabilities	$1,792,233,493
Property accounts .	$1,457,853,930
Mining royalties advanced, etc	44,242,832
Deferred charges	1,784,936
Sundry investments	3,477,257
Sinking and reserve fund assets	15,804,960
Inventories, material on hand	158,091,036
Cash, current accounts, etc.	110,978,542
Total assets	$1,792,233,493

During the year bonds of subsidiary companies were issued to the amount of $9,407,000, while bonds were paid off or were redeemed by the various sinking funds to a total amount of $9,535,264, making a net decrease of $128,264 in the funded debt.

The expenditures during the year for additional property, new plants and other permanent improvements were $23,171,013, two of the larger items being $4,649,196 for the new steel plant at Duluth and $2,046,176 for steamships for export trade.

The second table shows the gross receipts and the income account for the year. As compared with 1913, there was a decrease of $238,479,366 in the gross receipts and a decrease of $65,517,630 in net earnings. Payments from surplus were $25,219,677 for dividends of 7% on preferred stock and $15,249,075 for dividends of 3% on common stock, leaving a deficit of $16,971,981 for the year. The common stock dividends include two of 1¼% each and one of ½%, no dividend being declared for the fourth quarter.

EARNINGS AND INCOME

Gross earnings:	1913	1914
To customers outside of U. S. Steel	$518,999,605	$380,228,143
Intercompany sales......	211,910,441	129,565,729
Transportation companies	57,726,430	42,040,131
Miscellaneous	8,257,823	6,580,930
Total	$796,894,299	$558,414,933
Manufacturing and operating costs	....	494,824,859
Net balance	....	$63,590,074
Subsidiaries' accounts, investments, etc	....	18,156,444
Total net earnings		$81,746,518
Subsidiary charges		$10,082,903
Depreciation and replacement funds		17,044,183
Sinking funds		8,099,024
Interest on U. S. Steel bonds		23,148,618
Total charges		$58,374,728
Surplus		$23,371,790
Add adjustment of accounts, etc.		124,978
Total surplus for 1914		$23,496,768

SHIPMENTS OF MATERIAL

(In Tons)

	Domestic	Export	Total
Rolled steel and finished products	7,982,325	1,096,234	9,078,559
Pig iron, ferro, ingots, scrap	494,144	47,790	541,934
Iron ore, coal and coke	1,153,575		1,153,575
Sundry materials and byproducts	80,357	190	80,547
Total	9,710,401	1,141,214	10,851,615
Universal portland cement, bbl	9,117,752		9,117,752
Total value of business	$337,444,052	$42,784,091	$380,228,143

The aggregate amount charged to gross earnings for depreciation of plants and exhaustion of minerals from lands owned was $64,847,641 during the year.

The third table shows the total production of all mines and plants for the year. The raw materials—ore, coal, etc.—are used in the manufacture of the finished products shown in the table.

GENERAL STATEMENT OF PRODUCTION

Products	1913	1914
Iron Ore Mined		
In the Lake Superior Ore Region	Tons	Tons
Mesabi Range	21,634,206	10,894,463
Vermilion Range..........	1,301,163	1,112,854
Gogebic Range	1,871,700	1,469,601
Menominee Range	980,346	874,909
Marquette Range..............	583,266	496,896
In the Southern Ore Region		
Tennessee Coal, Iron & R. R. Co.'s Mines	2,367,770	2,186,258
Total	28,738,451	17,034,981
Limestone Quarried.......	6,338,509	4,676,479
Coal Mined		
For use in the manufacture of coke	24,081,192	15,890,382
For steam, gas and all other purposes	6,705,381	5,271,911
Total	30,786,573	21,162,293
Coke Manufactured		
In beehive ovens	11,062,138	7,092,792
In byproduct ovens	5,601,342	4,081,122
Total..............	16,663,480	11,173,914
Blast Furnace Production		
Pig iron	13,879,706	9,909,062
Spiegel......	65,236	25,397
Ferromanganese and silicon	135,788	117,998
Total ...	14,080,730	10,052,457
Steel Ingot Production		
Bessemer ingots..	6,131,809	4,151,510
Openhearth ingots.	10,524,552	7,674,966
Total.....................	16,656,361	11,826,476
Rolled and Other Finished Steel Products for Sale		
Steel rails (heavy and light tee and girder)	1,927,745	978,907
Blooms, billets, slabs, sheet and tin plate bars...	842,175	921,826
Plates	1,108,147	689,241
Heavy structural shapes	998,624	613,739
Merchant steel, bars, hoops, bands, skelp, etc...	2,024,192	1,423,740
Tubing and pipe......	1,186,740	818,435
Wire rods ...	174,478	164,153
Wire and products of wire	1,432,182	1,380,376
Sheets (black and galvanized) and tin plate.	1,280,537	1,075,419
Finished structural work	652,363	521,225
Angle splice bars and all other rail joints..	256,676	129,849
Spikes, bolts, nuts and rivets	86,465	62,133
Axles	159,075	64,662
Steel car wheels	93,375	53,638
Sundry steel and iron products..	152,064	117,169
Total	12,374,838	9,014,512
Spelter	30,424	28,031
Sulphate of iron	33,829	30,212
Universal portland cement, bbl................	11,197,000	9,116,000

No figures of cost of production are given in the report. Only a very rough approximation can be made. The gross receipts were $61.46 per ton of rolled and finished steel, or $51.48 per ton of all material shipped, excluding portland cement; the net earnings were $9 and $7.53 per ton respectively. Taking another statement, the value of all materials shipped, again excepting cement, was $41.88 per ton.

The fourth table shows the total shipments of products of all kinds to purchasers, the domestic and foreign business being given separately. The decrease in total tons shipped was 25.4%; in total value of shipments, 26.7%. The decrease in value of export business was 36.9%; in domestic business, 25.2%. The value of the export trade was 11.25% of the total sales.

The average number of employees in the service of all companies was as follows:

	1913	1914
Manufacturing properties	165,277	131,616
Coal and coke properties. ..	24,996	16,155
Iron ore properties	13,789	11,170
Transportation lines	21,951	17,857
Miscellaneous	2,893	2,555
Total number	228,906	179,353
Total salaries and wages...	$207,206,176	$162,379,907

The decrease in the number of men in 1914, as compared with 1913, was 49,553, or 21.6%. The average wage or salary per day in 1914, excluding general administrative and selling force, was $2.88; including all employees, $2.97, against $2.85 and $2.92 respectively in 1913. The total amount paid for wages in 1914 was 29.1% of the gross receipts.

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Gold Production of Australia

The corrected gold production of Australia, as shown by the reports of the mines departments of the different states is shown in the accompanying table, in fine ounces:

GOLD PRODUCTION OF AUSTRALIA
(In Fine Ounces)

	1912	1913	1914
Western Australia	1,282,658	1,314,041	1,232,973
Victoria	480,131	434,932	409,706
Queensland	347,946	265,735	248,395
New South Wales.........	165,295	149,658	124,507
Tasmania	37,973	33,400	27,320
South Australia	7,340	7,292	6,000
Total, ounces	2,321,343	2,205,061	2,048,901
Total, value	$47,982,150	$45,578,611	$42,350,784

The total decrease in 1914, as compared with 1913, was 156,160 oz. or 7.1%. The maximum production was in 1903, when the gold output of Western Australia was at its height. The production reported in that year was 3,837,064 oz., or almost double that of 1914. All the states showed decreases last year, with little differences in proportions.

The report for the Northern Territory has not yet been published. This production was 14,681 oz. in 1913, when it was stated separately for the first time. The New Zealand report for 1914 is also missing to make up the production for all Australasia.

* * *

Mineral Production of Spain for 1913

According to *Revista Minera* of Feb. 24, 1915, the mineral production of Spain for 1913 has been made public by the Department of Mines, and was as follows:

Substance	Metric Tons
Anthracite	232,517
Asphalt	5,582
Mercury	19,960
Sulphur	62,653
Barite	3,049
Bismuth	56
Zinc	171,831
Copper	2,268,691
Tin	6,626
Fluorspar	351
Iron (ore)	9,861,668
Iron (pyrite)	926,913
Bituminous coal	3,783,214
Kaolin	5,263
Lignite	276,791
Magnesia	958
Manganese (ore)	21,594
Silver (ore)	402
Lead (ore)	279,078
Lead (argentiferous)	23,600
Salt	26,238
Soda (sulphate)	293
Vanadium	25
Wolfram	237
Uranium	1
Wulfenite	10

* * *

Nevada Safety Requirements

By A. L. H. Street*

A mining company is liable for injury to a miner resulting in direct consequence of the company's failure to comply with the requirement of the Nevada statutes that iron-bonneted safety cages be used in vertical shafts which are deeper than 350 ft. In reaching this decision recently in the case of Ryan vs. Manhattan Big Four Mining Co., 145 *Pacific Reporter* 907, the Supreme Court of Nevada held that an injured employee could not be deemed to have assumed the risk of injury resulting from his use of a bucket as a cage with knowledge that his employer was violating the safety law. But the case makes it plain that the mere fact that the law is not complied with and that a miner is injured does not establish liability against the mining company; it must appear that the accident would not have happened except for the violation.

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*Attorney, St. Paul, Minn.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c each. British patents are supplied at 40c each.

AGITATOR. John Van Nostrand Dorr, Denver, Colo. (U. S. No. 1,131,222; Mar. 9, 1915.)

CADMIUM—Removal of Cadmium from Zinc Ores. Gilbert Rigg, Palmerton, Penn., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,129,904; Mar. 2, 1915.)

CONCENTRATION—Improvements in or Relating to Method and Apparatus for Concentrating Ores. G. E. Ohrn, Lidingo, Stockholm, Sweden. (Brit. No. 22,346 of 1913.)

COPPER AND NICKEL—Process of Separating Copper from Nickel and Matte and Other Products. Noak Victor Hybinette, Christiansand, Norway, assignor, by mesne assignments, to National Trust Co., Ltd., Toronto, Canada. (U. S. No. 1,128,313; Feb. 16, 1915.)

COPPER CEMENTATION—Anode for Electrolysis. Noak Victor Hybinette, Christiansand, Norway, assignor to Pacific Securities Co., Ltd., Toronto, Canada. (U. S. No. 1,128,316; Feb. 16, 1915.)

COPPER-NICKEL ANODES—Process of Producing Copper-Nickel Anodes. Noak Victor Hybinette, Christiania, Norway, assignor to Pacific Securities Co., Ltd., Toronto, Canada. (U. S. No. 1,128,314; Feb. 16, 1915.)

CRUCIBLE FURNACE. Franklin M. Iler, Denver, Colo. (U. S. No. 1,129,983; Mar. 2, 1915.)

DRILLS—Front-Head Construction for Self-Rotating Hammer Drills. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,130,957; Mar. 9, 1915.)

ELECTRIC FURNACES—Method and Apparatus for Protecting the Electrodes in Arc Furnaces. Jegor Israel Bronn and Wilhelm Schemmann, Rombach, Germany, assignors to the firm of Rombacher Hüttenwerke, Rombach, Germany. (U. S. No. 1,129,377; Feb. 23, 1915.)

FILTER. Charles G. Osgood, Tonopah, Nev., assignor of one-half to the Montana-Tonopah Mines Co., Tonopah, Nev. (U. S. No. 1,128,495; Feb. 16, 1915.)

HAULAGE—Attachment for Ropes for Haulage and Like Purposes. Frederick Ringrose, Bothwell, and Thomas Stevenson, Hamilton, Scotland, assignors of one-half to Charles Fletcher Lumb, London, England. (U. S. No. 1,129,124; Feb. 23, 1915.)

HOISTING—Safety Attachment for Hoisting Machinery. George F. Royer, Wilkes-Barre, Penn. (U. S. No. 1,129,733; Feb. 23, 1915.)

HOISTING ENGINE. Sven T. Nelson, Chicago, Ill. (U. S. No. 1,129,041; Feb. 16, 1915.)

INGOTS—Process of Treating Ingots. Hiram W. Hixon, Philadelphia, Penn. (U. S. No. 1,130,513; Mar. 2, 1915.)

MAGNETIC SEPARATOR. George Ullrich, Magdeburg, Germany, assignor to Fried. Krupp Aktiengesellschaft, Grusonwerk, Magdeburg-Buckau, Germany. (U. S. No. 1,130,618; Mar. 2, 1915.)

METALLURGICAL FURNACE. Utley Wedge, Ardmore, Penn. (U. S. No. 1,131,449; Mar. 9, 1915.)

MINING TOOL CAR. Edward Pyle, Butte, Mont. (U. S. No. 1,126,862; Feb. 2, 1915.)

ORE REDUCTION—Process of Reducing Ores. Albert F. Greene, Chicago, Ill. (U. S. No. 1,129,862; Mar. 2, 1915.)

ORE SEPARATING AND CONCENTRATING MACHINE. William F. Clifford, Ottumwa, and John C. Cook, Russell, Iowa. (U. S. No. 1,128,[illegible]; Feb. 16, 1915.)

RADIUM—Metallurgical Process. Louis F. Vogt, Washington, Penn., assignor to Standard Chemical Co., Pittsburgh, Penn. (U. S. No. 1,129,029; Feb. 16, 1915.)

SLAG-HEATED STEAM GENERATOR. Utley Wedge, Ardmore, Penn. (U. S. No. 1,129,928; Mar. 2, 1915.)

SLAGS—Process for Removing Slags from Furnaces and Means for Carrying Out the Same. Karl Prinz zu Lowenstein, Neckargemund, Germany. (U. S. No. 1,12[illegible]; Feb. 9, 1915.)

STAMP STEM GUIDE. James A. Little, [illegible], Calif. (U. S. No. 1,127,053; Feb. 9, 1915.)

VANADIUM—Treatment of Vanadium Ores. Louis F. Vogt, Washington, Penn. (U. S. No. 1,129,2[illegible]; Feb. [illegible], 1915.)

Editorials

Robert Hallowell Richards

The presentation of its gold medal by the Mining and Metallurgical Society of America to Dr. Robert H. Richards last week was a graceful and appropriate recognition of one who has rendered distinguished service both in the education of mining and metallurgical engineers and in the advancement of the art of ore-dressing. Professor Richards, who has been identified with the Massachusetts Institute of Technology for half a century, was the first to create the system of mining and metallurgical instruction with the aid of a laboratory, equipped with working machines, wherein the students were taught to execute the lessons of the lecture-room; and thus blazed a trail in technical education which other teachers were glad to follow, which now they have converted into a broad, well marked road. For this, if for nothing else, Professor Richards is entitled to the thanks of the profession.

But in the specialty that he made his own—ore-dressing, or the mechanical concentration of ores—he has rendered service of equally altruistic character but far broader scope. He has been a developer of principles in an art that was destined to become the premier in importance, a codifier of its rules, and the exponent of both theory and practice in a field that was practically uncharted. His monumental treatise on ore-dressing was not only the first in the English language, but for many years it was the only one and is still the principal one.

Professor Richards has been essentially a teacher, but he has been able to put his teachings into practice and has invented two noteworthy machines—the Richards pulsator and the Richards jig—which have come extensively into use. It is sincerely to be hoped that Professor Richards will reap a larger material reward from these valuable inventions than yet he has gained. But throughout his life his personal interests have ever been subordinated to those of his work as a teacher and as a guider of men. To such leaders come rewards of a kind that money cannot buy. It was fitting that the Mining and Metallurgical Society of America should this year bestow its medal "for distinguished service" upon Robert Hallowell Richards.

The Smelting Company's Report

The American Smelting & Refining Co. has signalized 1915 by bringing out its annual report, covering 1914, in a new form. In the past we have often taken occasion to criticize the reports of this company, not because they did not make a good exhibit or show to its stockholders how their property stood, but rather because they failed to tell the stockholder what kind of a business it was doing and enable him to form some sort of an idea respecting future prospects. In the report for 1914 the directors have made revelations that will interest everybody, and indeed will surprise everybody with respect to the magnitude and the diversity of the business done by this great company.

The cash receipts of the company from sales of products and miscellaneous income were $187,504,400. The expenses for ore and bullion purchased and the cost of treating them were $173,864,673, a difference of $13,639,727; but metals were sold to the amount of $1,820,606 more than were purchased, wherefore the operating profit was apparently $11,819,667. In its statement of "income" the company puts it at $12,825,530. This was derived from (a) smelting and refining, (b) mining, (c) manufacturing and (d) from rents, interest and commissions. From rents, interest and commissions the company got $1,222,514. This comprises interest received on its large cash balances and commissions derived from the sale of Nevada Consolidated, Utah, Ray and Chino copper. The receipts from manufactured products were $2,665,957. These comprise such things as sulphuric acid, made at Perth Amboy; copper sheets, rods, tubes, etc., made at Baltimore; and white lead, sheet lead, etc., made at Selby. The company's statement does not make it clear just how these are reckoned. Inasmuch as its own products were manufactured we assume that the amount stated represents the value added by manufacture. There is a similar doubt with respect to the $3,135,809 received from mining properties, but the "income" statement makes this clear by giving $935,193 as the net from the mines. The net earnings of the smelteries, refineries and factories were $10,667,822. In order to find the total operating profit, however, there should be deducted from the total gross income ($12,825,530) the sums of $924,683 for administration, $175,859 for corporate taxes, and $1,540,350 for depreciation, leaving a net income from operations of $10,184,638, of which we may assume that something like $8,000,000 to $8,500,000 was derived from smelting, refining and manufacturing. But in fact the business of this company is so complicated as to defy analysis on the basis of figures presented in this report, and perhaps by anything short of an examination of the accountant's books.

Take the smelting and refining business alone. The company operates copper refineries and lead refineries. It refines its own bullion and purchased bullion and some that is handled on toll. It operates lead smelteries, copper smelteries and zinc smelteries, which treat ores purchased, ores mined by the company itself, and a large tonnage of ore, especially that of the Utah, Chino and Ray companies, that is simply smelted on toll. The coke used in the smelteries is to a large extent made by the company out of coal that it mines itself. It is therefore difficult to distinguish among its earnings as a coal and ore miner, a coke manufacturer, a copper, lead and zinc smelter, a copper and lead refiner, a manufacturer of lead and copper wares, a selling agent, an operator of steamships and a capitalist.

In 1914 it employed 12,179 men, who earned an average of $2.33 per eight hours, not including the employees in Mexico. It smelted 4,171,258 tons of charge and refined 588,718 tons of bullion, out of which was produced 529,686,000 lb. of copper, 316,591 tons of lead, 2,540,911 oz.

of gold and 77,604,483 oz. of silver. Of fuel there was used 447,761 tons of coke, 544,619 tons of coal, 976,528 bbl. of oil and 7,430,300 cu.ft. of natural gas (for zinc smelting). The company itself produced 129,650 tons of coke and 257,942 tons of coal. As a miner of silver-lead and copper ores it produced 1,266,702 tons. The report does not specify whether the last figure measured crude ore or concentrated ore, but probably the former is meant.

It would be interesting if the company in its future reports should dwell more fully upon its mining business, stating just how much ore passes from its mines to its smelteries and how much metal is derived from them. Apart from its own ores the company is simply a middleman in the handling of ores for other persons, taking them in and disposing of their products, making a charge for the conversion out of which comes its profit. Theoretically it does not matter whether the company purchases the ore from the producer or treats if for him on toll. This is chiefly a matter of the convenience of the producer. The large producer, with ample capital, may prefer to have his metals returned to him for sale by himself. The small producer, on the other hand, is likely to lack both the means of selling for himself and the capital for carrying on his business in that way, wherefore the smelter becomes in effect his agent and banker. This was exemplified last fall, when for a time there was no sale for copper and silver and the **A. S. & R. Co.** made advances to the producers thereof, to which reference is made in the report and this is what Mr. Guggenheim means when he says that the company endeavors to make sales of its metals at the same price at which they were purchased and is not financially interested in the market price for its products.

What interests the company most is to keep its plants operating at as nearly maximum capacity as possible, wherefore it is to its advantage to encourage the maximum production of ore. In this it is aided by extracting all possible byproducts from the ores and reducing the cost of treatment to the minimum. By every economy that the smelter effects the miner profits through the smelter's ability to receive a lower and lower grade of ore.

The Steel Corporation's Year

The report of the Steel Corporation for 1914 shows that its business for the year reflected pretty closely the general conditions of the iron and steel trade. If anything the Corporation's results were below those secured by the larger independent companies rather than above them. The depression of the earlier months of the year and the general dullness of trade were fully manifested in the earnings, while the disorganization caused by the war entirely demoralized the export trade which had been built up with so much labor and expense. With a diminished business there was naturally an increased ratio of expenses, the total of all operating and renewal charges for the year having been 85.4% of the gross receipts. The net earnings, from which interest charges had to be paid, were actually $1,722,909 less than the 7% dividends on the preferred stock; and the dividends on the common stock, though cut from 5 to 3%, were paid wholly out of the accrued surplus. This is discouraging enough, but it can hardly be expected that another year will unite in itself so many unfavorable factors and there are already signs of a marked improvement in the current year.

Comparing results in 1914 with those of 1913, we find that the total decrease in sales and deliveries was 26.7%, the loss in domestic business being 25.2% and in foreign trade 36.9%. The foreign trade was only 11.2% of the total, a considerable falling off from the preceding year. The report, although very full in its financial details, does not give sufficient data to enable us to compute costs of the material sold. It does state that the lower prices realized contributed to the decrease in earnings, as well as the falling off in business. In 1914 the average realized on finished material sold, it is stated, was $2.54 per ton less than in 1913. This does not appear fully in the results as the value of the total sales in 1914 decreased 26.7%, as stated above, but the tonnage of sales fell off 25.4%; indicating that the proportion of the higher-priced products must have been larger in 1914 than in the preceding year.

That the Corporation managers are hopeful for the future is evident from the fact that work on new plants and extensions was not discontinued, $23,171,013 having been expended on them in 1914. The largest item is found in the new steel plant at Duluth, for which one-fifth of this improvement fund was paid. Another sign of this hopefulness is found in the fact that no step was taken toward reducing wages. In fact there was a slight increase, the average wages per day for all employees having been $2.97 in 1914, while it was $2.92 in 1913. The magnitude of the operations is illustrated by the fact that although there was a reduction of 21.6% in the total number, 179,353 men were employed in 1914. The number in the preceding busy year was 228,906 in all. Nearly three-quarters of the whole force—73%—were employed in the manufacturing plants; 15% in iron-ore and coal mining; and 12% in transportation and miscellaneous activities.

In previous years the Steel Corporation has furnished close to one-half of the finished-steel production of the country, its proportion varying from 46 to 57%. For 1914 we have not yet the data on which to base the calculation, but the pig-iron production was 43.1% of the total reported for the United States. The blast-furnace output was always the weaker side of the Corporation's activities, and finished steel will probably reach a slightly higher proportion.

On one point the report is silent. While noting the termination of the Hill ore-land leases, nothing is said of the results of those leases beyond the brief statement that the ore mined has slightly exceeded the minimum provided for in the contracts. The total ore shipped from those properties was 26,573,808 tons. The total expenditure is not stated, but there is little doubt that this was high-priced ore, when all the conditions are taken into account. The surrender of the leases still leaves an abundant supply of ore available from the properties of the Oliver Iron Mining Co. in Minnesota and Michigan.

The report, like those of previous years, is full of financial details, but it is weak on the technical side. A brief and condensed list of improvements made in the various plants is given, but beyond that there is no information as to the technical activities of the year. It is possible that such details might have increased the size of the report too much, and that the financial results are what stockholders look for. It can at least be said for the Steel Corporation that the management is not secretive and that information of any important improvements is generally accessible to the technical world, if it is not conveyed in the annual report.

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The Situation in Tin

One week ago, on Mar. 17, the price of spot tin in London was £194 for Straits and £190 for Standard. Today it is £172 for Straits and £168 for Standard, a fall of £22 per ton. The high price reached in London has for some time been looked at askance by authorities in the trade here and the slump was not unexpected. The whole situation is involved and complex and predictions concerning the future are extremely hazardous, but certain factors which have played a part in the movement are readily apparent and easily susceptible of analysis.

The rise in London was chiefly on spot and nearby tin, and was partly due to the increased quantities tied up in transportation through the slower movement of ships and the congested condition of the docks in London. Something like 5000 tons of tin above normal was rendered unavailable to the market in this way. A far greater influence, however, was the heavy demand on London for shipment to Scandinavia and Holland. This tin, suppositiously, was to supply the domestic requirements of those countries, or for Russian account, and certain restrictions were thrown about its shipment intended to prevent the tin finding its way into "enemys' country."

The price of tin in Germany attained very high figures, ranging anywhere from £200 to £250 per ton, and despite precautions taken by the Admiralty in London this high price attracted large quantities, especially during the last few months. Nearly as much in fact went to Germany as in times of peace and the German price suffered a heavy fall in consequence.

The English authorities seem to have been very slow in waking up to what was going on, but finally becoming aware of conditions have now surrounded the exportation of tin not only from England but also from the Straits with such stringent regulations that it would seem impossible for further quantities to reach Germany; and the fall in London is attributed to the resale of lots previously bought for export but which probably cannot now be shipped out of England.

Other factors that played an important part in raising the London price since Jan. 1 were due to prior causes, one of the chief of which was the interruption to shipments from Bolivia, owing first to the disorganization entailed by the war, and later to the activities of the German fleet off the west coast of South America. Since shipments have been resumed nearly 7000 tons of Bolivian tin have arrived in England [illegible] is more than arrived there July to December, inclusive. This will restore to the market not only as much as it formerly received from this source, but a large quantity in addition. The average arrivals in Great Britain from Bolivia were formerly not in excess of 1200 tons per month.

The part that Holland has played in occasioning the recent stringency in London is also shown on an examination of the figures, according to which their total sales August to December, [illegible] amounted to only 3000 tons, most of such sales [illegible] in Holland and some to Germany. The [illegible] in November, December and January amounted to only 268 tons. In February, however, from [illegible] the Dutch Government sold 2000 tons of Banca and Billiton tin, and to the middle of March had sold something like 1500 tons additional. Much easier conditions will necessarily ensue when these large shipments reach the consuming markets.

There seems no escape from the conclusion that the recent scarcity and high prices will soon be a thing of the past. With Germany excluded as a consumer and the London exports confined to the domestic requirements of the other countries of Europe, demand must undergo a substantial shrinkage. The total consumption of Holland, Sweden, Denmark and Russia is only about 4500 tons per annum or say 400 tons per month. Three or four times this quantity has been shipped from London monthly of late, the difference going to Germany.

As to the future, figures have been offered to prove that with Germany eliminated the position of tin is anything but strong; in fact whether or not the markets are accessible to her, that supplies are actually in excess of demand. In the first place it must be borne in mind that tin plays but a small part in the arts of war while war's damage to the arts of peace is enormous. In the United States, for instance, during eight months of war ending with March, deliveries will show a decrease of about 4000 tons, or 15%. In Great Britain exports of tinplate January to February shrunk from 84,000 tons to 54,000 tons, or about 33⅓%.

The chief difficulty we have to combat in the United States is one of transportation. As soon as that problem is solved there will be plenty of tin available for local consumption, and the restrictions surrounding exports from London which at present embrace America will doubtless be removed shortly, permitting free movement to this side. Steps to that end have already been taken. Meanwhile, supplies on the spot are scarce but the demand seems to be light, only small lots changing hands at about the prices stated in our market report. Owing to the scarcity local prices have so far been little affected by the fall in London, but it is needless to say that with the first signs of larger imports the parity between the two markets will be restored and a drop of somewhere between 10 and 15c. per lb. is not unreasonably to be expected.

BY THE WAY

Practically the whole of the first battalion of the Artists' Rifles, a corps formed by young professional men of every line, will soon be commissioned as second lieutenants in the British army. Among them, says a London dispatch, are several young American mining engineers employed on the Guggenheim properties in South America, who came to England to enlist because of a feud with the German chemists in the assay department of the mines. This makes interesting reading but, unfortunately, it belongs to the "interesting if true" class. A number of Europeans were engaged in the construction work of Guggenheim properties in Chile at the outbreak of the war and some of these young men, particularly a number of Englishmen and Frenchmen, returned to their respective countries to join the colors. So far as we have been able to learn by casual inquiry, none of the Americans left Chile for this purpose, but we hate to spoil a good story by pursuing the inquiry to the bitter end.

PERSONALS

Frank D. Klinglund, superintendent of the Empire Iron Co., Negaunee, Mich., was in Chicago recently.

W. H. Aldridge, who has been making a trip through Chihuahua, expects to be back in New York about Mar. 29.

Fred W. Denton, manager of Copper Range Consolidated mines, has returned to Michigan after three weeks' vacation.

John Knox, general superintendent of the Calumet & Hecla and subsidiaries, has gone to San Francisco for a month's vacation.

Henry M. Payne, consulting engineer to the Canadian Klondike Mining Co., will leave New York about April 1 for the Yukon.

Homer L. Carr has returned to New York from Honduras where he has been engaged for several months on a placer examination.

C. H. Benedict, milling expert for the Calumet & Hecla Mining Co., passed through Chicago on Mar. 16, on his way to the copper country.

Scott Turner, European manager for Ayer & Longyear. with mines in Spitzbergen, passed through Chicago on Mar. 17, on his way to Minneapolis.

S. W. Ough, superintendent of the Maravillas y San Francisco mill in Pachuca, has left Mexico with his family and will return to England soon.

Eugene A. J. Goldschmid, chairman of the Central Chile Copper Co., is on his way to Panulcillo, Chile, for an inspection of the company's properties.

Oscar Lachmund, general manager of the British Columbia Copper Co., Ltd., Greenwood, B. C., passed through Chicago recently on his way to New York.

R. R. Seeber, superintendent of the Winona and Houghton Copper companies, in the Lake Superior copper district, spent several days in Chicago last week.

Herbert C. Shotwell, mining engineer with office in Prescott, Ariz., was in Chicago on Mar. 19, in the interests of a consolidation of two Arizona gold properties.

Boyd B. Jack, late with the Inland Steel Co., Indiana Harbor, Ind., has been given charge of the new sheet mills of the Empire Rolling Mill Co., Cleveland, Ohio.

George E. Hooper, superintendent of the Victoria mine, in the Michigan copper country, spent several days in Chicago on business, during the week of March 15, on his way from Boston to Michigan.

David H. Ladd, of Houghton, Mich., has been in New York on his way to London where he will make his home in the future, acting as selling agent for the Wallaroo & Moonta Copper Co. of Australia.

L. P. Alford, editor of the "American Machinist," read a paper entitled "Some Machine Tool Developments of 1914" at the meeting of the Cleveland Engineering Society in Cleveland, Ohio, Mar. 23.

Baylies C. Clark has been appointed Secretary pro tem. and Superintendent pro tem. of the Bunker Hill Consolidated Mining Company during the absence of Mr. Hampton, who is on leave on account of illness.

James Aston, metallurgist, connected with the University of Cincinnati, has resigned to enter the service of the U. S. Bureau of Mines. Mr. Aston will be commissioned to carry out an investigation of safety and efficiency in steel plant operation.

L. G. Sicka has resigned his position as mechanical superintendent of the Tooele plant of the International Smelting Co., and has accepted a more important one as mechanical superintendent and engineer for the St. Joseph Lead Co., Bonne Terre, Missouri.

H. V. Winchell of Minneapolis, Minn., and J. R. Finlay of New York have been retained as mining experts for the Jumbo Extension Mining Co. of Goldfield, Nev., in the apex litigation instituted against it by the Reorganized Booth Mining Co. of Goldfield.

Wm. J. Kee, Jr., for the past four years superintendent of the Argentine acid plant of the National Zinc & Chemical Co., formerly United Zinc & Chemical Co., has resigned to become connected with the new acid plant designed by Utley Wedge for the Anaconda company at Anaconda, Montana.

OBITUARY

James Tregenza, head blacksmith for the Champion mine of the Copper Range Consolidated, died at his home at Painesdale, Mich., aged 53 years. Mr. Tregenza was born in England and came to this country in early youth. He has been a blacksmith miner ever since, working first in New Jersey and Pennsylvania, going to the Michigan copper country 25 years ago. He was employed at the Champion for 10 years, before that at the Atlantic mine.

Frederick W. Taylor died in Philadelphia, Mar. 21, aged 57 years. He was born in Philadelphia and had his early training in the Sellers machine shops and the Midvale Steel Works. He was widely known as the originator and earnest advocate of the modern science of efficiency engineering, on which he wrote several books. He was also well known for his experiments and improvements in the manufacture of tool steel. He was a past president of the American Society of Mechanical Engineers, vice-president of the mechanical engineers' section of the American Association for the Advancement of Science, a member of the Society for the Promotion of Scientific Management and of the American Philosophical Society.

SOCIETIES

New Mexico School of Mines—This school at Socorro anticipates an enrollment next year of 100 students and an appropriation from the Legislature which will permit power and machine shop installation. President Jones will issue for public use, April, University bulletin on the "Economic Geology of New Mexico" and with it a companion bulletin on "Rare Ores of the State." The two combined will be an official state publication of the mineral resources.

INDUSTRIAL NEWS

The Standard Silver-Lead Mining Co. is installing one 5x6-ft. Chalmers & Williams adjustable quick-discharge tube mill.

The Northern Chemical Engineering Laboratories announces the adoption of the name, C. F. Burgess Laboratories. The new name implies no change in management or ownership.

El Arco Mines of Mexico has purchased an adjustable quick-discharge Chalmers & Williams tube mill, together with Nissen stamps and other equipment for its new plant in Sinaloa, Mexico.

The Royal Manufacturing Co. of Rahway, N. J., is aiming to put the cotton and wool waste business on a scientific basis by guaranteeing to ship by uniform grades, to ship bales of guaranteed uniform weight and to ship bales of uniform tare.

The Terry Steam Turbine Co. announces that after Mar. 22, its Chicago office will be in charge of A. W. de Revere, and located in the Peoples Gas Building. It has also opened an office in the Michigan Trust Building, Grand Rapids, Mich., in charge of A. L. Searles, to cover the southern peninsula of Michigan.

TRADE CATALOGS

C. O. Bartlett & Snow Co., Cleveland, Ohio. Bulletin No. 43. Ship Hoists. [illegible] pp., illus., 6x9 inches.

Cambria Steel Co., Morris Building, Philadelphia, Penn. Catalog. Steel Mine Ties. 12 pp., illus., 6x9 inches.

Bausch & Lomb Optical Co., Rochester, N. Y. Bulletin N-A. [illegible] pp., illus., [illegible] inches.

General Electric Co., Schenectady, N. Y. Bulletin No. [illegible] Mine Hoist Equipment. [illegible] pp., illus., 8x10½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Catalog. Some Interesting Pictures of Allis-Chalmers Tractor Trucks. 12 pp. illus. 9x12 inches.

Justrite Mfg. Co., Chicago, Ill. Catalog. 1915 Acetylene Lamps and Accessories. 18 pp., illus., 3½x6¼ inches. Jobber's Price List No. 10, Feb. 25, 1915. 2 pp., 6x10 inches.

Editorial Correspondence

SAN FRANCISCO—Mar. 18

Twelve Thousand Dollar Pocket discovery reported in San Francisco papers has been reduced to $12. The location which was said to be guarded with secrecy by the prospector is at Murphy's Ridge. There are plenty of pockets in Amador County where $12 can be discovered. Why is a newspaper reporter?

Resumption at Trinity Copper is thought to be indicated by the appointment of Frank M. Leland, general manager of the Balaklala Copper Co., as manager of the Trinity. The mines are near together in Shasta County and are controlled by the same interests. The Trinity has not produced extensively since the closing of the Balaklala smeltery and cannot resume full operations unless the Balaklala plant is blown in.

First-Aid Contests will be held under supervision of the U. S. Bureau of Mines at the Panama-Pacific Exposition Sept. 23 and 24. It will be a national meeting, invitations having been sent to all the mining states, and also to some of the Canadian mine operators inviting them to send teams to participate. Mr. Wilson, U. S. Bureau of Mines engineer, in charge of the safety department of the bureau, who is in San Francisco, met with the Metal Producers' Association recently and invited the association to take part in the arrangement and to make an effort to induce representations of the larger mines in California. The various committees have been selected, but until all of the members shall signify their intention of serving, the list is not available for publication. The bureau has a full equipment of first-aid and rescue-work paraphernalia on exhibition at the exposition, and also has an auto-truck fitted for rescue work. Demonstrations are given every afternoon at two o'clock and attract a good deal of attention.

BUTTE—Mar. 18

Changes and Improvements that will greatly increase the capacity of the Pittsmont smeltery of the East Butte Mining Co. and repairs at the mines that will put them in better shape for operation, are nearing completion, and the resumption of work at an early date waits now only on the arrival of some of the machinery. The smeltery has been entirely overhauled. One of the blast furnaces has been rebuilt and its capacity raised to 500 tons per day; the other furnace has a capacity of 300 tons. In the mill an elaborate system of slime-treating tables has been installed. In the mines a large amount of retimbering has been done to permit future mining at practically all levels between the 600- and 1500-ft. When the mine closed six months ago, the output was about 1,250,000 lb. of copper per month. The mines expect to start Apr. 15, and the smeltery probably Apr. 25.

The Pilot-Butte Company, on Mar. 12, was granted its motion, in the case of the Anaconda Mining Co. against it, to dissolve the temporary restraining order, issued on Feb. 14 last, which amended the one issued Oct. 8, 1914. The ground for dissolving the injunction was that what was asked for in the latter injunction was covered in the previous one. Thereupon the Anaconda company applied to the court for an order citing Paul A. Gow, superintendent of the Pilot-Butte, to show cause why he should not be punished for contempt in disobeying a restraining order issued by the court which was signed by Judge Lynch Oct. 20, 1913, prohibiting the Pilot-Butte company from operating in the Emily vein. The order was issued on the strength of an affidavit of Reno Sales of the Anaconda company who declares that Superintendent Gow ordered the work done and superintended the removal of the ore.

Mining Activity in Butte is increasing and it is expected that there will be between 11,000 and 12,000 men working in the various mines of the camp by May 1. This means a monthly payroll of about $1,[illegible]. Of the various operating companies Anaconda, of course, leads with the employment of about 8000 men; Butte & Superior follows with 1000, North Butte with 600, East Butte with [illegible], Elm Orlu and Timber Butte with 500, and with [illegible] employed in the other smaller mines. The active mines of the Anaconda company now are the Anaconda, St. Lawrence, Steward, West Gray Rock and [illegible] Gray Rock, Original and [illegible], Badger State and [illegible], West Colusa, East Colusa, Leonard, Tramway and Rarus, J. I. C., Berkeley, Silver Bow and the Poulin. The mines that are still down are the Neversweat, Mountain Con., Diamond, Belmont, High Ore, Moonlight, Mountain View and Pennsylvania.

Butte-Duluth in the Hands of Receivers as the result of a friendly suit filed for the purpose of conserving the interests of the creditors, bondholders and stockholders. Charles M. Everett, secretary of the company, was appointed receiver of the properties by Judge McClernan Mar. 16 on the application of the Provident Securities Co. of Delaware, holder of three fourths of the stock of the Butte-Duluth company, and A. Purdy, who as an employee of the company has $500 in wages due him. Operations will continue under Receiver Everett. Individual suits which were threatened by numerous creditors will thus be avoided. The liabilities of the company consist of about $250,000 of floating debts, in addition to a mortgage of $500,000. Most of the indebtedness was incurred in the construction of the new plant and in the continued operations during the hard times of the past eight months. Some months ago Captain Wolvin proposed to his employees that if they would take half their pay in cash and the balance in due bills to be paid when the market became normal again, he would try to raise the funds to pay the cash part of the proposition.

SALT LAKE CITY—Mar. 18

The Utah Mining News, a new local paper, was issued for the first time on March 11. L. G. Schwalenberg, formerly of the "Ely Expositor," and L. E. Camomile, of Salt Lake, are at the head of the enterprise.

Lands Withdrawn from Entry in this state when conservation was at its height, are being gradually restored to entry by Secretary Lane. Since the first of the year 270,000 acres withdrawn as coal lands have been restored.

A Banquet to Samuel Newhouse will be given by members of the Salt Lake Stock & Mining Exchange as a mark of appreciation for what he has done for the exchange, making a gift of the building site, and other favors. The banquet will be held at the Newhouse Hotel shortly after the opening, about the end of March.

The Extensive Resources of the State in copper, coal, iron, alunite (potash), carnotite (radium), salt, sulphur, gypsum, various hydro-carbons, agriculture, etc., and the opportunities for investment in these, many of which are undeveloped, were called to the attention of capital and the public by the state legislature in a resolution adopted at the close of the present session, Mar. 11.

Four Large Coal Companies, the Castle Valley, Consolidated Fuel, Black Hawk and Panther, owning extensive coal lands and producing mines in Carbon and Emery counties, are to be consolidated into one company, to be known as the United States Fuel Co., capitalized at $10,000,000, of which $3,000,000 is preferred stock, and $7,000,000 common. The mines and mining property will be placed under one management. E. L. Carpenter is to be president.

Open Hostilities in the faculty of the University of Utah led to the resignation this week of 14 professors and instructors, including two deans and three heads of departments. This followed the action of the board of regents in sustaining President Kingsbury and refusing to order a public investigation of the reasons for the dismissal of four professors and the demotion of a fifth, and the curtailment of the duties of a sixth. The movement among the members of the faculty which resulted in yesterday's resignations, is asserted to be part of a program conceived to oust Dr. Kingsbury as president of the university. Among the reasons assigned for their action by the professors and instructors who resigned, is lack of harmony, the right of free speech curtailed and coercion. Many of the professors stated in their resignations that they did not feel sure of their positions, and that good work could not be accomplished unless there was reason to believe they would have employment for more than one year. The period of service at the university of those who resigned runs from one to 20 years. The sentiment of the students seems to be about equally divided in regard to the stand of the regents and the 14 resignations.

SEATTLE—Mar. 17

Reports from Shushana are that the McCarthy-Bonanza trail over the glacier is in bad shape. One party took three weeks to make the round trip, less than 200 miles; five successive days being spent stormbound near the glacier. Under more favorable conditions the trip has been made, one way, in 15 hr. actual traveling.

Ruby is Optimistic on account of the excellent results obtained from the large amount of winter work that is being done. Paystreaks are, for the most part, irregular, and the pay is spotted, but the spots are rich enough to make up for the low-grade areas. Good prospects are reported from Spruce and Solomon creeks and pay has been located at intervals for three miles on Tamarack.

Outlook for Tolovana District is more promising since reported strike of pay on Casey Creek, a small tributary entering the Tolovana about 18 miles above the mouth of Livengood Creek, on which was made the strike that precipitated the recent stampede. Depth to bedrock on Casey said to be 30 ft., with 6 ft. of gravel panning 10c., or $4 per sq.ft. of bedrock. Report has not been verified. On Livengood and nearby creeks there is much prospecting, but no authentic report of pay has yet been made.

LORDSBURG, N. M.—Mar. 19

The Road Between Silver City and Mogollon will be repaired or constructed as a result of two important forces that have materialized. One is the passage of a bill in the state legislature, declaring the road a state highway and providing a tax levy for maintaining it. The other is the activity on the part of the mining companies of Mogollon and the business men of Silver City. The Mogollon companies have subscribed $6000 and Silver City plans to subscribe a similar amount to be spent on the Grant County part of the road. The Mogollon money is to be spent on the Socorro County division. The most pressing need is a bridge across the Gila River. At the present time the Lyons cable-way is transferring freight and passenger automobiles across the stream. Another bill was enacted, creating a state highway between Hondo in Lincoln County and Mogollon and providing for a tax levy to construct a part thereof and authorizing the Socorro County commissioners to solicit and receive contributions for the remainder. The Mogollon mining companies have suffered greatly from the lack of adequate transportation facilities and during the past winter work was carried on only spasmodically. At times it was impossible to get any form of supplies into the camp and the supply of fuel oil was exhausted several times. The poor roads have been one of the camp's greatest hindrances to progress and both mining companies and shippers see the need of immediate effective action.

GOLDFIELD—Mar. 18

The Apex Litigation in Goldfield is discussed by George Wingfield as follows: "I have kept litigation out of this camp for 10 years. Now that litigation has been forced on me I am going to be fair in every respect and try our lawsuits in the courts and not in the newspapers. It is not my disposition to work hardships on innocent stockholders of any of the local companies in which I am or am not interested. It is my intention to give stockholders of companies in which I am not interested the same consideration I give to those of companies in which I am interested. It is not my disposition to stop work in this camp. I am very deeply interested in the welfare of Goldfield; therefore, it is my disposition to encourage work in every way, and that is why I consented to the stipulation entered into between the Reorganized Booth Mining Co. and the Jumbo Extension Mining Company."

JOPLIN—Mar. 20

The Largest Drainage Project that has ever been undertaken in the Joplin mining district is the draining of approximating 800 acres of mining land lying south of Carterville and east of Webb City. On this tract are a number of old mines, formerly worked extensively but at present full of water. This work has been undertaken by T. J. Franks and associates who have organized under the name of the Zinc Corporation. The work of pumping this large quantity of water from the old mines on this tract presents quite a difficult problem. In addition to pumping against a considerable head the water is so strongly acid that it precludes the use of cast-iron pumps and pipes. Pumps of bronze and wooden discharge pipes are being used. Two 6-in centrifugal pumps have already been installed and are in operation and additional pumps are being put in as rapidly as possible. The pumping capacity will exceed 5000 gal. per min. The complete unwatering of this tract will provide an area in which there are two well defined deposits of ore that have been proved by former mining operations. The first is the soft-ground or disseminated deposit extending from the 75-ft. level to a depth of 175 ft., the second is the sheet-ground extending from 190 to 230 ft. deep. In 1905 there were several mills operating on ore taken from this tract, but they were shut down on account of a flood which came in the spring of that year filling all the mines with water, some of which were subsequently partly drained but others have not been touched since. Adjoining this land on the south are the properties of the American Zinc Lead & Smelting Co. and the Continental Zinc Co., who have mined extensively in the sheet-ground. On the west lie the numerous rich mines on what is known as Sucker Flat. On the north is the rich tract of the Center Creek M. Co. which holds the district's record for value of ores produced.

KELVIN, ARIZ.—Mar. 17

Tailings in the Gila River, said to originate in camps at Mogollon, N. M., and discharged into the Gila by the Frisco River, are becoming a serious menace to the lands in the Gila Valley, and canal companies are taking steps to stop the evil. A meeting of the directors of the San Jose, Union and Montezuma canal companies was held recently at the office of water commissioner Colton to discuss the matter.

PHOENIX, ARIZ.—Mar. 17

Mining is at a Low Ebb in this section of Arizona and has been for some time, but there are evidences of increased activity soon. The Governor is quoted as having said that he will soon call an extra session of the State Legislature. There are good reasons for believing that it will not pass any laws which will hamper the Arizona mining industry.

HOUGHTON—Mar. 20

Rush Shipments of Copper continue to leave the Lake Superior district. Opening of navigation will find comparatively little metal on hand. Lake Superior copper is specified in practically all of the war munitions and that is using up most of the output from this district at present. Over 10,000,000 lb. have been shipped out by rail thus far this month. This breaks the record for all-rail shipments in March in the history of the industry. Trains carrying a million pounds of metal are not infrequent. Every smeltery yard is bare of metal, except one. The Calumet & Hecla smelting and milling plant has increased its working force 25% in the past 30 days. Two additional furnaces went into commission this week, making 10 running at present.

TORONTO—Mar. 20

The Calgary Oil Excitement has been renewed by an important strike at well No. 2 of the Alberta Petroleum Consolidated, Mar. 14. The well struck oil at a depth of 2774 ft. and had oil 900 ft. deep in the bore on the evening of the strike. The oil is heavier than the product of the Dingman well and of a dark olive green color.

The Change in Management of the Dome made at the meeting held in New York on Mar. 19 when Captain J. R. DeLamar succeeded Ambrose Monell as president was the most interesting development of the district during the past week. The spectacular rise in Dome stock from $6 a share to over $11 is largely accounted for by this change although the improved condition of the mine on the lower levels enters into the explanation. Mr. Monell, who is president of the International Nickel Co., has never taken any interest in the stock market end of the business and a number of shareholders believe that the stock has been left to the mercy of the traders to the detriment of the stockholders' interests. Under Captain DeLamar who is one of the most spectacular mining operators in the United States, it is expected that there will be a wider market for the stock and higher prices than have prevailed for the past year. The change in the presidency may also result in a dividend being declared at the next annual meeting.

OTTAWA—Mar. 20

Much Activity in Mining has compelled the Mines Branch of the Department of the Interior to increase its office force in order to cope with the increased official business due to the discoveries of gold on the shores and bars of the North Saskatchewan River. Mining of gold in the sands and gravels of the river beds is being energetically pursued by use of the old-fashioned rocker which shows that the dirt must be rich, otherwise there would be no profit in such work. In the early Yukon days anything less than a 10c. pan was not profitable for the grizzly and rocker methods, though later 2½ to 3c. pans were considered favorable. The Saskatchewan will not average anything near 10c. pans, but 2 to 5c. pans are common, and pay the miner fairly well.

The Mining News

ALASKA

CHATHAM CREEK MINES CO. (Fairbanks)—Closed down about a year ago owing to pinching of orebody at water level and lack of funds for deeper prospecting. New company expects to start work in near future.

HANSEN & MAGNUSSON (Chatanika)—These operators, who recently found good pay on Vedine ground near Chatanika, have shipped to property complete working plant including 40-hp. boiler, Lidgerwood double-cylinder hoist, cable, carrier bucket, pipe, points, and car-load of lumber. Plant will be set up immediately and ground opened for summer mining.

MOTHER LODE COPPER (Kennecott)—Situated near famous Bonanza in Copper River belt employing 40 men. Equipment installed last summer includes gasoline engine, air compressor, machine drills, etc. Leschen aërial tramway conveys ore from portal of Marvelous tunnel to McCarthy Creek flats, distance of 7000 ft. Tram is in two sections and has capacity of 5 tons per hour when using 14 buckets, can be increased to 15 tons by using more buckets. Ore is hauled from discharge end of tram to shipping station on Copper River railway by horses.

ALASKA GOLD (Juneau)—D. C. Jackling, now in Alaska, wires: Everything here is in most excellent shape. The mill is doing splendid work. Both the tonnage treated and the recoveries are fully up to my expectations. When finally adjusted a section will handle 2500 tons, giving a capacity of 10,000 tons to the entire plant. That the recoveries will be fully as good as determined by our experimental results is now certain. The second section will be ready in 60 days and the mine will be sufficiently opened by that time to furnish the tonnage for it. The third section should be started about July 1. The ore we are now milling is coming from six different and widely separated points in the mine, thus giving us a good average of the property, and is holding at nearly $2 per ton, and we are treating 1800 tons per day. The tonnage for the month of March should be about 40,000 tons. The mill is the simplest and most economical in all points and the most satisfactory one we have ever built.

ARIZONA

Cochise County

CALUMET & ARIZONA (Warren)—Reported to have changed original plans for railroad from new porphyry subsidiary, New Cornelia, at Ajo, to Gila Bend; now planning to tap main line at Tucson, distance of 100 miles. Cornelia plans to change its character to permit mortgaging of its property to accommodate financing of permanent development and equipment. One-ton experimental leaching plant operated continuously for practically six months. For last 74 days plant gave an extraction of 80.07% of copper contained. A 40-ton plant just completed, now in operation. If this plant duplicates results obtained in one-ton plant will proceed with construction of final mill of 4000 tons daily capacity.

Mohave County

CHAMPION (Cerbat)—Recently put a force at work mining rich zinc ore.

TOM REED (Oatman)—The clean-up for February yielded four bars of bullion valued at $100,000.

GOLD ROAD (Goldroad)—Recently shipped $17,000 worth of bullion. Mill has run for some time on low-grade material broken several years ago in stopes on west side of No. 1 shaft. As soon as these stopes are clear a careful investigation of that part of mine will be made.

Pinal County

RAY CONSOLIDATED (Kelvin)—Production for January was 4,090,025 lb., compared with 5,105,000 lb. in corresponding month last year and with 3,126,536 lb. in December.

Santa Cruz County

RUPERT (Patagonia)—Sold to Eastern people recently, who will soon resume operations.

WORLDS FAIR (Patagonia)—Shipments increased to 30 tons daily. Mine operated by Louis N. Nofer.

FLUX (Patagonia)—Two carloads of mine equipment have been shipped. Installation expected to be completed in May and mine to be ready to ship ore in June.

Yavapai County

MONARCH (Crown King)—New hoist being installed and sinking to be resumed.

MONICA—J. A. Park, of Philadelphia, is head of a syndicate to take over the Monica property. Old workings are being cleaned out and ten-stamp mill rehabilitated.

BROOKLYN-ARIZONA (Mayer)—Boston capitalists who recently ecquired the Brooklyn-Arizona properties planning to resume operations. Property has been in litigation for last two years.

CALIFORNIA

Amador County

PLYMOUTH (Plymouth)—New mine hospital has been completed and thoroughly equipped. This will reduce the cost of caring for injured men formerly sent to hospital at Sacramento.

CENTRAL EUREKA (Sutter Creek)—Repair work on tailing flume nearing completion. Flume put out of commission temporarily by January storms and 20 of the 40 stamps were hung up. Shaft will be deepened 100 ft.

Calaveras County

CALAVERAS COPPER (Copperopolis)—Mine leased to Coffer and Trask and is being unwatered. Good orebody disclosed in Union shaft.

MELONES (Melones)—Twenty new stamps will be added to the 100-stamp mill. Four miles of the flume which furnishes mill water and power will be rebuilt during the summer.

ORO WATER, LIGHT & POWER CO. (Oroville)—The 6-cu.ft. bucket dredge on Mokelumne River, near Clements, under construction since November, is completed. Part of machinery from old Empire dredge was used. New machinery was built at the New York machine shops at Oroville. C. G. Leeson superintended construction. Benjamin Fowler is dredgemaster.

ROYAL GOLD (Hodson)—Shaft has been unwatered 550 ft. to 600-ft. level. Forty stamps of the 120 have been put in shape and will be put in operation on arrival of amalgamation plates. New tramway will be completed last of this month. Additional stamps will be put in operation as fast as practicable.

Eldorado County

UNION EXTENSION (Eldorado)—Preparations being made to reopen old Union mine, which in early days was large gold producer from depth of 1300 feet.

RED TOP (Eldorado)—Ore from this mine will be treated at Hillside mill. Development of Hillside mine will be resumed by W. G. Busick, superintendent of both properties.

Inyo County

SILVER-LEAD claims have been located in Marble Cañon by J. W. Messick. Ledge appears to be about 6 ft. wide well defined.

NEW COSO MINING CO. (Oakland)—Foreclosure sale in Superior Court of Inyo County to satisfy claims of about $20,000 held chiefly by Inyo County Bank and Walter B. Young.

Los Angeles County

PACIFIC MINERAL PRODUCTS CO. (Los Angeles)—Plant installed at Avenue Nineteen and Humboldt St., between the Sante Fe and the Salt Lake tracks, opened on Mar. 10. Said to have cost $200,000. Is to treat mineral substances of California and Arizona, making a specialty of soapstone, talc, fuller's earth, manganese and tungsten. V. Mott Pierce of Buffalo, N. Y., is president.

Mono County

STANDARD (Bodie)—Property sold to J. S. Cain Co. in settlement of suit against Standard Consolidated Mining Co., for ore extracted from Midnight. Reported that Standard and South End mines will be consolidated and South End ores will be worked through Standard mine and mill. Property has complete equipment, cyanide plant, pole line and water rights.

Nevada County

HIGHGRADE (Emigrant Gap)—Property reported to be bonded to Samuel Newhouse. Small force of men employed preparing for development work in the spring and hauling in of machinery and supplies. Property is in Meadow Lake district which in early days supported a town of 3000 people known as Summit City.

BRUNSWICK CONSOLIDATED (Grass Valley)—Contemplated construction work includes new headframe at the vertical shaft, new mill equipment, small cyanide plant for treating concentrates, assay office, and probable addition to pump equipment. Development below the 1250-ft. level continues satisfactory and Brunswick vein is yielding excellent ore.

EXCELSIOR (Emigrant Gap)—This property in Meadow Lake district on which was made first discovery of gold in district in 1863 to be reopened by Excelsior Consolidated Mining Co. composed of men of Worcester, Mass. Necessary equipment for development is being installed and installation of mill is contemplated. Property is situated in one of deepest snow regions in the West, can only be operated economically in winter with proper equipment and supplies hauled in from Emigrant Gap, distance of 38 miles by wagon road and trail.

Trinity County

GOLDEN JUBILEE (Carrville)—Mine reopened is equipped with hoist and 10-stamp mill. New equipment contemplated includes cyanide plant. Upper workings in good repair and enough ore was left blocked out by former operators to keep the mill going while development proceeds. C. L. Probestel is manager.

HEADLIGHT (Carrville)—Resumption of mining and milling is contemplated. Mine formerly good producer of ores amenable to cyanidation. Encountering heavy sulphides necessitated a change in metallurgical methods which will be made when mining is resumed. D. W. Shanks of Trinity Consolidated Hydraulic Mining Co. operating the Union Hill and Hupp mines at Weaverville, is manager.

San Bernardino County

ORO BELLE (Hart)—Optioned to Tonopah Belmont company of Tonopah. Property 14 miles west of Searchlight, Nev., in Hart mining district. Has shaft 814 ft. deep. Fifteen feet of ore in shaft said to average $8.44 gold per ton.

Sierra County

YORK (Downieville)—Caved shaft, from which bonanza ore was taken several years ago, will be reopened and a modern milling plant will be installed.

GOLD BLUFF (Oxford)—A 250-ft. tunnel being driven to cut Meserve ledge at depth on Oxford ground. Repairs to Gold Bluff mill have been completed and stamps will soon be in operation. Sol Camp has charge.

CLEVELAND (Sierra City)—Mine has been bonded to R. G. Gillespie who is making extensive repairs to mill and all buildings and has let contract for sinking. A tunnel at river level will be driven during coming summer.

PLUMBAGO (Alleghany)—The 20-stamp mill and concentrating plant destroyed by fire Mar. 17, loss about $35,000, of which $15,000 is covered by insurance. The fire supposed to have originated in the transformers. This mine is owned by Croesus Gold Mining Co. and is one of richest in the district. Walter B. Pearson is manager.

COLORADO

Boulder County

UNITED STATES GOLD CORPORATION (Boulder)—Additional machinery for mill has been ordered and management hopes to have plant completed in about thirty days.

Clear Creek County

GOLD SOVEREIGN MINING & TUNNEL CO. (Cripple Creek)—This property is being equipped with additional machinery preparatory to sinking the shaft which now has a depth of 1250 ft.

ENGINEERS LEASING CO. (Idaho Springs)—Station on the 100-ft. level below the Newhouse Tunnel has been completed. The flow of water encountered has been much less than expected, about 10 gal. per min. Drifting has commenced on an 18-in. vein that assays 6.3 oz. gold and 12 oz. silver per ton. The company is developing a block of ground 100 ft. high and 450 ft. long.

Lake County

COLORADO MINERALS SEPARATION CO. (Leadville)—Philadelphia interests have formed this company under Delaware laws to build mill to treat zinc ore in Leadville dumps. Reported that an electrostatic plant for zinc separation is planned.

San Juan County

BIG GIANT (Silverton)—Sufficient milling ore has been opened up to warrant the lessees to overhaul and remodel the Contention mill.

BONNER (Burro Bridge)—Pay ore has been opened and two carloads of $60 ore have been sorted out for shipment to smeltery. Lessees contemplate construction of small testing mill.

San Miguel County

CONCENTRATES SHIPPED FROM TELLURIDE during February totaled 97 cars. Shipments to the smeltery at Durango included 48 cars from the Tomboy, 26 cars from the Smuggler-Union, and 11 cars from the Liberty Bell. The Smuggler-Union also shipped 11 cars of zinc concentrate to the zinc smeltery at Blende.

PRIMOS CHEMICAL CO. (Vanadium)—Recent prospecting on a blanket vein owned by this company further up the mountain than the old workings has justified extensive development. Shaft will be sunk to depth of 400 ft. Compressor plant hoist and drilling equipment will be installed. Power line, 3500 ft. long, from lower to upper workings, is under construction by the Western Colorado Power Company.

IDAHO

Shoshone County

SUCCESS (Wallace)—Over 20 ft. of ore in winze sunk 100 ft. below 900-ft. level, most of which averages 30% zinc and the rest 8 to 10% lead. Mine shipping 80 tons concentrates daily that average about 40% zinc.

INTERSTATE-CALLAHAN (Wallace)—Constructing aërial tramway from mill to railroad, a little less than two miles, to eliminate wagon haul. Is shipping 150 tons per day of ore and concentrates averaging 50% zinc.

HIGHLAND-SURPRISE (Kellogg)—Flotation plant to be added to 100-ton mill, which will be ready to start June 1. Wagon haul nine miles to railroad. Previous ore shipments, both lead and zinc, amount to over $100,000.

FRISCO (Gem)—Flotation plant recently installed is to have several units added and the crushing capacity is to be increased by another tube mill. Body of zinc-lead ore cut in raise from 2200-ft. level. Report, unofficial, that mine will be in operation by Apr. 15.

MORNING (Mullan)—Employment of about 30 men placing new compressor and other preliminary work indicate preparation for resumption after long shutdown. High price of zinc and improved lead market, both important products of the mine, reason for resumption. Owned by Federal Mining & Smelting Co.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Stamp mill will be ready in 60 days to handle 1400 additional tons, bringing tonnage up to 4000 daily.

OSCEOLA CONSOLIDATED (Osceola)—To increase rock tonnage to 5000 tons daily about July 1. Present tonnage is 4100 tons daily.

CENTENNIAL (Kearsarge)—Accident to compressor plant interfered with mining at this Calumet & Hecla subsidiary for a week, but rock tonnage was maintained. Plant again in operation.

COPPER RANGE (Painesdale)—Production of copper from two of the three mines of this corporation, Baltic and Champion, will be 15 per cent. above normal for the month of March if present production holds out.

Iron

PENN IRON MINING (Vulcan)—Crushing plant is being erected at Curry Shaft. Similar plant for Brier Hill shaft is under contemplation.

OLIVER IRON MINING CO. (Negaunee)—Blue mine of Queen group will be closed down on April 1. Ore supply is exhausted. Has been operated about 25 years; the fee is owned by the Breitung company.

JONES & LAUGHLIN (Ishpeming)—Company plans to resume shaft sinking at Iron Mountain Lake property Apr. 1. New boilers will be installed and new pumps at work. Work had to be stopped in December because shaft filled with water due to striking a large water course not known to exist. Shaft is down about 350 ft. and will have to be sunk to 600 ft. before drifting can be started. Some of samples from drill holes assayed 63% iron.

MINNESOTA

Mesabi Range

ARTHUR MINING CO. (Calumet)—Stripping operations were resumed this week on property between Calumet and Marble. It will be late in fall, or spring of 1916, before enough overburden will have been removed to allow ore to be mined.

DEAN (Buhl)—Todd-Stambaugh & Co. have contracted to take 300,000 tons of ore from this mine this season. This is first sale of ore reported from Mesabi range this year. The ore will be shipped to Cleveland. The price will be agreed upon later when the going prices of iron ore are fixed.

ORDEAN (Virginia)—Engineers are busy running lines on this property, which will be stripped by the Oliver Iron Mining Co. Stripping will be started within a few weeks. The property consists of only 40 acres but has rich ore. It is not expected that ore shipments will be made until 1916.

KANSAS

Cherokee County

THE HARTFORD MINES are running full force again for first time since strike of men for higher wages on account of increased price of spelter. Mines were shut down temporarily but new men were secured and operations have been resumed with full force.

OPERATION ON THE JAMES MURPHY LAND has been suspended on account of breaking of flume and consequent flooding of mines in lowlands during recent heavy rains. Preparations being made to unwater the ground again. This is the first time for three years that this ground has been overflowed.

MONTANA

Fergus County

BARNES KING DEVELOPMENT CO. (Kendall) — Bullion shipped from North Mocassin mine for February was $41,705 secured from 4287 tons of ore, giving a yield of $9.73 per ton.

NEVADA

Churchill County

GOLD STRIKE (Alpine)—In Stone Cañon north of Alpine 10 in. of ore opened in 150-ft. shaft assaying $150; being sacked for shipment to Fallon.

Elko County

ARTHUR ZINC MINING CO. (Ruby)—Ore shipments will commence at once; wagon haul to railroad is 40 miles.

BUNKER HILL MINING CO. (Elko)—Suit for damages to amount of $5000 filed by former lessee. Plaintiff claims lease revoked without cause soon after work started.

Esmeralda County

FLORENCE (Goldfield)—Sinking of main shaft will be postponed 60 days.

JUMBO EX. (Goldfield)—Is now operating again on normal scale as result of working agreement with litigant.

NEW GOLDFIELD SIMMERONE (Goldfield)—Organized to resume work on the old Simmerone. H. C. Cutler will be manager.

FLORENCE AMERICAN (Goldfield)—Work will be resumed, 800-ft. shaft will be sunk to 1000-ft. level and lateral development work on 500-, 600- and 800-ft. levels will be continued

KEWANAS (Goldfield)—Station, sump and orepocket cut on 840-ft. level; lateral development will now be done. This level reached by winze from 700-ft. level of Laguna shaft. Electric hoist installed on 700-ft. level.

ATLANTA (Goldfield)—Incline raise from 1750-ft. level opened oreshoot 6 or 7 ft. wide assaying $20 per ton. Vertical raise being lifted from 1750-ft. level to connect with winze from 1400-ft. level of Grizzly Bear workings of Goldfield Consolidated for ventilation. Lease acquired on south half of Grizzly Bear claim below 1400-ft. level.

Humboldt County

SMALL STAMP MILL FOR HAYSTACK is being built. Mill will have capacity of 15 tons daily; steam power to be used. Considerable tonnage free-milling ore, assaying $12 to $18 per ton, on dumps.

DELAWARE (Seven Troughs)—Reported to be contemplating erection of mill. Vein averages 5 to 7 ft. of $18 ore.

LEONARD CREEK PLACER STRIKE made recently is developing satisfactorily. Gasoline pump, hoist and long line of sluices will be installed.

COLE LEASE (Rochester)—This lease, together with Kalaher lease, building road to head of Codd and Big Four tramway, so that ore can be sent to new milling plant.

NEVADA VALLEYS POWER CO. is extending its line to Upper Rochester. Four-J, Big Four and Codd leases, on Nenzel Hill, and Lincoln Hill Co., at mine and mill, will use this power.

BIG FOUR (Rochester)—Oreshoot struck on lowest or 500-ft. level; drifting now under way. Raise 500- to 250-ft. level completed, making possible handling of all ore by tramway from lower tunnel.

Lander County

KATTENHORN (Maysville)—Operations at this silver mine suspended until rise in price of silver. Stated 1000 tons good-grade silver ore ready for shipment.

ELECTRIC POWER PLANT FOR BATTLE MOUNTAIN may be built. H. R. Lemaire and H. C. Christenson applied to county commissioners for franchise. Oil engines will be used.

Lyon County

OCHEECHEE (Yerington)—Operations begun by new owners. Shaft will be sunk 200 ft. deeper.

NEVADA PROGRESSIVE CO. (Yerington)—Oreshoot 4 ft. wide cut by crosscut on 200-ft. level.

Mineral County

BLACK EAGLE (Rawhide)—Mill closed; considerable repair work being done; expect operations will be resumed in near future.

AURORA CONSOLIDATED (Aurora)—Enlarged mill expected to resume operations Apr. 1. Zinc precipitate will be shipped to Goldfield Consolidated plant for refining.

PITTSBURGH-DOLORES (Rockland)—Milling plant completed, expected operations will begin immediately. Mine being retimbered; development work progressing satisfactorily.

GOLDFIELD-CANDELARIA COÖPERATIVE MINING CO. (Candelaria)—Company, new $200,000 incorporation, owns six claims in Goldfield district and has long-time lease on Bi-Metallic property at Candelaria. Operations, for present, will be confined to Bi-Metallic group. Development work done includes two shafts, 280 and 600 ft. deep respectively, and 10,000 tons $6 ore blocked out. Will sink 280-ft. shaft to 500-ft. level.

Nye County

TONOPAH PRODUCTION for week ended Mar. 13 was 10,586 tons, estimated gross milling value $216,508, compared with 10,408 tons last week, valued at $213,304. Producers were: Tonopah Belmont, 3889; Tonopah Mining, 2500; Tonopah Extension, 1820; West End, 1076; Jim Butler, 1100; Tonopah Merger, 150; and Montana-Tonopah 51 tons.

HALIFAX (Tonopah)—Shaft retimbered and mining operations will be resumed at once.

TONOPAH MINING CO. (Tonopah)—Net profit for January, $56,875; ore mined, 12,000 tons.

MIDWAY (Tonopah)—Operations resumed; two shifts employed. Shaft sinking from 1200-ft. level under way.

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia City)—Pump installation on 2700-ft. level of Mexican-Ophir winze and power cable on 2500-ft. level under way. Work of installing winches at 2500-ft. level winze station progressing satisfactorily.

CONSOLIDATION OF SOUTH END MINES at Virginia City will be made; application made to state corporation board of California. Mines concerned are, Yellow Jacket, Crown Point, and Belcher Gold & Silver Mining Co. New company will be called The Jacket, Crown Point, Belcher Mines Co. Old companies will receive shares in new, and, if permitted, 100,000 shares new stock at $1 will be issued.

White Pine County

STUART MILL (Cherry Creek)—Plant purchased recently and will be operated as custom mill.

New Mexico—Grant County

CHINO (Hurley)—Production for January was 3,563,681 lb., compared with 2,827,891 lb. in December and with 6,401,911 lb. in January a year ago.

OREGON

Baker County

BEN HARRISON (Sumpter)—The purchase of this mine by the A. S. & R. Co. and its intention to install concentrating plant is officially denied by the latter company.

Lincoln County

ABERT AND SUMMER LAKE PROJECT (Newport)—Preliminary investigation plans being made by J. G. Kelley, engineer, Portland, for pipe line of Oregon fir 14-in. diameter, 270 miles long, costing two million, to connect Abert and Summer Lakes with Columbia River at intersection of Des Chutes where plant will be built. Reported Gould interests backing project. Finance arranged for immediate construction. J. C. Moore, of 111 Broadway, New York, is president.

PENNSYLVANIA

GRASSELLI CHEMICAL (Newcastle)—Will double present capacity of local plant to cost $200,000 for manufacture of sulphuric acid.

UTAH

Salt Lake County

UTAH COPPER CO. (Salt Lake)—Production in January [illegible]609,616 lb., compared with 6,[illegible] lb. in December, and [illegible]49,036 lb. in January a year ago. Not for five months has output been as high as 8,000,000 pounds.

BINGHAM MINES (Bingham)—In 1914 the Dalton & Lark mine produced 30,292 tons of lead-silver and copper ore, value $224,336; Commercial, 20,433 tons copper ore, value $67,450; Yosemite, 693 tons lead ore, value $11,770; Eagle & Blue Bell, 32,736 tons, value $513,235. Net receipts from ore shipments from Eagle & Blue Bell, $286,485, net operating profit for year, $121,536. Company's net gain and income for year, $172,530.

Summit County

PARK CITY ORE SHIPMENTS for week ended Mar. 12 were 4,477,460 pounds.

PARK CITY MILLS (Park City)—Company will install Holt-Dern roaster of 35 to 50 tons daily capacity. Extraction of 85% expected. Company operated on American Flag ores in 1914, but roasting difficulties encountered made changes necessary. Chloridizing is used.

SILVER KING CONSOLIDATED (Park City)—Report for year ended Feb. 1 showed 9987 dry tons ore shipped, value $346,990, after payment of smelting charges and freight. Ore averaged 50.44 oz. silver, 0.0514 oz. gold, 28% lead, 1.291% copper, bringing $34.74 per ton net at smeltery.

WASHINGTON

REPUBLIC CONSOLIDATED (Republic)—Electric hoist is to be added to equipment this summer, together with a 700-ft. compressor having a capacity for 17 drills.

CANADA

British Columbia

HEDLEY GOLD (Hedley)—In 1914 treated 78,494 tons ore average $10.80, all of which came from Nickel Plate property. Ore reserves equal to those of year ago.

BERRY DREDGE (Circle)—Freighting Berry dredge from Circle City to Mammoth Creek completed and work of assembling will commence at once. Contract for 1500 cords of wood to dredge practically completed.

TAMARAC (Highland Valley)—Johns & Keffer, formerly on the staff of the B. C. Copper Co., have bonded this group which lies about 25 miles south of Ashcroft. The bond provides for continuous development after first of July.

GRANBY CONSOLIDATED (Grand Forks)—Completion of fourth furnace at Anyox expected within 60 days. Company will then have total capacity of 50,000,000 lb. copper per year. Production costs at Anyox reported to be 20% lower than at Grand Forks plant. January output of two smelteries 2,170,139 pounds.

MERRY WIDOW (Vancouver Island)—Stewart Mining & Development Co. has bonded this group and has 90 men at work. Diamond drilling has disclosed orebodies averaging 3½% copper, 70c. in gold and 50c. in silver per ton. Contract has been let for constructing an electric railway from property to South East Arm of Quatsino Sound, distant 12 miles. Hydro-electric plant will be installed to furnish power to mine.

Ontario

COBALT ORE SHIPMENTS for week ended Mar. 12 were: 724,503 lb., as follows: Mining Corporation, 173,820 lb.; Nipissing, 129,675; Dom. Reduction, 88,000; O'Brien, 40,920; McKinley-Darragh, 84,630; La Rose, 84,740; Beaver Con., 122,718 lb. Week's bullion shipment: Crown Reserve, 19,500 oz. valued at $10,000.

NORTH THOMPSON (Porcupine)—Has been closed down. Lack of funds is supposed to be the reason. Property controlled by Associated Gold Mines of Western Australia.

DOME (Porcupine)—Is operating mill from power from its own power house. Shortage of water in Mattagami River, which caused a partial shut down of the hydro electric plants, is the reason.

NIPISSING (Cobalt)—A short time ago an attempt was made by two German-Poles to blow up company powder magazine. Explosion averted by defective fuse which burned to within 4 in. of primer and went out.

TIMISKAMING (Cobalt)—Stated at annual meeting, Mar. 16, that the big vein followed from Beaver workings on 500-ft. level has been encountered in drift on 460-ft. level, where it is 7 in. wide, average assay 3500 oz. silver.

HOLLINGER (Porcupine)—The new central main shaft has passed the 400 ft. level and will be put down to 2000 ft. To meet power shortage one of the 35 drill compressors, installed last fall has been converted into a steam engine of 1500 hp.

McKINLEY-DARRAGH (Cobalt)—Annual report shows total of 1,396,540 oz. silver recovered, smallest production since 1909. Cost of production increased from 22⅔c. in 1913, to 31⅓c. in 1914. Total estimated reserve was 2,132,000 oz. as against 3,210,000 oz. previous year. Total net profits were $307,652, and dividends amounted to $404,584.

ALGOMA STEEL (Magpie Mine)—Extensive improvements being made on roasting plant at Magpie. Original hot-ore conveyors proved unsatisfactory and are being replaced by rotary coolers 4½ ft. diam. brick lined throughout. Gases entering kilns will pass through coolers, over hot ore; expected to save large amount of heat. Capacity of drying plant in powdered coal mill being doubled to insure coal below 0.75% moisture at all times.

MEXICO

Sonora

SAN MIGUEL (San Miguel)—This mine in Soyopa district resuming activity, has just imported auto truck and a passenger roadster for use between mine and Hermosillo. Consul states 500 Mexicans killed by Yaquis during past year along this trail.

NICARAGUA

PANAMA MINING CO., now controlled by Tonopah Mining Co., of Nevada, is constructing large power plant and will build 100-ton fine grinding and cyanide mill. Rolls will be used for crushing instead of stamps.

The Market Report

METAL MARKETS

NEW YORK—Mar. 24

Copper and lead have been distinctly stronger, especially on account of foreign demand. The business in tin was but trifling, and quotations for this metal are essentially nominal. The situation in spelter is confused. Fancy prices are being realized on the small demand for near-by shipments, while smelters are unable to sell their usual contracts in any free way.

Copper, Tin, Lead and Zinc

Copper—At the close of our last week of record, the market was about 14¾@14⅞c., regular terms, with one large agency selling at or near the lower figure. It having apparently disposed of all that it wanted to at that price, the market began to advance on Mar. 18, although the domestic demand was not very large. However, certain sellers who had special facilities in the European markets and in some noncompetitive markets were contented with them, and abstaining from this market left it in a position to respond quickly to any increase in demand. A moderate volume of business was transacted, but nowhere near so much as was paraded in the daily papers. The dearth of freight room has put the European market entirely out of joint with the American, and all kinds of fancy prices are realized by sellers who are so fortunate as to have stocks available for prompt delivery abroad, or contracts for freight room wherein to make early shipments. The demand for copper during the last week, both foreign and domestic, is attributed to military requirements, rather than peaceful. The form in which copper is sold is not always an index of what it is to be used for. Thus, it was found that cakes, which ordinarily are used for sheet rolling, are being bought to make bands to go around shells.

At the close of our week of record, sales as high as 15⅜c., regular terms, corresponding to about 15.20c., cash, New York, had been made, and bids of 15c., cash, New York, had been rejected.

Copper sheets were advanced ½c. on Mar. 22, the base price being now 20¼c. per lb. for hot rolled and 21¼c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 16¼@16½c. per lb., carload lots at mill.

Visible Stocks of Copper in Europe on Mar. 17 are reported as follows: Great Britain, 15,870; France, 1985; afloat from Chile, 1025; afloat from Australia, 4400; total, 23,380 long tons, a decrease of 436 tons from the Feb. 28 report.

Tin—Quotations on this metal represent actual transactions, but business is so small as to make them nothing but nominal. Orders to buy and sell a few tons swing the market one way or another. The conditions remain substantially as chronicled in our recent reports. Thus, on Mar. 24, somebody tried to sell a few tons, and this resulted in putting the price down to 48 cents.

Lead—There was some large business done for export, but nowhere near so much as reported in the previous week. The absorption of lead was sufficient, however, to induce the A. S. & R. Co. to advance its price to 4.15c., New York, on Mar. 24. The St. Louis market continued to rule above the normal differential owing to the buying of lead there for export and its shipment through Galveston. The condition continued to prevail also that domestic consumers could buy lead at five points or so below what was being realized on the foreign business.

The Chihuahua plant is the only one of the works of the A. S. & R. Co. in Mexico at work at the present time.

We find that we were in error in estimating the export sales of lead in the week Mar. 10-17 at 15,000 to 20,000 tons, as stated in our last report, having duplicated certain sales. An estimate more nearly correct would be 10,000 to 15,000 tons.

Canada was a large buyer of lead on Mar. 18 and 19.

An estimate of domestic consumption of lead at the present time is about 65% of normal.

Spelter—The willingness of buyers to pay fancy prices for metal required immediately, and their unwillingness to buy anything else, became again emphatically in evidence in the early part of the week, when sales of several hundred tons of spot, prompt and near-by spelter were made at around 9c., while there were sellers of May spelter at 8c. and April-May at 8@9c. After all danger of labor difficulties among the smelters was removed, spot and near-by spelter was offered down to 8½c. It is impossible to quote the spelter market with any precision. Buyers in immediate need of supplies are willing to pay high prices for them, but such business, although it may amount to some hundreds of tons per week, is far short of what smelters are obliged to sell, and buyers are unwilling to enter into the usual contracts. This situation, which is just as impossible as that which existed about two or three weeks ago, explains why ore prices in Joplin, a free market, have declined to $60 per ton and under.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Mar.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb
18	4.7950	50⅛	14.65 @14.75	*53	4.10 @4.15	4.05 @4.10	*8.17½ @9.17½	*8.00 @9.00
19	4.7925	50⅜	14.65 @14.75	*52	4.10 @4.15	4.05 @4.10	*8.17½ @9.17½	*8.00 @9.00
20	4.7938	50¼	14.75 @14.85	*52	4.10 @4.15	4.05 @4.10	*8.17½ @9.17½	*8.00 @9.00
22	4.7913	50⅛	14.80 @15.00	*53	4.10 @4.15	4.07½ @4.12½	*8.17½ @9.17½	*8.00 @9.00
23	4.7913	50⅜	15.00 @15.20	*52	4.10 @4.15	4.07½ @4.12½	*8.17½ @8.67½	*8.00 @8.50
24	4.7900	50⅜	15.10 @15.20	*48	4.15 @4.20	4.10 @4.15	*8.17½ @8.67½	*8.00 @8.50

* Nominal.

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Feb.-Mar.	Silver	£ per Ton	Cts. per Lb	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb	£ per Ton	Cts. per Lb
18	23⅝	67	14.36	67½		187	173½	23⅜	5.02	44¾	9.61
19	23 11/16	67	14.36	67½		178	167	22⅞	4.92	44¾	9.61
20	23¾										
22	23 11/16	68¼	14.86	68¾		171	166½	22⅞	4.97	44¾	9.61
23	[illegible]	69	[illegible]	[illegible]		173	167	23⅜	5.02	44¼	9.51
24	23 11/16	68¾	14.88	69¼		168½	165	23⅜	5.02	44	9.56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £15 = 3.21c.; £20 = 4.28c.; £30 = 6.42c.; £40 = 8.56c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Zinc sheets are quoted today at $13.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The manufacturers have received a number of inquiries from abroad.

The Pittsburgh Zinc Co. has made arrangements to start up its plant at Pittsburg, Kan., which was idle throughout 1914. A contract for a supply of Western ore is said to have been made.

The labor troubles among the zinc smelters of Kansas and Oklahoma were general. At Caney, Dearing and Cherryvale, things were settled right away by an increase of 25c. per day to the furnace men. The companies operating in Collinsville and Bartlesville had until Mar. 20 in which to settle things. Before that time a compromise was effected by the same advance as at the other places, and with the week beginning Mar. 22 everything was in full blast again.

The United States Zinc Co., a subsidiary of the American Smelting & Refining Co., which operates the zinc smeltery at Pueblo, Colo., has purchased the plant of the Tulsa Spelter Co. at Sand Springs, Okla., which was built last year by C. A. H. de Saulles and George E. Nicholson. This plant will probably be run on ores from the mines of the A. S. & R. Co.

The recent sale of 2000 shares of the Edgar Zinc Co., 20% of its capital stock, is supposed to be a matter of some importance in the affairs of that company.

Foreign Trade of the United States in metals other than iron and steel, year ended Dec. 31.

	Exports		Imports	
	1913	1914	1913	1914
Copper, long tons	425,302	382,588	182,491	136,764
Tin, long tons	2,203	802	46,555	42,433
Lead, short tons	80,267	44,544	57,147	28,338
Zinc, short tons	8,403	70,242	6,100	880
Nickel, lb.	29,173,088	27,595,152	47,194,101	35,006,770
Antimony, lb.	63,920	1,600,979	15,383,355	17,490,515
Aluminum, lb.	41,535	129,750	23,185,775	16,241,340
Quicksilver, lb.	85,521	108,426		
Platinum, oz.	1,191	143	117,974	72,267

Copper, lead, nickel and antimony totals include metallic contents of ores, matte, etc. Exports include reëxports of foreign material. In addition to the exports in the table manufactures of aluminum were exported valued at $966,094 in 1913, and $1,546,010 in 1914; the quantities not given.

Exports of Metals and Minerals in Spain, year ended Dec. 31, reported by "Revista Minera,' in metric tons:

	Metals		Ores, etc.	
	1913	1914	1913	1914
Iron	7,626	39,176	8,097,309	6,083,193
Copper	24,091	16,320	160,599	81,900
Copper precipitate	5,870	10,056		
Lead	203,440	148,997	2,349	1,727
Zinc	1,044	3,478	114,419	66,949
Quicksilver	1,489	7,285		
Manganese		....	27,793	8,985
Pyrites		..	2,903,554	2,664,948
Salt			564,041	509,936

Imports of coal in 1914 were 2,504,085 tons; of coke, 370,768 tons. Imports of superphosphates and basic slag were 113,673 tons; of nitrate of soda, 36,376 tons.

CONTRABAND

Additions to the British contraband list, proclaimed Mar. 13, include the following mineral products: Tin, chloride of tin and tin ore; paraffin wax; copper iodide; lubricants; ammonia and its salts, simple or compound; liquid ammonia.

Other Metals

NEW YORK—Mar. 24

Aluminum remains quiet and rather dull. Prices are slightly easier, 18½@19c. per lb. being quoted for No. 1 ingots, New York. **Antimony** is scarce and there is very little spot offering. Chinese and Japanese are the principal supplies. Ordinary brands being 21½@23½c. per lb. The better brands are largely nominal, Cookson's being held at 29@30c., with very little to be had. **Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 5c. higher. **Quicksilver** is still in rather short supply. For large lots in New York the price is nominally $65. Small lots have sold up to $70@75 per flask. San Francisco price is reported by telegraph at $60@62.50 per flask for domestic orders; no sales for export. London price is £12 5s. per flask.

Minor Metals—Current sales of **Bismuth** have been at $2.75@3 per lb., New York. **Selenium**—Quotations are $2@3 per lb. for larger quantities, $4@5 per lb. for smaller lots. **Cadmium** is quoted in London at 6s.—$1.44—per lb.—**Tellurium** is reported sold at 80s.—$19.20—per lb. in London.—**Vanadium** to the quantity of 4820 lb. was included in the exports from Baltimore last week.

Gold, Silver and Platinum

NEW YORK—Mar. 24

Gold—An additional sum of $10,800,000 gold from Ottawa was received at New York this week. The total receipts at New York since Jan. 1 have been $38,400,000, of which $26,800,000 came from Ottawa on London account; $5,200,000 from China; $4,000,000 from Japan; the balance chiefly from South and Central America. The only exports were $2,000,000 taken for French account.

Gold production of the Kolar field in Mysore, India in February was $1,027,402. For the two months ended Feb. 28 the total was $2,081,283; an increase of $132,288 over last year.

Silver—The market has ruled quiet and steady this week with a good undertone. Indian Bazaar orders have continued, and there has also been buying for Continental demand. The market closes steady at 23$\frac{13}{16}$d. in London.

Shipments of silver from London to the East, Jan. 1 to Mar. 11, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes	
India	£1,400,000	£1,386,500	I.	£13,500
China	40,000		D.	40,000
Total	£1,440,000	£1,386,500	I.	£53,500

Platinum—The market continues dull and no important changes can be noted. If anything there is slightly less firmness, and a smaller range of prices. There has been no advance, but some sales at low figures. We quote $38@40 per oz. for refined platinum, and $44@49 for hard metal, according to quality.

Iridium is still rather scarce and remains high. Prices are subject to negotiation and no general quotation can be given.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Mar. 20

The base price for 60% zinc ore declined this week to $63 per ton. The base price offered for 80% lead ore was $49@50 per ton. No sales of lead ore were reported.

SHIPMENTS, WEEK ENDED MAR. 20

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	3,930,500	....	243,000
Year	44,274,260	618,390	3,971,600

Shipped during week to separating plants, 3,833,240 lb. zinc ore.

JOPLIN, MO.—Mar. 20

Blende, high price, $68; assay base 60% zinc, low in lead, $65@63; as lead content increased the base declined to $50; metal base not reported; calamine base, 40% zinc, $38@30; average selling price, all grades of zinc, $60.77, a decline of $7.48 per ton.

Lead, high price, $51; base $50 per ton of 80% metal content; average, all grades of lead, $49.60 per ton.

Heavy decline and light buying in zinc ores; an advance of $1 in lead.

SHIPMENTS, WEEK ENDED MAR. 20

	Blende	Calamine	Lead	Values
Totals this week	8,653,900	988,880	1,503,230	$333,17
Totals this year	116,732,430	10,962,640	17,815,140	4,180,03

Blende value, the week,, $277,350; 12 weeks, $3,560,360.

Calamine value, the week, $18,540; 12 weeks, $200,240.

Lead value, the week, $37,280; 12 weeks, $419,430.

NEW CALEDONIA ORES

Exports of ores from New Caledonia for the year ende Dec. 31, 1914, were 55,474 tons nickel ore, a decrease of 37,71 tons from 1913, 48,852 tons chrome ore, a decrease of 11,91 tons. Exports of metals were 3005 tons nickel matte, a decrease of 2888 tons.

Iron Trade Review

NEW YORK—Mar. 24

The general tone of the iron and steel markets is sti sound and hopeful. Business grows slowly, but so far ther is no recession and gradual improvement is expected.

There has been some improvement in demand for structur steel as the open season approaches. Bridge and buildin work is increasing and more contracts are promised. Tl demand for plates and shapes for shipbuilding is good, whi agricultural implement makers are taking fair quantities of bars and other steel.

Export business is developing and some large orders are reported. Over 300,000 tons of heavy bars and other material, including 90,000 tons of wire, have been placed. The French government has contracted for 40,000 tons of rails. Other rail orders are noted, including quite a number for girder and other trolley rails.

The pig-iron market is still backward. The production is increasing, but the chief gain is in the steel works furnaces. Prices are not advancing.

Exports and Imports of Iron and Steel, and of manufactures thereof, in the month of January are valued as below by the Department of Commerce:

	1914	1915	Changes
Exports	$16,706,398	$18,053,421	I. $1,347,023
Imports	2,334,895	1,616,593	D. 718,302
Excess, exports	$14,371,503	$16,436,828	I. $2,065,325

The largest proportional increase in exports this year was in wire and wire products, though there were also large gains in sheets and in billets.

PITTSBURGH—Mar. 23

The steel trade is easily holding the ground gained in the movement of the past four months. Operations continue at the rate of fully 65% of steel ingot capacity, and shipping orders are being received at a rate sufficient to maintain the pace. In most cases the shipping orders received thus far in March exceed the bookings of the corresponding period of February. The notable feature is that demand for commodities of ordinary consumption, like wire, merchant bars, tinplate, sheets, etc., is practically normal, while demand for structural material, as well as railroad material generally, is light. While money is easy for ordinary commercial accommodations, very little indeed is flowing into new investments. In some quarters the belief is entertained that within the near future prospects for an early termination of the war will have so improved as to cause a marked loosening of funds for permanent investment and this would eventually bring a demand for steel along new lines, though the mills could hardly feel the direct effect, in increased operations for several months.

Galvanized sheets, contrasted with black sheets, are in very light demand on account of high prices forced by the scarcity of spelter. Steel prices are well maintained all along the line. In accordance with the program of mills announced early in February, bars, plates and shapes for March specifications are 1.15c. and for second quarter 1.20c., it being expected that the 1.15c. price will disappear at the end of this month.

Pig Iron—A sale of 500 tons of bessemer iron, at $13.60, Valley, for shipment during the balance of the month, is the first transaction in this grade of iron outside of carloads reported for many weeks. Basic iron is very quiet and buyers have not all been taking out their tonnages according to contract. Foundry iron continues quiet, with a similar condition prevailing so that the expected contracting for second quarter is not yet in evidence. Prices are unchanged: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25; forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley; furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Mills are expecting limited consignments to come from England in the near future. There is less fear entertained of an actual shortage, but it is recognized that relatively high prices will have to be paid for some time. The contract price remains at $78, Baltimore, as recently advanced, and subject to possibility of delivery. There is no definite spot market, but odd lots are quoted at not far from $100.

Steel—Shipments on contracts for billets and sheet bars have been heavier this month than last, but there is no new buying of the least consequence. The market is quotable unchanged at $18.25@18.50 for billets and $18.75 for sheet bars, f.o.b. maker's mill, Youngstown, and at $1 higher delivered Pittsburgh. Rods are $25, Pittsburgh.

IRON ORE

The movement of iron ore from the Lake docks is increasing, and promises to reach a fair total in March. There has been no discussion of season prices yet.

Imports and exports of iron ore in the United States in January, in long tons:

	1914	1915	Changes
Imports	101,804	75,286	D. 26,518
Exports	[illegible]	1,[illegible]62	D. 4,860

Of the imports this year [illegible] tons were from Cuba, 7067 tons from Sweden and 5193 tons from Spain. The exports were to Canada.

The total Lake Superior ore on Lake Erie docks March 1 was 7,509,587 tons, which is 33,703 tons less than on March 1, 1913. The larger stocks were at Ashtabula and Cleveland.

FOREIGN IRON NOTES

Pig Iron Production in Germany in January is reported by the German Iron & Steel Union at 874,135 metric tons, which compares with 1,566,505 tons in January, 1914, a decrease of 692,370 tons. It was, however, 19,949 tons more than in December, 85,179 tons more than in November; and 287,484 tons more than in August, which was the lowest point of last year.

COKE

PITTSBURGH—Mar. 23

Connellsville—The Girard Iron Co., Girard, Ohio, has contracted with J. H. Hillman & Sons Co. for 10,000 to 12,000 tons of furnace coke a month to the end of the year, at a price understood to be a trifle under $1.75 at ovens, and Girard furnace will be blown in about Apr. 1. A large local interest is out with an inquiry for about 20,000 tons a month for the twelvemonth beginning July 1, but few sellers are disposed to quote for that delivery at this early time. Prompt furnace coke is selling in small lots at $1.50@1.60, according to grade. Foundry coke is $2@2.35 for prompt, according to grade, contract being nominal at about $2.15@2.30, at ovens.

Coal and Coke Tonnage of Pennsylvania R.R. lines East of Pittsburgh and Erie, two months ended Feb. 28, in short tons:

	1914	1915	Changes
Anthracite	1,585,731	1,665,857	I. 80,126
Bituminous	7,116,249	6,602,414	D. 513,835
Coke	1,660,502	1,427,303	D. 233,199
Total	10,362,482	9,695,574	D. 666,908

The total decrease in 1915 was 6.4%. The largest proportional loss was in coke tonnage.

Exports and Imports of Coal and Coke in the United States in January are reported by the Department of Commerce as below, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	197,415	190,299	106	1
Bituminous	923,760	633,145	112,303	134,075
Coke	66,220	57,447	7,188	5,118
Bunker coal	607,652	528,418	.....	
Total	1,795,047	1,409,309	119,597	139,194

The greater part of the trade, both imports and exports, is with Canada. The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. There were decreases of 385,738 tons, or 21.5%, in exports; and of 19,594 tons, or 14.1% in imports.

Chemicals

NEW YORK—Mar. 24

The general market is rather unsteady and variable, with not much business forward.

Arsenic—Business continues quiet with sales moderate and good supplies. Quotations are unchanged at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business remains steady. Prices have been advanced 25c., present quotations being $5.75 per 100 lb. for carload lots and $6 per 100 lb. for smaller parcels.

Nitrate of Soda—Business seems to be improving and demand steadier. Quotations are unchanged, at 2.20c. per lb. for spot and up to July 1, and 2.17½ for later deliveries.

Imports and Exports of Raw Material for chemical manufacture, year ended Dec. 31, in long tons:

	Imports		Exports	
	1913	1914	1913	1914
Sulphur	[illegible]	22,810	89,246	98,462
Pyrites	848,674	977,372		
[illegible]	66,180	74,086		
Magnesite	149,941	107,635	2,818	1,529

Exports include reexports of foreign material. Excess of sulphur exports over imports in 1914 was 75,652 tons. Sulphur imported in pyrites in 1914 is estimated at 390,948 tons.

Imports and Exports of Chemicals in the United States, year ended Dec. 31, in pounds:

	Imports		Exports	
	1913	1914	1913	1914
Arsenic	6,688,216	4,079,672	[illegible]	[illegible]
Borax	[illegible]	[illegible]	[illegible]	[illegible]
Potash salts	47,011,478	31,777,727	[illegible]	[illegible]
Acetate of lime			[illegible]	[illegible]

Exports include reexports of foreign material. Imports of soda salts are not given in quantities. Values were $[illegible]22 in 1913, and $[illegible]96 in 1914. Potash salts do not include those imported for use as fertilizers.

Assessments

Company	Delinq.	Sale	Amt
Caledonia, Nev.	Mar. 8	Mar. 31	$0.05
Challenge, Nev	Mar. 31	Apr. 21	0.05
Confidence, Nev.	Mar. 11	Mar. 31	0.10
Copper King, Ida.	Mar. 1	Apr. 1	0.005
East Hercules, Ida, (post.)		Apr. 7	0.001
Eastern Star, Ida	Mar. 25	Apr. 25	0.002
Emerald, Utah (three instal.)		June 9	0.01
Enterprise, Ida	Mar. 20	Apr. 20	0.002
Galena King, Utah	Mar. 25	Apr. 25	0.0075
Great Falls, Utah	Mar. 18	Apr. 22	0.01
Idaho-Nevada, Ida	Mar. 10	Apr. 2	0.002
Index, Ida	Feb. 27	Mar. 27	0.005
Indiana, Mich	Feb. 4	. .	1.00
Iron King, Ida	Feb. 18	Mar. 19	0.001
Jack Waite, Ida	Mar. 1	Mar. 24	0.01
Kentuck, Nev	Mar. 18	Apr. 7	0.02
Keystone, Utah, (post)	Feb. 23	Mar. 23	0.02
King Pine Cr'k, Ida	Feb. 12	Mar. 13	0.002
Laclede, Ida	Mar. 20	Apr. 6	0.003
Majestic-Idol, Nev	Dec. 15	Jul 20	0.005
Nabob, Ida	Mar. 18	Apr. 12	0.005
Neva, Utah	Mar. 18	Apr. 12	0.002
Nevada-Douglas, Nev	Apr. 24	......	0.10
Oreano, Ida	Mar. 25	Apr. 26	0.0015
Overman, Nev	Mar. 8	Mar. 26	0.05
Pioche Metals	Mar. 20	Apr. 20	0.0025
Rescue-Eula, Nev	Feb. 11	Mar. 22	0.01
Rio Grande, Utah	Mar. 25	Apr. 17	0.003
Saltese, Ida	Mar. 1	Apr. 1	0.002
Samson, Ida	Apr. 3	May 3	0.002
Selma, Utah	Mar. 20	Apr. 6	0.0025
Silver Cliff, Ida	Apr. 3	Apr. 24	0.0025
Snowstorm Ex., Ida	Feb. 19	Mar. 22	0.003
Sonora, Ida	Mar. 15	Apr. 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Syndicate, Ida. (post.)	....	Jan. 28	0.001
Tarbox, Ida. (post.)	....	Mar. 25	0.0025
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Torino, Ida.	Feb. 20	Mar. 20	0.001
Utah, Nev.	Mar. 25	Apr. 15	0.02
Wanlass	Jan. 30	Mar. 20	0.00375
Wolf Mountain, Utah.	Mar. 15	Apr. 14	0.0015

Stock Quotations

Among the securities sold at auction during the last week we note 2500 shares Cobalt Central at $17 for the lot.

COLO SPRINGS Mar 23		SALT LAKE Mar 23	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	.04¾	Beck Tunnel	05¼
Banner	.01⅛	Black Jack	.12
Cripple Cr'k Con.	.0065	Colorado Mining	11
C. K. & N.	.06	Crown Point	01
Doctor Jack Pot.	.08½	Daly-Judge	5 00
Elkton Con.	.45½	Gold Chain	08
El Paso	1 45	Grand Central	59
Findlay	.03¼	Iron Blossom	1 00
Gold Dollar	.03½	Little Bell	.10
Gold Sovereign	.05¼	Lower Mammoth	.05½
Isabella	14⅛	Mason Valley	1.12½
Jack Pot	06	May Day	.13
Jennie Sample	‡ 02	Opohongo	.01½
Jerry Johnson	.03	Prince Con	.37
Lexington	.0075	Seven Troughs	02½
Mary McKinney	.33¼	Silver King Coal'n	2.90
Pharmacist	.01	Silver King Con	1 72½
Portland	1.14¼	Sioux Con.	03½
Raven B. H.	03¼	Uncle Sam	03
Vindicator	1 65	Yankee	05

TORONTO Mar 23

Bailey	03	Dome Exten.	09
Coniagas	4 80	Foley O'Brien	10
Peterson Lake	.23	Hollinger	23 00
Right of Way	02	Imperial	02
Seneca Superior	1.20	Jupiter	11
Silver Queen	01	McIntyre	37
T. & Hudson Bay	23 00	Pearl Lake	01½
Timiskaming	.24	Porcu. Gold	‡ 25
Wettlaufer-Lor.	04	Preston E. D.	01½
Big Dome	11 25	Rea	12

SAN FRANCISCO Mar 23

Comstock Stocks		Misc. Nev. & Cal	
Alta	17	Belmont	1 60
Belcher	‡ 30	Jim Butler	84
Best & Belcher	06	Lone Star	06½
Caledonia	28	MacNamara	.03
Challenge Con.	‡ 03	Midway	16
Confidence	15	Mont.-Tonopah	.45
Con Virginia	12	North Star	.14
Crown Point (Nev	‡ 32	Rescue Eula	11
Gould & Curry	03	West End Con.	58
Hale & Norcross	04	Atlanta	38
Julia	‡.01	Booth	.26
Mexican	.36	C O D Con	05
Occidental	.85	Comb. Frac	08
Ophir	08	Jumbo Extension	1 00
Overman	‡ 10	Pitts.-Silver Peak	12
Potosi	‡ 02	Round Mountain	40
Savage	.05	Sandstorm Kendall	07
Sierra Nevada	06	Silver Pick	09
Union Con	.16	Central Eureka	‡ 25
Yellow Jacket	‡ 47	So. Eureka	‡ [illegible]

N. Y. EXCH. Mar. 23	
Name of Comp.	Clg.
Amalgamated	60¾
Am.Sm.&Ref.,com	66¾
Am Sm. & Ref., pf.	103⅞
Am Sm. Sec., pf. B.	‡78
Anaconda	28½
Batopilas Min	⅞
Bethlehem Steel	69¾
Bethlehem Steel, pf.	105
Chino	37⅞
Colo Fuel & Iron	27⅞
Federal M. & S., pf.	23
Great Nor., ore, ctf.	33⅞
Guggen Exp	52
Homestake	116
Inspiration Con.	22½
Mex. Petroleum	71⅝
Miami Copper	24
Nat'l Lead, com.	58½
National Lead, pf.	107½
Nev Consol.	12⅞
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf.	1
Ray Con.	18¾
Republic I&S, com.	20⅛
Republic I&S, pf.	77⅛
SlossShefl'd, com	26⅞
Tennessee Copper	30
Utah Copper	56
U. S. Steel, com	47⅛
U. S. Steel, pf.	105½

N. Y. CURB Mar. 23	
Name of Comp.	Clg.
Beaver Con	.30
Big Four	.07
Blue Bell	03½
Braden Copper	7⅞
Buffalo Mines	.65
Can. Cop. Corpn.	1
Can G. & S	04
Caribou	.47
Cashboy	.08
Chambers Ferland	.14
Con Ariz. Sm.	.37½
Davis-Daly	.90
Diam'field-Daisy	.06½
Dia. Black B.	03½
Ely Con	‡.01
Florence	.58
Goldfield Con.	1¾
Goldfield Merger	22½
Greene Cananea	30
Kerr Lake	4 11/16
La Rose	.62½
McKinley-Dar-Sa	43
Mines of Am	2
Mutual Min., pf.	‡2½
Nevada Hills	25
New Utah Bingham	.56
Nipissing Mines	6⅞
Ohio Copper	05
Oro	11½
Pacific Smelt	.09⅞
South Utah	7
Stand'd Oil of N.J.	395
Standard S. L.	1⅞
Stewart	1⅛
Tonopah	7⅝
Tonopah Ex.	2¼
Tonopah Merger	.38½
Tularosa	12½
West End Ex.	03
Yukon Gold	2⅜

LONDON Mar. 12			
Alaska Tre'dwell	£7	2s	6d
Camp Bird	0	6	1½
El Oro	0	8	3
Esperanza	0	9	3
Mexico Mines	4	0	7½
Oroville	0	11	6
Philippine Dr.	1	0	0
Santa Gert'dis	0	8	9
Tomboy	1	3	0
Tough Oakes	0	13	7½

BOSTON EXCH Mar. 23	
Name of Comp.	Clg.
Adventure	1¾
Ahmeek	300
Alaska Gold M.	34¾
Algomah	1
Allouez	45½
Am Zinc	27¼
Ariz. Com., ctfs.	4⅞
Bonanza	35
Butte-Ballaklava	2½
Butte & Superior	47½
Calumet & Ariz	54¼
Calumet & Hecla	405
Centennial	18½
Copper Range	39
Daly West	2½
East Butte	10¼
Franklin	6½
Granby	70¼
Hancock	12¾
Hedley	26⅞
Helvetia	30
Indiana	4¼
Island Cr'k, com.	43
Island Cr'k, pfd.	86
Isle Royale	22½
Keweenaw	2⅞
Lake	10½
La Salle	4
Mass	7⅝
Mayflower	4⅝
Michigan	.85
Mohawk	61¼
New Arcadian	6
New Idria Quick	‡3½
North Butte	27
North Lake	1⅞
Ojibway	.85
Old Colony	4½
Old Dominion	43
Osceola	73
Quincy	60
Santa Fe	1⅞
Shannon	6¼
Shattuck-Ariz	23
Superior	28⅞
Superior & Bost.	1⅛
Tamarack	33½
Trinity	3⅞
Tuolumne	.25
U. S. Smelting	24
U. S. Smelt'g, pf.	42
Utah Apex	2 15/16
Utah Con.	11
Victoria	1¼
Winona	2⅝
Wolverine	47
Wyandot	.60

BOSTON CURB Mar. 23	
Name of Comp.	Bid
Alvarado	70
Bingham Mines	3
Boston Ely	.15
Butte & Lon'n Dev	.19
Calaveras	1 5/16
Calumet-Corbin	.13
Chief Con	.85
Corbin	‡.50
Cortez	15
Crown Reserve	.80
Eagle & Blue Bell	.78
First Nat. Cop.	1⅝
Houghton Copper	1⅝
Iron Cap Cop., pf.	3
Majestic	.13
Mexican Metals	.17
Nevada-Douglas	.34
New Baltic	1⅛
Oneco	60
Raven Copper	‡ 07
Smokey Dev.	10
So. Lake	06
Tonopah Victor	‡ 17
Trethewey	16
United Verde Ext.	3⅛

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.177	28.357	26.573	22.753
March	57.870	58.067		26.669	26.788	
April	59.490	58.519		27.416	26.958	.
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	.
July	58.721	54.678		27.074	25.219	.
August	59.293	54.344		27.335	25.979	...
September	60.640	53.290		27.986	24.260	.
October	60.793	50.654		28.083	23.199	...
November	58.995	49.082		27.263	22.703	. .
December	57.760	49.375		26.720	22.900	..
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	....	64.276	.....	69.170	..
April	14.211	....	64.747	.....	69.313	.
May	13.99	....	63.182	.....	67.786	.
June	13.603	.	61.336	....	66.274	.
July	13.223		60.540	.....	64.955	.
August	*		‡	....	‡	..
September	*		‡	.....	‡	.
October	*		‡	.....	‡	.
November	11.739		53.227	....	*	
December	12.801		56.841	...	*	
Year	.		.....	. .	.....	.

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038		173.619	
April	36.154		163.963	
May	33.360		150.702	
June	30.577		138.321	
July	31.707	.	142.517	
August	*		‡	
September	32.675	.	‡	
October	30.284		‡	
November	33.304	.	139.391	
December	33.601		147.102	
Av. year	34.301		.. ..	

LEAD

Month	New York		St. Louis		London.	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	...	3.850	.	19.651	
April	3.810	....	3.688		18.225	.
May	3.900	.	3.808		18.503	
June	3.900	.	3.810	. .	19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828	.	3.658		‡	
October	3.528		3.384		‡	
November	3.683	.	3.585	.	18.500	
December	3.800		3.662	. .	19.097	
Year	3.862		3.737	.. .	..	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250		5.100		21.460	.
April	5.113	.	4.963	....	21.569	
May	5.074	.	4.924	...	21.393	.
June	5.000	...	4.850	. . .	21.345	
July	4.920	...	4.770	. .	21.568	
August	5.568	...	5.418	.	‡	.
September	5.380	.	5.230		‡	
October	4.909		4.750		‡	.
November	5.112		4.962		25.016	.
December	5.592		5.430		27.369	
Year	5.213		5.061		.....	. .

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07		13.94		14.10	
April	14.90		13.[illegible]		14.13	
May	14.90		13.90		14.27	
June	14.90		13.90		13.96	
July	14.90	. .	13.90	.	13.90	
August	14.90	.	13.90	..	14.08	
September	14.90		13.90	.	14.03	
October	14.84	.	13.75		13.97	
November	14.59		13.43		13.83	
December	14.70	.	13.45		13.83	
Year	$14.88	..	$13.78	......	$14.01	

The Engineering and Mining Journal

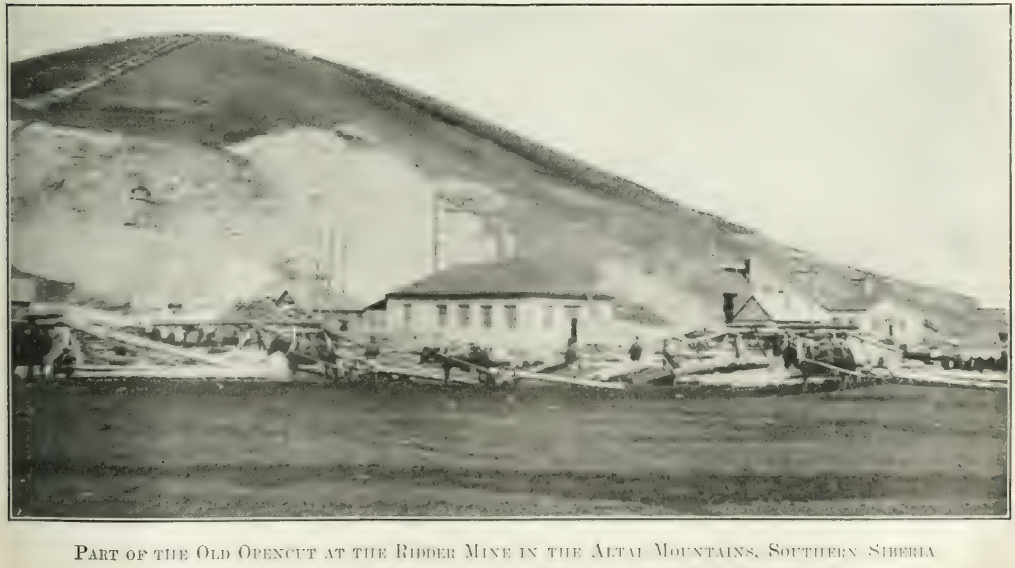
VOLUME 99 APRIL 3, 1915 NUMBER 14

Ridder Mine of the Irtysh Corporation

SYNOPSIS—This mine, in the Altai Mountains in southern Siberia, is one of the world's important mineral developments of recent years. The mine was formerly worked for its oxidized ores; the present development is of the underlying complex sulphides that were of no interest during the previous period. There is a compact-sulphide orebody, estimated at nearly 900,000 tons of solid ore, beneath which is a zone of mineralized hornstone containing over 1,500,000 tons of "disseminated ore"; the most valuable metals are gold, zinc and lead, with silver of less importance and copper in small amounts. The ores will be concentrated at the mine and transported for smelting to the Ekibastus coal field, also owned by the Irtysh Corporation, Ltd. The Ridder concession embraces about 1600 square miles, and there are other old mines that present as favorable superficial prospects as Ridder, notably the Sokolny, which is now to be drilled to learn what underlies the oxidized zone worked in former years.

The Ridder mine in the Altai mining district of southern Siberia has been classed as one of the important mineral developments of the last decade. Mention has been made from time to time of this property, which has been under development by the Russo-Asiatic Corporation, Ltd., for several years. Through the courtesy of R. Gilman Brown we are now able to present some photographs taken in this region. The accompanying technical data are from the report of H. H. Knox, consulting engineer for the Irtysh Corporation, Ltd., which was formed to acquire from the Russo-Asiatic Corporation the issued share capital of the Ridder Mining Co. and of the Kirgiz Mining Co., which controls the Ekibastus coal field.

Acting on the recommendations of H. H. Knox and their technical advisers, the Russian companies have embarked on the following program: At the Ridder mine, diamond drilling will be continued, as well as the development and equipment of the mine for a minimum output of 600 tons of ore daily. The 50-ton test concentration mill will be enlarged to a capacity of 100 tons of solid-sulphide ore daily and plans for the first unit of a larger concentration mill having a capacity of 300 tons of solid-sulphide ore are being prepared. A water-power development is planned and surveys have been completed for a railway from the mine to Ust Kamenogorsk on the Irtysh River; arrangements are also



PART OF THE OLD OPENCUT AT THE RIDDER MINE IN THE ALTAI MOUNTAINS, SOUTHERN SIBERIA

Machine shop in center; shaft in center background; at the right is the test mill being made for the purchase of steamers and barges for river transport.

At Ekibastus foundations have been started for a lead- and zinc-smelting plant, and exploration is proceeding at the colliery with drills and shafts in order to determine the most suitable location for new main shafts and plants.

The Ridder concession comprises an area of about 1600 square miles and forms a part of the Altai Imperial Domains. It is held by the Ridder Mining Co. under a 72-year lease from the Russian Cabinet. The Ridder group of mines is situated close to the village of the same name in the Government of Tomsk, about 50 miles east of Ust Kamenogorsk, on the Irtysh River. The river for six or seven months of each year, during open navigation, affords communication between Ust Kamenogorsk and Omsk on the Trans-Siberian Ry. The distance as measured by the windings of the river is about 750 miles.

Mines Formerly Worked for Oxidized Ores

The Ridder, the Sokolny and the Krukovsky mine have been worked extensively in the past on behalf of the Russian Cabinet for the precious metals. The limited technology and transport of the period admitted of the treatment only of oxidized ores. Hence the sulphide ores lying below the relatively shallow oxidized zone remained intact and virtually unexplored until operations were resumed by the Russo-Asiatic Corporation. Henceforth the wealth of the district will be derived not only from the gold and silver but also from the base metals contained in the ore.

The orebodies outcrop along the hillsides that rise from the flat valley at an elevation of 2400 ft. and culminate in peaks of the Altai, 7000 ft. above sea level. The slopes of the mountain afford ample timber for mining purposes and construction, and the mountain streams offer power at all seasons beyond any probable requirements.

Geology

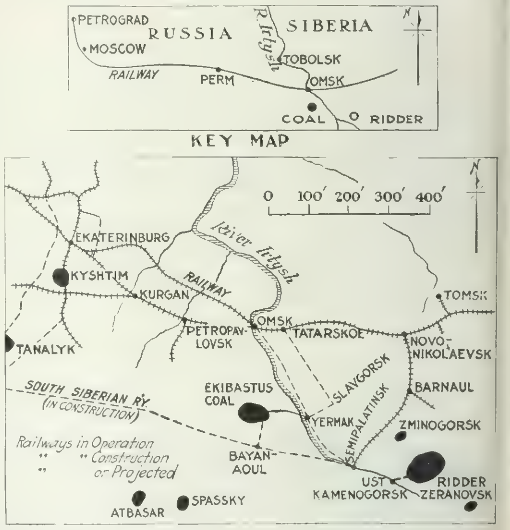
The country inclosing the mineral deposits is composed of a series of ancient sediments interbedded with igneous rocks. Among the former, slates and tuffs may be recognized, and the latter are represented by both effusives and sills. Since the deposition of the strata, the series has been tilted and metamorphosed.

The hanging wall of the Ridder deposit is formed by a bed of shale which has been less altered than the other members of the series. The shale is usually succeeded by a band of crushed rock from a few inches to several feet in width, sufficiently mineralized to include it among the ores. Directly under this lies a compact sulphide orebody (the so-called solid-sulphide ore), being a fine-grained aggregate of blende, galena, pyrite and chalcopyrite, containing gold and silver and minor proportions of quartz and calcite. This is succeeded by a zone of hornstone, originally probably a shale, highly silicified and brecciated, containing the same metallic minerals as the compact orebody, but distributed throughout the siliceous gangue and known as "disseminated ore." Further toward the foot wall the metal content diminishes, but sometimes appears again in other bands of higher tenor.

The orebodies, though varying in width between wide limits, are approximately conformable to the inclosing strata. The compact sulphides have evidently replaced a shale, whereas the disseminated ore is a partial replacement of hornstone. The various stages of folding, metamorphism, igneous intrusion and brecciation, culminating in the deposition of minerals from solutions, are phases of the general processes involved in the uplift of the Altai mountain chain. It is not unreasonable, says Mr. Knox, to surmise that the intrusive magma of the sill should have altered the adjoining shales to hornstone, that later crustal movements should have shattered the less altered shales immediately adjacent, thus affording channels for the circulation of solutions, and that these should have deposited their metallic burden by total replacement of the shattered shale as compact ore and by partial replacement of the less hospitable hornstone as disseminated ore.

The Ridder Lode

The Ridder lode has a general northwest-southeast strike. Within the workings it dips nearly vertically, but at greater depth, as shown by the bore holes, the lode flattens out toward the west. The mine workings attain a depth of 175 ft. below the outcrop and extend 580 ft. along the strike on the fifth level. This level, about 140 ft. below the outcrop, marks the approximate limit of the oxidized ore which alone was sought by the old miners. In further exploration for such ore a sixth and last level was opened but without system, and consequently the exact knowledge of the extent of the orebody at the lowest mine level must await the further development now being prosecuted.



Map Showing Situation of Ridder Mine

The sixth level was driven only about 35 ft. below the oxidized zone. In order to determine the further extent and quality of the lode, the management undertook exploration with diamond drills.

Two lines of diamond-drill holes parallel to the general strike of the lode were laid out; the first were 100 ft. from the outcrop and the second 170 ft. farther west. Along these lines drill stations, 125 ft. apart, were es-

LOOKING DOWN THE FILIPOVKA RIVER IN FRONT OF THE RIDDER MINE

THE RIDDER VALLEY IN THE ALTAI MINING DISTRICT OF SOUTHERN SIBERIA

The Altai country is attractive and the climate is similar to that of New Hampshire. The Ridder mine is at an elevation of about 2400 ft., while the Altai peaks reach 7000 ft. above sea level

THE GRAMATOOK RIVER

MANAGER'S RESIDENCE, RIDDER MINE

Power for the Ridder mine will be developed on the Gramatook River, which is seven miles from the mine

Steamer on the Irtysh River

Camels at the Ekibastus colliery

TWO MEANS OF TRANSPORT IN THE ALTAI

THE EKIBASTUS COLLIERY

The Ekibastus coal field will supply coal for smelting the zinc and lead concentrates and for general commercial purposes. The view at the left shows the main incline, at the right, the old vertical shaft and buildings now converted into a machine shop, coal heaps in background tablished and from each a bore hole at a depression of 63° was projected to cut the orebody at vertical depths varying between 250 and 400 ft. At the date of the report nine of these bore holes were completed; none of the 12 holes had failed to reveal ore of profitable grade. A third line of holes is now being drilled.

Two Classes of Orebodies—36 and 110 Ft. Wide

The orebody is shown to extend at least 750 ft. along the strike and to attain a depth, measured on the dip, of at least 700 ft. from the surface, or 540 ft. measured vertically. The solid-sulphide ore is everywhere of profitable grade. Its average width is 36 ft. The disseminated ore, on the other hand, while generally continuous, here and there shows intervals of barren rock. As there are all gradations, from highly profitable ore to barren rock, the distinction between ore and waste must be marked by a value corresponding to the estimated cost of production. For present purposes, only material of a gross value exceeding £2 per ton was considered as ore; accordingly, the average width of the disseminated ore may be taken at 110 feet.

OREBODIES DISCLOSED BY RIDDER BOREHOLES

		Depth on Bore, Ft.	Width Ft.	Au Oz.	Ag Oz.	Cu %	Pb %	Zn %	Gross Value in Russia £	s.	d.
Solid-Sulphide Ore:											
A	1	267-290	23	0.86	7.8	2.1	19.1	29.2	17	0	0
	2	315-353	38	0.38	8.7	1.9	19.1	34.3	16	3	0
B	1	253-311.5	58.5	0.27	7.4	1.2	19.2	30.0	13	17	7
	2	308-340	32	0.39	14.9	1.3	18.0	30.6	15	3	2
C	1	286-398	112	0.45	12.5	1.3	17.9	33.4	15	16	0
	2	344-370	26	0.12	17.9	1.2	16.9	30.7	14	2	0
D	1	361-379	18	0.38	8.0	1.2	21.9	33.8	15	17	10
	2	Not yet started									
E	1	318-339	21	0.23	10.2	1.7	19.3	38.4	16	10	10
	2	371-410	39	0.33	12.5	1.4	17.2	27.3	13	16	7
G	1	363-388.5	25.5	0.49	8.7	1.3	17.0	31.9	15	1	0
	2	447-489	35.5	0.21	10.2	1.4	13.7	24.6	11	3	0
Concentrating Ore (disseminated):											
A	1	290-512	222	0.56	1.0	0.4	3.0	5.3	4	14	0
	2	353-373	20	1.00	2.3	0.5	9.6	10.2	9	1	0
		373-466	93	0.32	0.9	0.2	1.1	2.7	2	7	10
		550-612	62	0.98	1.1	0.7	4.2	9.5	7	16	5
B	1	311.5-503	191.5	0.46	0.9	0.2	2.3	4.3	3	11	2
	2	300-308	8	0.46	5.3	0.9	7.1	12.4	7	11	5
		340-349	9.25	0.26	7.0	0.7	5.2	9.4	5	3	0
		456-620	164	0.65	1.8	0.5	2.7	4.3	4	16	2
C	1	258-286	28	0.10	4.0	0.3	3.7	10.8	4	8	2
		398-488	90	0.26	1.1	0.2	3.1	6.9	3	17	5
	2	338-344	6	0.07	1.7	0.2	5.2	8.5	4	1	2
		449-491	42	0.15	3.1	0.4	1.7	4.6	3	18	2
D	1	445-505	60	0.25	0.4	0.6	0.2	1.9	2	2	0
E	1	310-318	8	0.17	3.5		0.7	2.9	1	17	2
		339-440	101	0.16	0.6	0.3	1.4	5.1	2	9	5
	2	Returns not yet in									
G	1	425.5-432	6.5	0.35	1.5	0.5	10.2	12.5	7	0	10
	2	489-540	51	0.32	0.5		1.0	1.6	1	17	7
Zinc Lode:											
A	1	740-755	15			1.2		14.9	3	11	5

About 2,500,000 Tons of Ore Indicated

The explorations, to date of the report, are estimated to have disclosed about 883,000 tons of solid-sulphide ore and 1,565,000 tons of disseminated ore, making a total of 2,448,000 tons of both classes. The solid-sulphide ore is estimated to contain: Au, 0.43 oz. per long ton; Ag, 10.09 oz.; Pb, 17.62%; Zn, 30.90%; Cu, 1.37%. The disseminated ore is estimated to contain: Au, 0.60 oz. per long ton; Ag, 1.29 oz.; Pb, 2.89%; Zn, 5.60%; Cu, 0.33%. The total gross value of the solid-sulphide ore is estimated at £14.91 and of the disseminated ore, £4.73, being based on the following Russian prices, which in turn are based on London prices: Gold, £4 per oz.; silver £0.10 per oz.; lead £20 (London £16) per long ton; zinc £24 (London £20); copper £90 (London £60) per long ton.

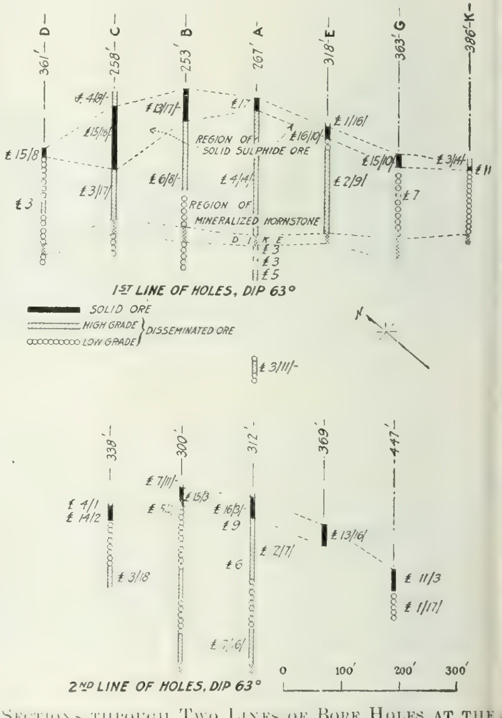
The accompanying table summarizes the estimated values, costs and profits on these ores. It is estimated that the cost of production, based on a daily output of 600 tons (200 tons of sulphide ore and 100 tons of disseminated ore), including mining, treatment, transportation, royalty, and all other charges except depreciation and amortization, will amount to £2.38 per ton of ore, leaving a profit of £3.03 per ton, or a total indicated profit of £7,400,000 on the tonnage estimated at this time. **On a tonnage of 200,000 tons per year there would be an annual estimated profit of £606,000 for 12 years, without reference to further possible additions to the ore reserves.**

ESTIMATED VALUES AND PROFITS OF RIDDER ORES

	Assay Value	Recoverable Value	Operating Cost	Profit
Solid sulphide	£14.91	£9.82	£3.97	£5.85
Disseminated ore	4.73	3.20	1.58	1.62
Average	£8.40	£5.41	£2.38	£3.03

Smelting Plant at Ekibastus

The complex nature of the Ridder ore will require concentrating and smelting works to effect a separation of the metallic contents. Assuming a daily capacity of 600 tons and the treatment of the solid and disseminated ore in such proportion as to preserve the average grade, a concentrating mill will produce daily 39 tons of lead concentrates and 116 tons of zinc concentrates. These products cannot be economically transported to Ust Kamenogorsk on the Irtysh River, 57 miles distant, over the rough wagon roads of the country, and therefore a narrow-gage railway is projected to this point. From Ust Kamenogorsk the concentrates will be transported by steam tugs and barges to Yermak, and thence by the company's railway to Ekibastus, where it is proposed to



Sections through Two Lines of Bore Holes at the Ridder Mine erect the smelting works on account of the cheap fuel supply from the company's coal mines.

The suggestion of an assumed output of 200 tons of solid-sulphide ore and 400 tons of disseminated ore was merely as a basis for calculation, since the superior value of the solid sulphide renders it expedient that in the initial stages of the enterprise attention should be directed to the treatment of this ore, leaving the treatment of the disseminated ore to a later period, though it would be of advantage ultimately to extract the two classes of ore in the ratio of their occurrence.

Mr. Knox states that with respect to a mine but partly developed, such as the Ridder, the most uncertain item in estimating the cost of production is the cost of mining, and therefore an outside figure of 12s. was assumed for that operation. It is expected that in practice this figure will be materially improved, and each reduction of 1s. below the estimated cost of mining will add £10,000 to the annual profit. Metallurgical improvements may also be expected, and further accessions to ore reserves may increase substantially the assets of the corporation.

Outlying Mines

Of the old workings in the immediate vicinity of the Ridder, the most noteworthy are the Krukovsky and Sokolny mines. Of the former little can be said as the workings are inaccessible and only the rather extensive waste dumps give evidence of its former productiveness. Much of the Sokolny, however, is open to inspection, and the extent of the workings and size of the dumps confirm the records of its former importance. The suspension of activity is attributed to the exhaustion of the oxidized ores, as the sulphides had no interest at that time. The dumps compare favorably in value with those of the Ridder, although the precious-metal values are represented by silver rather than by gold as at the Ridder. Mr. Knox considers that the Sokolny "presents a field for exploration, possessing possibilities not inferior to those of the Ridder before systematic investigations were undertaken" and suggests that enough diamond drilling be done to secure a general idea of the Sokolny deposit.

The Ekibastus Coal Field

The Ekibastus coal field, owned by the Kirgiz Mining Co., was examined in detail by Forster-Brown & Rees, and is of importance as a source of fuel for smelting as well as for general commercial purposes. The mines are about 75 miles west of the Irtysh River and are connected with the river at Yermak (near Pavlodar) by a broad-gage railway, belonging to the company and now in operation. The basin contains seams of all grades, between bituminous shale and a good quality of steam coal, and there is estimated a profit of 10s. per ton for such coal as may be sold for commercial purposes outside the company's own requirements. A colliery equipment costing approximately £50,000 has been recommended for the mine at Voskresensky.

In the last decade there has been an influx of immigrants from Russia into this part of Siberia, and it is anticipated that there will be a plentiful supply of unskilled labor. Skilled labor, however, will have to be imported. Labor supply may be curtailed as a result of the war, but it may be remarked in passing that a Russian coal mine, after the vodka prohibition, discovered that with 50% of its force it was able to make a 130% production, as compared with the period when vodka flowed freely.

Mr. Knox recommended raising the sum of £500,000 in cash to be expended in putting the properties of the Irtysh Corporation, Ltd., in condition to return an annual profit of £600,000. The funds required for the equipment of the properties were provided at the time of the formation of the Irtysh Corporation, so that, despite the war, the company's developments are being carried forward without interruption except such as may arise from delay in the receipt of supplies and equipment.

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Steam-Turbine Installation in Mexico*

For many years the Compañia Minera "Las Dos Estrellas" S. A., El Oro, Estado de Mexico, Mexico, has been purchasing its power from a public-service corporation. The slipping of one side of its greatest dam a few years ago seriously affected the power company for a time and caused heavy losses to innumerable customers. The Dos Estrellas company, being one of the several large consumers, in consequence installed a Westinghouse-Parsons multiple-expansion parallel-flow 1500-kw. steam turbine to generate three-phase current at 50 cycles and 3000 volts as a stand-by.

This turbine has a somewhat peculiar history. About two miles from the plant, in the center of a large masonry bridge, the trucks on one end of the car carrying the turbine broke down, precipitating the turbine to the river bed below, some 30 ft. Evidently, it did not wish to be installed at an 8000-ft. elevation. The machine was picked up uninjured except for a few paint scratches, and was installed and operated according to its specifications.

Shortly after, the turbine wrecked itself so completely that an entire new spindle had to be purchased. Failure to start the auxiliary oil pump, unintelligent operation and weak masonry foundations, allowing severe vibrations, were the causes, and conditions were made worse because of a 200-hp. compressor, operating on practically the same floor and foundation, the vibrations of which gave a harmonic with the turbine vibrations. Another fault was that the I-beams were set directly on the masonry wall instead of being placed on some sort of material to distribute the weight. The I-beams thus sank into the masonry, and the machine, instead of resting on the entire length of the foundation wall, was practically on the point where the I-beams had been.

To avoid further trouble it was decided to build a new foundation of 1 : 3 : 5 concrete directly under the turbine and do away with the masonry foundations, so designing the new work that the turbine would have absolutely no connection with the building or other apparatus except the condenser, etc. The change was made with some difficulty, inasmuch as the machine had to be kept ready for immediate use in case of emergency.

From Fig. 1 an idea can be had of the conditions. The dotted lines show the temporary timbering. The space directly beneath the turbine, between the old masonry walls, was dug up and the concrete footing *A* laid. Wall

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*Excerpts from an article by John Klemm in "Power," Feb [illegible]

B was built up to 5 in. below the 15-in. I-beam shown, and 12x12-in. and 8x8-in. timbering was placed between the new wall *B* and the old wall at *C*. This green timber was kept wet to prevent it from shrinking, so that the weight of the turbine could not come on the condenser. The old wall at *C* was then removed, a new concrete footing laid and the wall *C* built up and steamed to crystallize the cement, which was done in about 60 hr., thus avoiding the slow 28-day process.

For the steaming, ½-in. pipe, previously drilled with ⅛-in. holes about 6 in. apart, was laid all around the bottom of the wall; the entire wall was then well covered with a heavy canvas and the steam turned on. At the beginning the temperature was held below 35° C., then gradually increased to 70° C., at which it was maintained for 12 hr. Great care must be taken not to overheat the concrete and thus ruin the entire work, especially if it is reinforced, as the coefficients of expansion for iron and concrete are different. The steam pressure never exceeded 1.5 atmospheres, and with this it was found that the best work was done on the top of the wall. After the steaming, the electrical end was dried out before being placed in service, to avoid danger of a burnout.

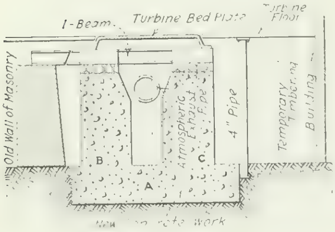

FIG. 1. REPLACING A TURBINE FOUNDATION

Full-length 10-lb. steel rails were then placed on the new walls *B* and *C*, Fig. 1, and 1-in. plates and steel wedges set tight against the 15-in. I-beams on which rested the turbine bedplate. These rails served to distribute the weight of the machine over the entire length of the walls. All spaces between and around the rails and I-beams were then filled in with concrete to the level of the bedplate, making of the whole almost a solid box-like construction with the opening in the center. It may be criticized as inconsistent with uptodate construction to allow so little space below the unit, but it could not well be avoided under the existing conditions. Moreover, the space was sufficient, as all high-speed machines, especially turbo-generators, have artificial ventilation, cold air being blown into the windings.

The timbering was finally removed and the I-beams, one end of each still in the old wall, were cut in a diagonal direction, as shown by Fig. 1, so that, in settling, the I beams could not again make contact with the old work, the tendency being to settle away.

An additional installation of three 400-hp. Babcock & Wilcox water-tube boilers brought the total boiler capacity up to 2100 hp. The addition may seem unnecessary and a useless expenditure, but steam is always required for purposes other than power generation, and it is desirable to have ample margin for cleaning, etc. Further, it does away with the need for induced or forced draft and attendant loss of heat up the chimney, the extra cost of the apparatus and the disadvantages of its boilers.

There are no peaks to consider; the load is steady throughout the 24 hr. The lighting load at night is hardly perceptible. The boiler-feed water is taken almost directly from the condenser, a 4-in. pipe being tapped into the 12-in. discharge pipe of the circulating condenser pump (see Fig. 2). This 4-in. pipe discharges into an old fire-tube boiler used as a heater, and the water is then brought up to 90° C. from the heater. It flows by gravity to the feed pumps, of which there are two Worthington 10x6x10-in. The pumps are also connected to the Alberger cooling tower and a tank which is used to cool a 200-hp. Ingersoll-Rand compressor, so that when the turbine is not in operation the boilers still get warm water. Steam is required for other purposes for 24 hr. daily, and is held for emergency. The heater is also connected to the company's service mains through a small storage tank above the heater, as Fig. 2 shows.

There are two wrought-iron expansion joints in the 8-in. steam header line, one U between what are known as No. 4 and No. 5 boilers, and a 90° elbow between No. 1 boiler and the turbine. These suffice to take up any expansion in the header.

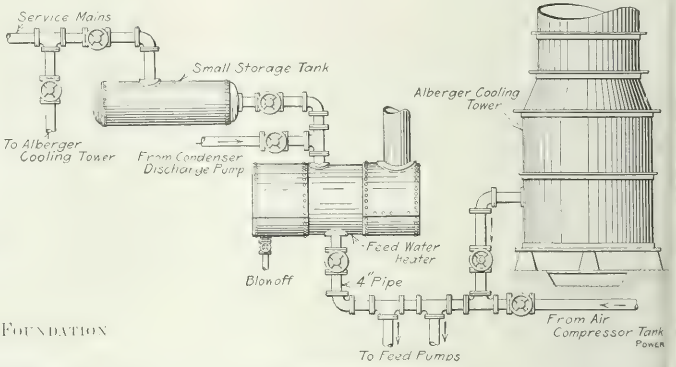

FIG. 2. OLD BOILER USED AS A FEED-WATER HEATER

American fuel shipped to these regions comes high, costing on an average about 24.50 pesos per metric ton (2205 lb.) on the plant grounds.

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Copper in Cyprus

United States Consul-General W. S. Hollis forwards an extract from a report by P. J. Louisides, which says that while Cyprus is in its infancy in metal production, its many deposits of copper are of economic interest. In historic times this island was well known for its copper mines, which are now unworked.

An American syndicate from Arizona has recently been organized and has sent here a mining engineer with a large amount of machinery to start work at Skouriotissia about 60 miles from Larnaca, where promising coppe fields have been located. At present the main purpose i to indicate the leading lines of the fields, and a systematic exploration is in progress. Several mining men ar expected soon from Arizona to form the staff at the works

Tin Mining in Bolivia

By Mark R. Lamb*

SYNOPSIS—Bolivia is one of the world's principal sources of tin, ranking second to the Straits Settlements, and producing about a quarter of the world's supply. At present the business is practically dead, due to the war difficulties. The production and minerals are described, and a plea is made for a tin-smelting industry in the United States.

Tin mining in Bolivia is nearly at a standstill. It is almost foolish to write about it, especially to Americans, when it is impossible to sell tin concentrates in the States (where three-quarters of the world's production is consumed). Instead of buying tin concentrates in Bolivia, smelting it in the States and getting all the business of the big Bolivian country, the States will continue to use the tin from the Straits simply because it comes in bars ready for use. Buying in the Straits will not help get a market for American products.

The Bolivian Tin Ores

It is true that Bolivian tin is not so easily refined as is the tin from streams, but it can be and is being refined in Germany for use in the States. It is all very well for the American manufacturer to sit back and say, "Let the producers of tin, nitrate and rubber find their own market and then buy what we want to sell them." But the producer is just as timid and unaggressive as the American user of tin, rubber and nitrate and is also sitting still, waiting for something to turn up.

The Bolivian tin ores contain lead, iron, antimony, bismuth, silver and other metals. The process of obtaining the tin consists of mining, crushing and concentrating. The concentration is divided into several systems. With ores of comparative purity it is simply jig, table and vanner concentration to obtain 60% concentrates. With somewhat impure ores and where there are pyrites in small quantities, concentrates are roasted and reconcentrated to eliminate the iron. With ores consisting largely of pyrites the ore itself is roasted before concentration. Where silver is present a chloridizing roast is given the ore and the silver leached out before the concentration for tin.

The tailings, as elsewhere, contain much tin, and lately tube mills have been put to work to grind the tailings still finer and permit a further concentration on vanners. One regrinding and reconcentration plant which cost $10,000 erected paid for itself in six months of operation.

Tin mining is not nearly so attractive as before the war. The shares of the tin companies have dropped and all the plants are working on the smallest scale possible. It is rumored on the street that Llallagua and Patiño are negotiating with an American company for the sale of their mines. If the American tin consumer wants an opportunity to get into the tin-producing business he has a fine opportunity at present, as the stocks of the best companies can be purchased at the lowest prices recorded. Even silver miners cannot continue working, though there is supposed to be a market for silver in London. Some have heretofore shipped cement silver; others have shipped silver sulphides; but neither is being shipped at present, and any definite offer or real money at a reasonable price would find several tons of silver per month.

Mining in Bolivia is not easy. It is not possible to import labor, on account of the altitude, so the work must be done with the native Indians. These are not bad laborers, considering how they are mistreated and neglected, but no one can work at 12,000 ft. and above as satisfactorily as at sea level, and the supply of Indians has been short. Of course, now, when the mines are running under low pressure, the supply of labor is greater than the demand, and many of them are ready to work for their board.

Transportation Difficulties

Transportation facilities are scarce and expensive. The Antofagasta railway is slowly getting to be a real railway, though many of its patrons call it an excuse for high rates, loss of goods and delayed deliveries. For a time it looked as though the control of this line would go to the Farquahar syndicate, and the users of the line were hoping for a change of management, but their hopes were blasted.

After leaving the railway, transportation to the mines is by means of llamas, which means that machinery must be sectional where there are no cart roads, and food should be packed in small boxes. There are a few cart roads, but it takes an expert to keep from getting lost when following them.

Short railroads are building or are completed to Potosí, Uníca and Cochabamba and others will be built—later. Probably the demand for tin (say eight years after the war) will be sufficient to stimulate and finance the Bolivian government to the extent of providing the funds necessary for railway extensions. The new Chilean railway from Arica to La Paz has opened up new districts and has reduced the freight rate to the plateau. The traffic is not yet in good running order, but the line is used so far as the equipment and the rolling stock permit.

Fuel Scarcity

Until lately fuel has been an important and expensive item for the Bolivian miner. Everything possible has been used. This includes peat, moss and llama dung, besides imported anthracite for producer-gas engines. Now that the Antofagasta railway has reluctantly decided to put tank cars on its line to Bolivia, it is possible to use Diesel engines. The freight rate on the oil is determined as freights in the States used to be fixed—at all the traffic will bear. For some of the mines it is necessary to provide carts and small drums for packing the oil, and by the time it reaches the mine it is as valuable as 30-year-old stock.

Fuel is so expensive that the drying of concentrates is often done in the open air. This also applies to the native copper concentrates at Corocoro, where the copper is pure and brings a high price in normal times. On account of this fuel item, the smelters on the highlands have made special provision for helping their employees. They provide a stream of hot slag where the women may cook. There is probably not a house in all Bolivia that is heated during the winter as we heat in the States, and when it is realized that Bolivian snow is cold, one of the disadvantages of life on the top of the world will be understood.

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*Mining engineer, Huérfanos 1157, Santiago, Chile.

The Problem of Packing

Heretofore we have always taken pleasure in complaining of the handling given our machinery in the coast ports by the British and German ships. Now, if any American ships happen to come down here, we shall probably have to complain of them. It is really not the ship's fault that the ports are not ports or that the sea is rough at times. The goods must be got out of the ship and they do this as quickly as possible. Passengers and baggage are dragged up the side of the ship and up the ladder. The ship rolls without noting whether or not there is a passenger on the ladder. Sometimes the passenger gets only a wetting. At other times the ladder is folded up against the ship's side, and the passenger then gets a wetting plus a squeeze. It takes a biograph to show this boarding and leaving of the ship, and it takes a timid woman to describe it.

Machinery for Bolivia must be marked so, as it must pass through Chilean or Peruvian territory to get to Bolivia. Besides being properly marked with weight, gross and net, it should be carefully boxed. This boxing has been mentioned before and is so important that the local representatives of American exporters have a hard time in doing business when their products are not carefully boxed. Heavy machinery can stand more rough treatment than other things, but even it suffers at times. So if a plain slide-valve engine is damaged, what is likely to happen to furniture or pianos or glassware?

I have just returned from a trip to the States and had an opportunity to make practical demonstrations of how packing should be done, so far as concerns my own interests. It can be taken as generally true that nothing breakable should be packed in less than 1-in. lumber where the boxes are small and light and in 1½-in. where the contents are heavy. Personally I do not consider crates acceptable under any circumstances. Food, liquors and clothing should have nothing on the case to indicate what the contents are. Delicate shipments are frequently protected on all eight corners with heavy pads of jute to prevent jars. It is an excellent scheme to rebox light cases in a second heavy case. The customer likes to have trouble opening cases, and he does not object to heavy boxes. Lately I had the pleasure of seeing a shipment of mining machinery unloaded at a Chilean port without a breakage—with one exception. A Case oil-fired furnace was packed in a crate (!) with the muffle in place! There was nothing left of the fireclay and brickwork, and the buyer must have been delayed at least three months for the spares. In another shipment a Curtis pneumatic hoist was crated all set up, with the result that valves, bolts and in fact everything removable were gone.

Another shipment of a mechanical classifier was boxed in such light lumber that some of the boxes were being forwarded entirely empty! Whatever became of the contents is not known, but as they were brass they undoubtedly are serving a good purpose somewhere.

Structural steel has been shipped to Bolivia which was 10 ft. longer than the longest car. This means that a few feet of steel entailed the cost of an extra car, and I have tried to convey the idea that freights in Bolivia are not low.

I saw one small induction motor unpacked after it had been out in the rain and snow for two weeks. The owner was confident that it was ruined, or at least that a long drying would be required. The motor was packed in three boxes of tongued and grooved flooring with tarred paper between, and was as dry as when shipped. The extra boxing may have cost $3 more, but it saved the motor.

Condition of the Trade

At present, the business of selling to Bolivia is nothing and is not likely to increase for many months. The only business of importance so far as their purchasing is concerned is machinery, and with tin without a market, the companies are buying nothing. The one other product of Bolivia, outside of copper, is rubber, and this also is having trouble finding an outlet. It is usual for the machinery men to make a trip to Bolivia once in six or nine months, but no one is going this year. Even before the war the tin market was bad, so that the entire loss of market was only a slight additional loss.

Lately it has been possible to make shipments of tin concentrates to England to be sold at private sale, as there is no public market. The prices obtained have not been so very bad, though this way of selling is so uncertain that all the mines running are running on a reduced output. It would be a fine thing for me if someone in the States would buy tin concentrates and smelt them.

[We do not think that American metallurgical people are so backward about the tin-smelting business or so blind to its possibilities, as Mr. Lamb and many other writers suppose. Many years ago A. C. Burrage built a modern tin-smelting works at Bayonne, N. J., intending to supply it with black tin from Malaya, but the government of the Federated Malay States put a quietus on that business by imposing an export tax upon black tin. Mr. Burrage then scoured Bolivia for an ore supply, but was unable to get it on terms that suited him; his works were never fired up and finally were torn down. The erection of a tin smeltery involves a good deal of money, and an adventurer in that direction naturally wants to see a reasonable probability of getting his money back, besides a profit, which means that he must have an ore supply guaranteed by the possession of a mine, or else by long-time contracts giving a smelting margin that will cover both amortization and profit. The Bolivian miners who are free to contract their ore have been unwilling to enter into such engagements. They are willing to sell their ore at present at almost any price, but they want to be free to find the highest bidder after the war. That does not offer an alluring prospect for anybody putting his money into a new tin-smelting works. If the attitude of the Bolivian mine owners were different, capital would quickly be found to build tin-smelting works here.—Editor.]

* * *

Base Map of Missouri—A very accurate base map of Missouri has just been issued by the Missouri Geological Survey. It is 42x50 in. and on a scale of 1 to 500,000 or about 8 miles to the inch. Railroads and the principal streams are shown in detail. The county outlines and the elevations above sea level of railroad stations and precise bench marks are also shown. The map may be obtained by addressing H. A. Buehler, State Geologist, Rolla, Missouri. The charge is 15c. to cover cost of packing and transportation. The same map mounted on cloth and attached to wood rolls may be obtained for 60c.

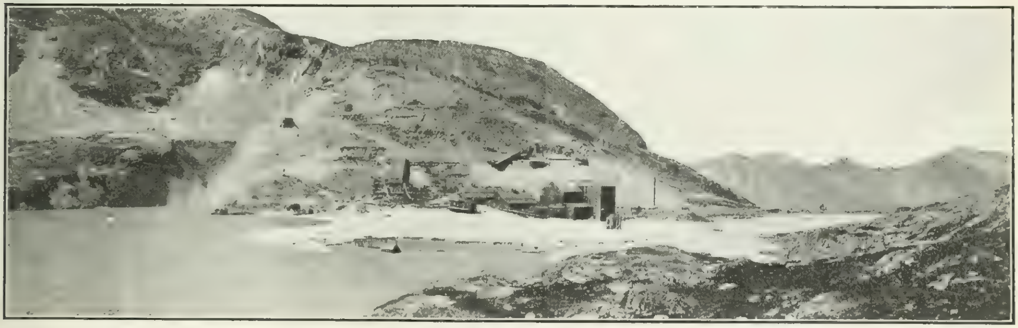
The Mears-Wilfley Tailings Mill

By Warren C. Prosser*

SYNOPSIS—A novel installation to treat an old tailings dump in a lake bed. The tailings are washed to the mill through a flume. The most notable feature in the mill are some Wilfley tables with a deck 47 ft. long.

A procedure which in itself is novel and which embodies a departure from lines laid down in general milling practice is that of treating fairly low-grade tailings with giant Wilfley tables, conducting these tailings to the mill over a long distance by fluming. This has been in progress near Silverton, Colo., for the last year, which time has been consumed in the construction of the plant and a trial operation.

The Silver Lake mine, situated in Silver Lake Basin[1] at an altitude of 12,150 ft. above sea level, was equipped in 1891, when owned by E. G. and G. H. Stoiber, with a 50-stamp mill containing crusher, rolls, Wilfley and Woodbury tables, Harz jigs and end-shake slime tables. For two years the mine did not produce very good ore, considered from an average-grade standpoint, but thereafter for seven or eight years the ore was fair and occasionally of excellent grade. The ore treated was of such a nature that the metallic minerals—sulphides of lead, copper, zinc and iron—were readily freed from the quartz gangue matter without fine grinding. It is estimated that the saving made was rarely higher than 60% of the combined values and in all probability much less the greater part of the time. This was, by the way, the first mill in the San Juan to operate successfully above timber line.



Silver Lake Basin

The outcrops of the Silver Lake vein, the remains of the old mill (burned), the mine buildings, the tailings in the lake, the pump boat and pipe line are all to be seen in this picture

The tailings from this mill were emptied into Silver Lake during the time of operation, covering nearly 10 years, and it was to treat these tailings that the Mears-Wilfley mill was built on the west bank of the Animas River, near the lower Silver Lake tramway terminal, two miles northeast of Silverton.

A small covered flatboat on the lake, moved from place to place by lengthening and shortening tie cables anchored on the bank, contains the motor sand pump set. A pipe connection supported on floats is made to the foot-valve hose, which hangs from the end of the floats. The sand and water feed is drawn through the pumps, thence through a rubber hose to a 6-in. pipe line, also supported on floats across the lake to its north end. Here the contents of the pipe line are emptied into the natural steam bed and travel thence to the top of the cliffs which separate Arastra gulch from Silver Lake basin, a distance of 3500 ft. at an elevation of 12,000 ft. They plunge thence down through a gorge in the cliffs and are picked up at the bottom at an elevation of 10,700 ft. A 12x12-in. flume on a 9% grade conveys them to a dewatering tank about 200 ft. down the slope.

This dewatering tank is about 14x20 ft. and 8 ft. deep, built V-shape. It is divided into two compartments, the first being a screen compartment with valve-governed outlet to the creek. The second and larger compartment has several outlets to the covered flume line, the whole being protected from rock and snow slides by a framework of timbers and lagging.

From the dewatering tank the 12x12-in. covered flume line, on first a 9%, then on 6% and 4% grades, conveys the tailings to the top of the hill at the river, opposite the mill, a distance of about two miles and dropping to an elevation of 9600 ft. Here the material is introduced into a 6-in. pipe line by means of a long wedge-shaped box, the pipe line leading thence to the mill tanks over a trestle across the river. In the pipe line there are three openings, valve-governed, one of which is directly over the stream, to be used in case of emergency.

The mill tank is divided into compartments arranged with baffle partitions and bottom discharge gates protected from clogging by hydraulic cleaning jets. The mill building is 90 ft. long and 52 ft. in width. It contains two giant Wilfley tables, an 8-ft. Traylor tube mill, two Wilfley sand pumps and four of the new-style 24-deck Wilfley slimers, with necessary launders, pipes, shaftings and motors.

The giant Wilfley tables, which are the first of the kind built, are 47 ft. long, 12 ft. wide at the head end and 8 ft. wide at the concentrate end. They are supported on 16 rocker rods, double ball and socket operated, with sidewise motion prevented by rocker maple spring boards, one end being fastened to the table, the other to the foundation. The decks are made of rigid wooden frames, with diagonal strips fastened thereto and beam supports underneath. Pine is used in the construction. The top is covered with linoleum and the riffles are added. The table is practically the same style as the 16-ft. standard table, but nearly three times as large.

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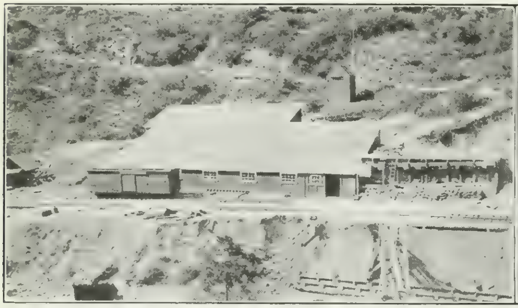
*Mining engineer, Silverton, Colo.

[1] "Eng. and Min. Journ.," June 20, 1914.

The slimers are of the 24-deck self-actuated automatic tilting variety.

The tube mill is of the short length, large diameter style, pebbles lodged in corrugated lining taking the wear. The pebbles cost $20 per ton laid down at the mill.

The sand pumps, used for raising the material from the lake and in the mill for raising material to the pebble mill and slimers, are of special design by A. R. Wilfley. In these the runner, of ordinary slotted type, is taper-fitted to the end of the drive shaft and nut locked. The inside face of the runner is flanged and packing is inserted inside the flange. By means of a spring a sleeve over the drive shaft presses a 1-in. sleeve ring against the packing in the runner flange, the sleeve being inserted into the casing through a stuffing box. The case of the pump is of cast iron of extra thickness and the end plates bind the whole together by means of bolts passing through slots cut in their peripheries. Grease is fed to the packing in the flanged runner to prevent wear at that point. Mr. Wilfley claims for this pump that the material passing through the pump is prevented from coming in contact with the drive shaft, thus eliminating excessive wear.



Wilfley Mill on the Animas River

The 17-Ft. Wilfleys from the Concentrate End

Operation

The entire plant and equipment are designed to transport and treat 500 tons of tailings in 24 hours. Some trouble was first met with in the pipe line at the Lake getting clogged by settled mineral particles, but a greater speed for the pulp regulated this. Some difficulty was first encountered in forcing the tailings through the natural stream bed below the Lake, and while lack of water in dry seasons might make it necessary to flume along this section, in times of sufficient water flow settling can be overcome by increasing the flow of water and decreasing the amount of tailings in transportation.

The flume line has been used unlined and has cut out quickly on the turns and grades. Lining with concrete is now under consideration.

The operation of the giant Wilfleys has been watched with some little interest. Some people feared that such a long table would be subjected to severe buckling tendency, but on the contrary, these tables are standing up to the work excellently. They have a throw of somewhat over one inch, and the material used in bracing has been sacrificed for reduced weight. In the short trial made no fault has been discovered.

The slimers are not operating solely on slimes, but, strange to say, have been showing results in the treatment of middling products. This same style of slimer has now been operating at the Iowa mill, and is reported to have paid for itself and to be making money for the leasing company which owns it. Details of its operation have not been obtained for publication. It is estimated that there are about 700,000 tons of tailings in the Lake, of which 500,000 are recoverable. The value is said to be $3.60 per ton. Otto Mears and A. R. Wilfley are credited with being the chief factors in the enterprise.

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Geology of the Katanga Copper Deposits*

The Katanga copper deposits are situated on a plateau, the surface of which has been cut by erosion into numberless rounded hills and rather steep-sided valleys. The geological structure indicates that the country at some time past was mountainous; was later, as Cornet[1] holds, peneplained and still later eroded into its present rugged form; erosion has hence been rather deep. Elevations of the higher hills and the lower valleys are respectively 5200 and 3900 ft. above sea level.

Mineralized Hills Bare of Timber

The copper-bearing strata are harder, as a rule, than the associated rocks, and, in consequence, the ore deposits usually form cones or ridges. However, one or two of the deposits, notably Luushia, occur below low-lying land. The mineralized hills, in contradistinction to the surrounding timbered country, are bare, and between them and the forest grows the misuku or mahobohobo bush (a wild species of loquat), which is here a most excellent indicator of copper. The deforestation, due possibly to the presence of soluble copper salts in the soil and subsoil, has been a valuable aid in prospecting, as has the topographic relief of the deposits. C. Guillemain,[2] however, believes that the lack of trees is due rather to the soilless rocky outcrop of the hard beds of copper-bearing rocks, and states that all treeless areas are not cupriferous. He found, however, an azure blue flower to be confined to places at which copper occurs, growing only on outcrops, slag dumps, or piles of ore. Such bareness was noted by Messrs. Ball and Shaler in other copper regions, and probably is in part due to the presence of cupriferous solutions in the soil.

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*Excerpts from "Economic Geology of the Belgian Congo, Central Africa," by Sydney H. Ball and Millard K. Shaler, "Econ. Geol." Oct., 1914.

[1] Cornet, "Annales du Musee du Congo," series II, Tome I, Bruxelles, 1908, pp. 92-93.

[2] C. Guillemain, "Zeit. f. prakt. Geol." 1913, p. 321.

The rocks of this portion of the Katanga, in addition to various igneous rocks, consist of a series of sedimentary rocks, largely quartzose. They vary in age, according to Studt, from pre-Cambrian to Permo-Carboniferous, but following other correlations, from pre-Cambrian to Jura-Triassic. Sandstones and shales predominate, although dolomites and cherty dolomites also occur. The rocks differ widely in the amount of metamorphism suffered, the oldest rocks being thoroughly cemented and even schistose and the youngest but slightly consolidated sandstones and shales.

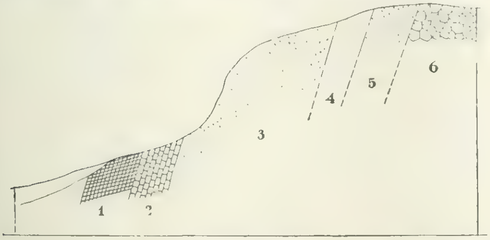

FIG. 1. SECTION OF LUKASI COPPER DEPOSIT, KATANGA

1, Hematite; 2, barren gray limestone, 3, 5, malachite-bearing sandstone; 4, pulverent oxides of iron, manganese and copper with malachite and chrysocolla; 6, quartzite with malachite in fractures and vugs. After Buttgenbach

SERICITE SCHISTS AND QUARTZOSE ROCKS THE CHIEF COPPER-BEARING STRATA

Most of the copper deposits occur in the Kambove and Lufira rocks; some, however, are in the Wemashi beds. The copper-bearing strata consist of sericite schists and quartzose rocks, varying from soft shaly sandstone to pure quartzite and in instances include also slate, dolomite and a cellular quartzose rock. These rocks are usually of light color near the ore deposits, because of bleaching. The interbedded reddish sedimentary rocks are barren.

Cornet[3] states that these rocks in Middle Carboniferous time were compressed into two systems of contemporaneous folds, junctioning near the Ruwe gold mine. The axes of one set in the Lualaba region extended from northeast to southwest, and those of the second in the central and southern portions of the Katanga, course from west northwest to east northeast. Studt, on the other hand, believes that the former were developed in pre-Silurian time and the latter in mid Devonian time. The predominant dip of the west northwest folds is to the north. The majority of the copper mines are strung along like beads on chains in lines parallel to the later folds.

The ore deposits are characteristically associated with sharp folding, faulting, brecciation and an unusual degree of metamorphism (Figs. 1 and 2). The orebodies vary in size from comparatively small to large ones, the largest of which, Kambove No. 2, is reported to be 3000 ft. long and, so far as tested, from 240 to 400 ft. wide. The ore, as a rule, impregnates a sedimentary bed or several beds rather sharply defined from the barren country rock. In several cases orebodies occur in well defined anticlines (Fig. 3), and in one case presumably in a syncline (Fig. 4). The deposits are tabular lenses, and in the greater number of cases the orebody follows the dip of the country rock. The ore within each sandstone bed is discontinuous, but in the same bed several lenses may replace each other along the strike. Studt notes the fact that ore in instances may occur on but one side of an anticline or syncline. In instances, according to Stutzer,[4] the ore cuts across bedding planes and follows secondary structures such as schistosity. Studt[5] regards the quartzose cellular rock as a silicified dolomite altered by the mineralizing solutions which deposited the copper ores. The ore beds parallel this breccia, which is frequently in the center of the deposit, and cross the bedding planes at high angles. In the Kansanshi mine, a presumably similar deposit across the Rhodesian frontier, the copper ore occurs in vertical fissures at right angles to the stratification. The ore usually preserves its width in the upper siliceous beds, but splits into stringers in the underlying dolomite, which contains disseminated chalcopyrite grains. At the Star of the Congo mine, Studt states that the ore in depth is parallel to the cleavage rather than the bedding planes and that the superficial oxidized ore is replaced in depth by pyritiferous dolomite.

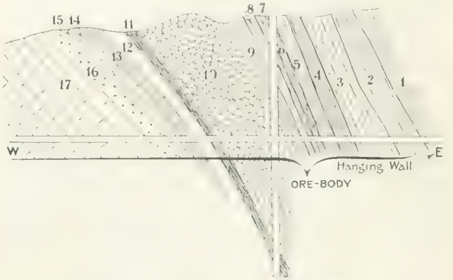

FIG. 2. CROSS-SECTION OF MAIN OREBODY, STAR OF THE CONGO MINE; SCALE 1 IN. = 50 FT.

1, Soft talcose-shaly schist, "talcose ore;" 2, green schist, "green ore;" 3, fissile schist; 4, siliceous schist; 5, laminated schist; 6, nodular schist; 7, laminated schist; 8, schist; 9, siliceous schist; 10, cellular quartzose rock; 11, hard schist; 12, black ore carrying considerable cobalt and good copper content; 13, ferruginous schist; 14, hard flagstone practically barren, 15, 16, flaggy sandstone, 17, dolomite ore—used for fluxing.

COPPER CONTENT VARIES WITH SCHISTOSITY AND POROSITY OF ROCKS

The quartzose cellular rock, which is much fissured, contains large masses of copper carbonates and oxides. Away from this quartzose band, the country rock is impregnated more or less completely with malachite, chrysocolla and azurite. In schists, thin sheets of these minerals occupy the closely spaced schistosity planes in such a way as to remind one, looking across the schistosity, of a book whose leaves are alternately green and white. In the sandstones, the plates of malachite are less closely spaced.

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[3] Cornet, op. cit., pp. 75-91.

[4] "Metall und Erz," Vol. X (N. F. I), heft 22, s. 670-86.

[5] "Trans. of Geol. Soc. of S. Africa," Vol. XVI, 1913, Johannesburg, [illegible] p. [illegible]

Finely divided chrysocolla, azurite and malachite also impregnate the various mineralized rocks, and the three minerals, frequently closely interbanded, occur in botryoidal and mammillary masses filling joint and breccia fractures. Atherton states that the amount of copper ore present varies directly with the porosity of the containing rock. Sandstones, once porous, are completely filled by copper ores, but massive flagstones are barren except for ore in fractures.

The most abundant copper minerals are malachite and chrysocolla; azurite, copper pitch ore and melaconite are less abundant. Cuprite, dioptase, native copper, lunnite, libethenite, olivenite and cyanotrichite are rare, as is also a blue crystallized phosphate of copper and cobalt,[6] presumably a new mineral found at the Star of the Congo mines. Buttgenbach[7] reports the presence of two generations of malachite; an older, contemporaneous with the original gangues of the ore, and a younger, deposited in cavities from the solution of the other. Studt states that cuprite alters to melaconite and then to malachite.

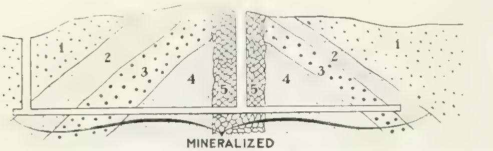

FIG. 3. MUSONOI COPPER DEPOSIT, KATANGA, SHOWING ANTICLINAL STRUCTURE

1, Barren sandstone; 2 and 4, sandstone; 3, quartzite; 5, "crush rock" (silicified dolomite). Adapted from Atherton.

SMALL AMOUNT OF SULPHIDE ORES

Sulphides are characteristically absent; however in native pits at Luushia, 6 to 12 ft. deep, chalcopyrite[1] occurs in shale with malachite, psilomelane and limonite. The chalcopyrite alters to malachite and limonite, and in consequence some of the malachite at least was derived from the alteration of sulphides. Chalcopyrite has also been found in veinlets at Kambove, and at the Musonia mine, impregnated sandstone. Both chalcopyrite and pyrite in small quantities were encountered in drill holes at the Star of the Congo mine at a depth of 60 m. Atherton reports pyrite at Kabolola, and believes copper glance to be present at Kambove. Studt mentions likewise the presence of chalcocite and also of bornite and covellite. The unimportance of sulphides is rather remarkable, in view of the fact that water level at the Star of the Congo mine is at a depth of about 50 ft., and at Kambove presumably at about the same depth.

COBALT CONTENT NOTEWORTHY

Cobalt is present as an oxide, probably carrying manganese, according to Guillemain, also presumably as a phosphate of copper and cobalt. Calcite, quartz (both crystalline and chalcedonic), dolomite, limonite, hematite, and manganese oxides (both psilomelane and braunite) are common gangues. Barite occurs also at Kambove mine No. 1, and Buttgenbach reports that there a bituminous substance is associated with copper oxide and pulverulent manganese oxide. Hematite is not only intergrown with malachite but also forms bed-like bodies in the vicinity of the copper deposits. Magnetite crystals and graphite (Atherton and Buttgenbach) are presumably to be considered as original constituents of the country rock.

The ore is of good grade and Atherton estimates that in 12 of the larger deposits there is ore carrying from 6.3 to 14.4% copper, equivalent to 1,177,960 long tons of copper. The ore is either siliceous, aluminous, talcose, ferruginous or dolomitic; of these, the siliceous ores are most abundant, Atherton[8] stating "the general average being from 51 to 63% of silica; extreme cases go to 83 per cent." Typical analyses are given in the accompanying table.

Although the Star of the Congo ore carries no appreciable quantity of precious metal, in the other mines traces at least of gold and silver are usually present. The gold varies from 0 to 3 grams per ton, and silver reaches a maximum of 72 grams. Although small placers are derived from the copper deposits, Buttgenbach in panning the copper ore of the Kambove mine failed to get a color. The amount of cobalt is noteworthy. In 1911, the crude copper from the Star of the Congo mine contained 89-90% Cu, 5.5 Co, 0.3 Fe, 1.1 S; shipments in the summer of 1913 analyzed as follows: Cu 89.85%, Co 3.25, Fe 1.8, S 0.8 per cent.

The Katanga copper deposits are quite similar in mineral paragenesis and in form, and probably all have a common origin. Cornet believes these deposits to be the "iron hats" of copper-sulphide bodies, as does Buttgenbach.

ANALYSES OF KATANGA ORES

	No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SiO_2	55.62	58.40	67.19	74.21	34.9	33.80	46.60	8.00	28.95	57.40	43.70	47.00	55.40	74.40	61.65	66.40
Al_2O_3	2.65	5.90	5.67	3.85	16.6	10.50	12.70	.....	8.60	12.28	11.69	11.43	4.40	2.46	4.64	4.32
FeO...	6.75	6.60	5.81	3.79	6.50	6.50	3.70		25.10	4.88	2.40	3.50	2.50	2.25	2.73	4.27
MgO	3.05	6.50	2.31	2.35	13.70	14.00	14.40	20.00	2.37							
CaO........	Traces	0.40		0.05		0.20	0.20	27.00	2.26							
CaO and MgO.										1.95	8.95	10.82	6.06	3.18	5.90	5.74
Copper	8.00	8.60	7.10	6.63	11.30	13.50	8.10	1.20	15.20	12.45	15.20	14.13	16.26	8.79	13.53	13.03
Cobalt	0.24					2.00										
Phosphoric acid.	0.13	...						(CO_2) 43.40								
Loss					12.2	19.50	1.50	0.40								

Nos. 1, 2, 3, 4—Siliceous ores, Star of the Congo mine. Nos. 5, 6—Aluminous or "green" ore, green schists in hanging wall, Star of the Congo mine. No. 7—Talcose ore in hanging wall, Star of the Congo mine. No. 8—Dolomitic ore in foot wall, Star of the Congo mine. (Another analysis shows 1% of Al_2O_3.) No. 9—Black ore, No. 12 of section, Star of the Congo mine (Fig. 2). Nos. 10 to 16. Analyses from north and south levels, Kambove mine.

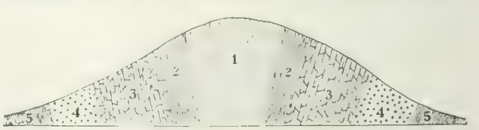

FIG. 4. CROSS-SECTION OF KIMBUI COPPER DEPOSIT, KATANGA, SHOWING PROBABLE SYNCLINAL STRUCTURE

1, Siliceous schist with many quartz veins, 2, filmy schist, 3, iron stained, brecciated schist, 4, cavernous quartzite; 5, soft fissile white schist. After Cornet who expects further that the sulphide body will consist of chalcopyrite, bornite, hematite and magnetite, in a vein or veins parallel to the bedding of the sedimentary rocks. He states that the rocks containing the copper ores were folded in Middle Carboniferous time, and that the ore deposition was of similar age. Studt believes them to be deposited by magmatic waters connected with a granitic intrusion of mid-Devonian age. Stutzer is also strongly inclined to believe that the Star of the Congo mine is situated on the oxidized portion of a sulphide vein. Stutzer states that the Katanga orebodies are similar to that of Bwana M'Kubwa, situated in Rhodesia, on the Belgian Congo frontier, at no great distance from and on the strike of the Katanga belt.

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[6] M. Cesaro, "Ann. de la Soc. Geol. de Belg.," Tome XXXIX, B, Liege, 1912, p. 241.

[7] Buttgenbach, "Annales du Musee du Congo," Series II, Tome I, Bruxelles, 1908, p. 40.

[8] Atherton, "Copper Deposits of the Katanga," July 31, 1907, Leeds, p. 10.

The authors' personal observations are too limited to speak authoritatively upon the origin of these deposits. They were perhaps formed by ascending waters, as were the rather similar copper deposits at Atbasar in the Kirghese Steppes, Siberia, deposition having taken place partly through cavity filling in highly fractured areas, and partly by the replacement of peculiarly favorable rocks. Whether or not these waters were meteoric and under artesian pressure, or were remotely connected with some magma, is, of course, most speculative. Igneous rocks are not absent, as in addition to the granite of mid-Devonian age, which occurs near some of the orebodies in the southeastern end of the belt, there are in the Star of the Congo mine, according to Studt,[9] several dikes of minette or mica-syenite. To the north of this belt the apparently similar copper deposit at Kapula occurs along a granite contact. According to Gwyn-Williams,[10] the ores and the mineralized rocks are like those of the copper orebodies in the main belt.

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Arizona Mining Legislation

SPECIAL CORRESPONDENCE

The mania for new legislation has probably passed its climax in Arizona. When the state was admitted in 1912, the Constitution then adopted provided for the referendum and the initiative. Recall of the judiciary was voted down at the time the Constitution was voted for, though some laid its later adoption to the fact that President Taft interfered with his veto—unwarrantably, as most Americans thought. Under the referendum a number of bills passed by the first state legislature were put to the vote, some of them extreme labor bills and some the other way. A bill of particular interest to mining men, which was known as the Miners' Lien law, was amended at the session just closed by providing that a prospector may bond his claims and by filing notice on the claims and in the Recorder's office of his county warn the world that he will not be responsible for any debts contracted by the lessees. Under a law, which was one of those referred in 1912, laborers and supply men could hold the claims, to which they had furnished labor or supplies, with a first lien even as against a mortgage made later than the date of the passage of the law. This was a most indefensible provision and destroyed the borrowing value of all the mining ground in the state, since it applied to patented lands, possessory rights, and every other kind of mine. This law was changed in the revision of 1913 to cover labor and material, though whether this change was of importance is not known. While the law as now amended does not go into effect for 90 days, it is thought that at the expiration of that time there will be a considerable increase in leases. As it was, no poor man or stranger could furnish the bond required by all careful owners, and even with responsible men it made dealing complicated. It was credited with sounding the death knell of development in the state, as the only persons whom it was safe to trust with one's claims were the very ones who did not want to lease. So apparent has been this dearth of development that it is confidently prophesied that no effort will be made to put the law to a vote.

At the last election in 1914 several radical laws were passed upon initiation by petition. Among these were the alien-labor law, which provided that not less than 80% of men employed in any occupation should be native born or naturalized voters. Since it is necessary to understand English in order to become naturalized, this law was confiscatory and was held unconstitutional by the Supreme Court, which decision will probably be confirmed in the higher court. Another law, the anti-blacklist, was practically held unconstitutional by the U. S. Supreme Court in passing on a similar law originating in Kansas. The old-age and widows'-pension laws have been improperly put upon the ballot and declared void by one of the Superior Courts of the state and it is predicted that the state Supreme Court will approve of this decision.

The Constitution adopted was considered progressive and provided for compensation laws, which were made to apply forcibly only to the dangerous occupations, being optional in a few others. This compensation to laborers, killed or wounded, is now in force and will require some changes to make it acceptable to anybody. It seems that the fundamental premise of all the compensation laws, namely, that each occupation or business should look after its own dead or injured, is radically wrong and that a law to cover the case and provide compensation must be made to apply equally to all persons of either sex and all ages, and be borne by the public at large. It is a fact that while a big mining company with a prosperous and profitable business can take care of its own losses, a small developing company would be seriously crippled by a death or two, and a poor fellow trying to open a mine would be eternally bankrupted by an accident resulting in deaths.

The last legislature passed a law taxing mines, upon a certain percentage of the gross plus a certain percentage of the net proceeds, this whole sum to be the value of the mine for taxation. But this law was only made effective for two years, so the Tax Commission will have to devise some method of mine taxation.

It is fair to say that while the people of Arizona stick to their guns as being progressive and in line with modern thought, they may be absolved from the charge of being radical, and the experimental symptoms so much commented on last year are to be ascribed to only a small part of the population.

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Wood Pipe for Conveying Water—"How long will it last?" is a question asked perhaps more than any other concerning the use of wood pipe, says "Engineering News." That the life of such wood pipe should be at least 20 years if the pipes are fully exposed and supported free from all contact with the soil, if the material is either fir or redwood, and if the pipe has been properly maintained, is the contention of a specialist of the U. S. Department of Agriculture in a professional paper on "Wood Pipe for Conveying Water for Irrigation" (Bulletin No. 155), which may be had free of charge by applying to the Department of Agriculture, Washington, D. C.

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[9] "Trans. of Geol. Soc. of S. Africa," Vol. XVI, 1913, Johannesburg, p. 839.

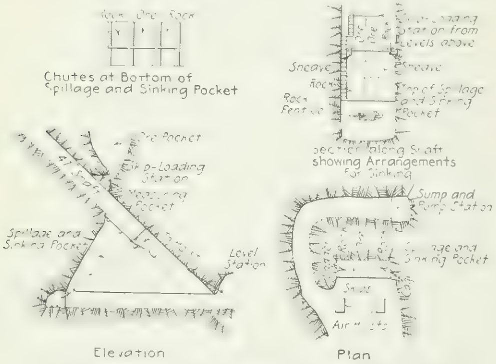
[10] Gwyn-Williams, R. H., "Mining Jou[illegible]," [illegible] 39, [illegible] p. 839.

Details of Practical Mining

Spillage and Sinking Pocket

By Albert E. Hall[*]

Where skips are being loaded, either direct from cars or from a pocket, there is always some spillage. When work is going on below the loading point, it is necessary to keep this spilled material from falling on those below, and a pentice or bulkhead is often used for this purpose. If, however, the skips must make trips to the lower workings, the labor of removing and replacing a pentice causes loss of time. Even where the skips do not make trips lower than the loading point, the material spilled in loading has to be cleaned up at intervals, which is slow and costly work.


Rock
Ore
Rock
Chutes at Bottom of Spillage and Sinking Pocket
Ore Pocket
Skip-Loading Station
Spillage and Sinking Pocket
Level Station
Elevation
Skip-Loading Station from Levels above
Sheave
Sheave
Rock
Rock Pentice
Top of Spillage and Sinking Pocket
Section along Shaft showing Arrangements for Sinking
Sump and Pump Station
Spillage and Sinking Pocket
Air Hoists
Plan

Plan Showing Arrangements for Sinking and Spillage Pockets

The pocket shown in the illustration serves the double purpose of catching the spillage from the loading pocket and also of acting as a pocket for the material hoisted from the shaft bottom during the sinking. The shaft in question is inclined at 47° and has four compartments, a ladderway, two skip compartments and a cage compartment. The cage runs to the sixth level, so that the cage compartment is clear below this point. The skips run to the seventh level, now the lowest level; below this point the shaft is being sunk. The loading station lies between the sixth and seventh levels. The illustration shows the general arrangement.

A drift was run in behind the shaft on the foot wall side and a pocket raised to the shaft just below the loading pocket. This was divided into three parts and chutes built in the drift to correspond to these divisions. The center chute, as shown, catches the ore spilled while loading the skips above. This is drawn from the chute and trammed around to the pocket on the seventh level.

The other two chutes in the drift handle the rock from sinking. Two air hoists are used to hoist this rock to the pocket, one hoistman being able to attend both ines. Just above the spillage pocket, sheaves were set, one in the cage compartment and the other in the ladderway. The setting of the last was made possible by moving the ladder as near as possible to the wall. The rock drawn through the chutes is trammed around to the pocket on the seventh level.

No extra labor is necessary with this arrangement. One hoistman handles both hoists and the buckets dump automatically. Two men handle all rock and ore coming through the chutes and tram it out.

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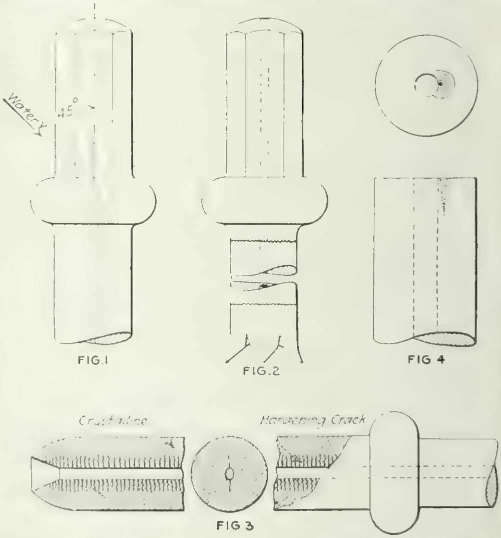
Failure and Heat Treatment of Drill Steel

By Sven V. Bergh[*]

The development of the hammer-drill machine during the past decade has brought with it high requirements for the drill steel. As a consequence, the steel has from time to time been much improved. However, to use to the best advantage the steel at present on the market, it should be selected with regard to the work to be done, and the right treatment should be applied when the steel bars are made into drills.



Defects in Hammer Drill Steel

The steel generally used for rock drilling may be classified as carbon steel; hence the degree of hardness means the percentage of carbon contained. Experience has proved that the proper percentage of carbon is governed chiefly by the hardness of the rock to be drilled and by the power of the machine. E. Odelberg says in *Jernkontorets Annaler*, 1912, that he seldom found among mining men a right understanding of the fact that the harder the rock, the softer must be the steel. This is due to the fact that the bit will not stand the impact if too hard a steel is used to penetrate hard ground, the degree of hardening necessary to improve the wearing qualities of the bit depending upon the conditions under which it has to be used. The above rule must also be applied when a heavier type of drill is being substituted for a lighter one and the steel does not seem to stand up well. The ultimate carbon hardness being already reached, a softer steel must be tried.

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[*] Mining engineer, Creighton Mine, Ontario.

[*] Mining engineer, Chrome, N. J.

In some drilling practice, as, for instance, when hand feed drills are used, bending stresses are likely to be put on the steel. Additional tensile and compressive stresses are thus induced during the period of the blow, producing an excessive strain in the steel. In such practice a heavy size of steel is to be recommended.

When the steel is shanked it is of importance to give the shank sufficient length and cross-sectional area. It happens not infrequently in mining fields, where a light type of drill has been substituted for a heavier one, that the old steel is continued in use. This is not advisable, for the additional reason that it necessitates a considerable change in the front head of the machine. The inconvenience of such a practice is shown by tests in the following table taken from my article in the JOURNAL, Sept. 26, 1914, p. 560.

EFFECTS OF NEW AND OLD CHUCK BUSHINGS ON DRILLING SPEEDS OF INGERSOLL M. C. 32 DRILL

Air Pressure Gage, Lb. per Sq. In.	Net Time of Run, Minutes	Depth Drilled, Inches	Front Head Bushing
78	3	14.6	New
78	3	12.2	Old

The number of ruptures may sometimes be greatly reduced by giving the shank a greater cross-sectional area. In 1911, tests were carried out at a mine in Sweden to find the effect of such a change. The rock at this particular mine is exceedingly hard to drill, as it consists of quartz-striped magnetite and hematite ore with leptite as a country rock. During a three-month period one and the same type of drill was used. The following results were obtained: Ordinary shanks ruptured, 185, corresponding to 6277 m. drilled; strengthened shanks ruptured, four (171 used in all), corresponding to 700 m. drilled. These figures show a considerable improvement following the use of the heavier shanks. Here it may also be mentioned that all abrupt changes in section and sharp corners should be strictly avoided.

So far as water-using drills are concerned, when the water is fed into the steel through a radial boring, it has proved an advantage to drill the hole at an angle of 15° with the center hole of the steel, Fig. 1.

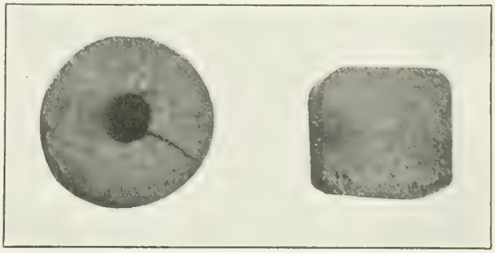
To shape the shank and the bit, the steel has to be upset at both ends. This operation changes the internal structure of the steel unfavorably, at the same time producing in some parts of it the bad effect of "cold work," due to the manner of applying the heat. Ruptures as shown in Fig. 2 are frequently seen. Thus to utilize the best properties of the steel it is necessary that the upsetting be performed in such a way that the steel receive the proper heat treatment. From this it may be understood why it is regarded good practice to forge and harden the bit in separate heats.

To obtain the finest grain, the bit has to be forged continuously from the highest temperature employed down to the finishing temperature, which probably is slightly above the point of recalescence. It is advantageous in hardening not to treat it to any higher temperature than necessary. The steel is liable, if heated too high, to change into a coarse crystallization and develop hardening cracks that may cause ruptures.

The shank must always be tempered properly after being hardened. Some good hints on this point are found in an article entitled "Hammerdrill Shanks," *Compressed Air Magazine*, October, 1914.

Finally, it may be mentioned that shanks sometimes rupture longitudinally, Fig. 3. Some cases that were investigated showed that the failure was due to careless straightening after the steel had been upset. The center hole of the shank was thus oval instead of round and this later caused it to rupture when the steel was used.

Two kinds of rupture may be distinguished, namely: (1) ruptures that appear as developed from a coarse-grained structure and (2) ruptures that evidently have developed from a partial break or inclosure in the steel. In regard to ruptures of the first class mentioned, the opinion frequently heard among users of drill steel is that the crystalline texture often found is due to vibrations. It is not my intention here to discuss whether such an opinion is wrong or not, but to call attention to the fact that the crystalline texture might have been caused during the manufacture of the steel bars by wrong or insufficient heat treatment. The crystallized steel is sometimes hard to restore completely. By annealing, the crystals may only be more or less broken up, still maintaining their previous orientation. Thus cleavage planes are developed along which ruptures occur, giving the appearance of a crystalline fracture, although the steel in reality is fine-grained.



SULPHIDE ACCRETIONS IN STEEL

The typical fracture of the second class is as follows: A circular or oblong cavity or a crack is found at some part of a transverse section. This cavity or crack is surrounded by concentric rings covering a certain portion of the section, the rest being more or less covered by an ordinary crystalline fracture, Fig. 4. Mr. Catlin, of Franklin Furnace, called attention to ruptures of this kind at a meeting of the New York section of the Mining and Metallurgical Society of America, in January, 1914. He stated that according to his experience these inclosures seemed to run through the whole length of the steel and if it was broken anywhere, one could expect to find them. I am also able to state from my own investigations that this kind of rupture occurs rather often.

Similar ruptures are often found in connection with broken rails. Two interesting articles recently published upon this subject are to be found, one in *Iron Age*, Feb. 19, 1914, and one in the *Railway Age Gazette*, Feb. 6, 1914

It is of practical importance to determine whether the inclosures mentioned consist of slag or of sulphide of manganese, the latter usually occurring in the form of round drops, which, if large in size, may be elongated by the rolling. Sulphide of manganese is best recognized by etching the surface of the fracture with a mixture of dilute hydrochloric acid and bichloride of mercury, when the sulphur appears as dark spots. A print may also be taken conveniently by exposing the fracture for four or five minutes to a piece of silk wet with the solution.

It may be of interest to many to hear that ruptures have also been found to start from groove marks on the steel, where numerals or other marks have been stamped by the drill runner.

It is evident from what is now said that the annealing of the drill steel at intervals will mean only a partial improvement. Internal strains produced by cold working of the metal and coarse-grained crystals may be effaced, but there is no possibility of eliminating ruptures of the second class noted. This is in accord with what has been found at various Swedish mining fields where the practice is to anneal drills every second month.

So far as the steel problem is concerned, the structure of steel exposed to vibrations has proved to be of utmost importance. The sorbitic structure has been found to stand up best. It is obtained either by cooling the steel quickly through the so called critical range without actual quenching or by rapid cooling and then reheating to about 600° C. While I have found no publications on this subject, this treatment may be used.

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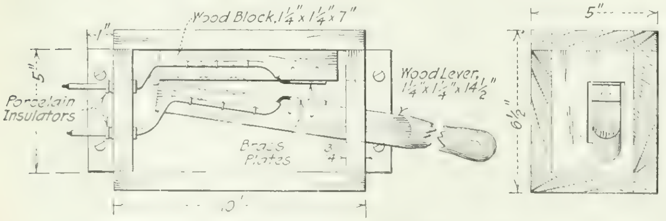
Gravity-Release Electric Signal Box

By W. R. Hodge*

An electric-contact signal box which has proved satisfactory through several years of hard service is shown in the accompanying illustration. The device consists of a fixed block nailed to the top of an inclosing box and a movable handle extending through the end of the box. The block and handle are connected by a butt hinge. Brass plates for making contact are screwed to both the block and the handle. Soldered to the side of each brass plate is a wire connecting with the bell line. The handle must be lifted to make a contact and give a signal. The contact made, the handle naturally drops to the open position without further attention. Ordinarily the boxes are unpainted but in unusually wet places a coat of paint and a shield which moves with the handle and covers the handle opening into the box make for increased efficiency. These boxes have worked well in wet stations.



GRAVITY-RELEASE ELECTRIC SIGNAL BOX

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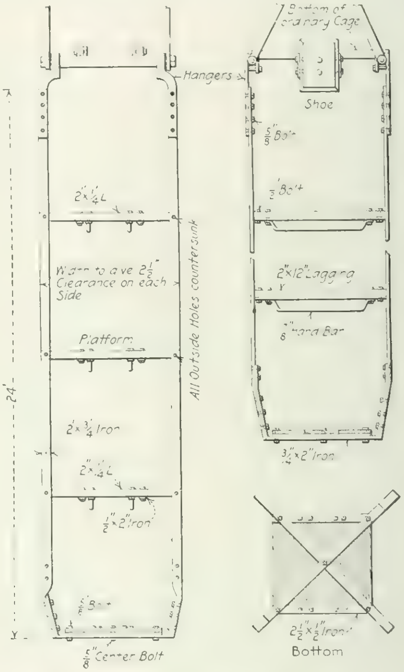
Four-Deck Shaft-Repair Cage

By Albert B. Pedersen*

The illustration shows a 24-ft. cage with four decks used by the Chief Consolidated Mining Co. at Eureka, Utah, for changing guides from $3\frac{1}{2}$x$3\frac{1}{2}$ in. to $3\frac{1}{2}$x7 in. After this work was done shoes were put on the bottom and the cage was used for regular shaft inspection and repair work. The long cage was swung from the bottom of the ordinary cage by means of the hangers at the top. The cage corners were made of 2x¾-in. strap iron; 2x¼-in. angles attached to the corner irons supported wooden platforms; to the bottoms of these were bolted hand bars of ⅞-in. round iron. The bottom was made tapered as shown.



FOUR-DECK SHAFT-REPAIR CAGE

Using this cage with one man on each deck, about 200 ft. of guides was changed on an average in eight hours.

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A Duty of 6.02 Cu.yd. Per Miner's Inch of water was obtained in the hydraulicking operations of the Yukon Gold Co. in 1914. A total of 3,241,641 cu.yd of gravel was hydraulicked for a yield of $514,262, or about 16.8c. per cu.yd. The working cost, exclusive of depreciation on the main ditch, was 7.6c. per cu.yd., a reduction of 2.1c. from the cost of the previous season.

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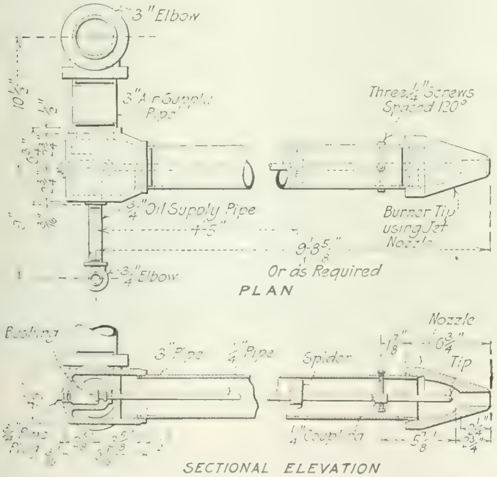
*Mining engineer, Ducktown, Tenn.

*Box 356, Eureka, Utah.

Details of Milling and Smelting

Low-Pressure Oil Burners at Steptoe

The low-pressure burners used on the reverberatory furnaces of the Steptoe Valley Smelting & Mining Co., at McGill, Nev., are shown in the accompanying illustration. In describing[1] the practice at this plant, R. E. H. Pomeroy states that the air for these burners is supplied at only 40-oz. pressure by a motor-driven Connersville blower of 42-cu.ft. capacity per revolution. The oil used is crude petroleum having a specific gravity of 16.5° Bé., flashing in open test at 199° F. The oil is heated to about 200° F. in a steam heater before going to the furnace, about nine boiler horsepower per furnace-day being required to heat the oil from the line temperature to the burning temperature. The oil is fed by gravity (34 lb., static pressure) through seven burners.



Low-Pressure Oil Burners Steptoe Type

The No. 2 reverberatory furnace, on which a series of tests were made, has the following dimensions at the skimming line: Length, 132 ft. ½ in.; average width, 18 ft. 10 in. The air supplied to the burners for atomizing and burning the oil amounts to about 10% of the theoretical air necessary for complete combustion, the remainder of the necessary air enters the furnace through the burner openings in the firing wall. No checker holes are provided and the charge holes in the roof are equipped with slide gates and "dog houses" to minimize air leakages. The combustion of the fuel is practically complete, the carbon monoxide in the effluent gases being less than 0.5%. The draft at the firing end of the furnace is 0.18 in. of water; in the uptake above the verb the draft is about 1 in., and in the stack 1.4 in. The top of the stack is about 320 ft. above the skimming line of the furnace.

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[1] "Bull. of A. I. M. E.," February, 1915

Successful Roll Operation

By James Humes*

The idea of a fleeting roll is one which has long been held by mine and mill operators. H. Kenyon Burch experimented largely on this subject, but did not attain commercial success.

Operators and users of grinding machinery should pass a vote of thanks to the Traylor Engineering & Manufacturing Co. for its accomplishment in bringing the crushing roll to its present state as a dependable machine for medium-fine grinding, either wet or dry, to 16 or 20 mesh. The design of the roll is such that it no longer requires the constant attention of an expert to keep it in operating condition.

To fully value the superiority of this type of roll it is only necessary to see it operating beside the usual standard machine. The operator should consider carefully the improvements in construction. The automatic lateral-adjusting or fleeting device, which is no longer an experiment, is unique, and every mechanical defect has apparently been removed. At the same time developments have greatly simplified the speed-shifting device, which has been so timed that the fixed roll moves over and back once in 30 min.

At the Silver King Coalition mill a type "A," 30x16-roll has been in constant operation for nearly two years, and is used for regrinding ½-in. jig middlings and tailings down to a fineness of 2 mm. at the rate of 9 tons per hr. The gangue consists of a hard, tough quartz, upon which a set of rolled-steel tires last about 90 days. The tires have shown no signs of corrugations or flanges. In fact, although they are run until worn down to a thickness of ½ in., they are nearly as smooth when worn out as when put in commission.

It is well known that the crushing efficiency of rolls depends on the condition of the tires and their smoothness. But operators have met with difficulty in securing the services of men who will see to the shifting by hand often enough to prevent corrugation. The automatic adjustment accomplishes this perfectly and requires no attention on the part of the operator. After nearly two years' operation the rolls to which I am referring seems to be in excellent condition. The bearings are large and well protected and show but slight signs of wear.

Adjustment once in 16 hr. is necessary to compensate for wear, but the method used for tightening up makes it a matter of ease and simplicity. The tension rods are geared together, there being a machined wormwheel on each. These two wormwheels are connected by means of a shaft and gear meshing into them so that the turning of the shaft will open and close the roll as desired. This is an exceedingly important matter, since it prevents getting the roll shafts out of parallel.

The fixed-roll shaft is controlled laterally by the auto matic adjusting device, and the movable shaft is controlled by collars turned on the end of the shaft, making them an integral part of the shaft. These collars are engaged by a bronze bearing on the inside of the housing of the main-roll bearing. The method of construction protects the collars and insures perfect lubrication. It also eliminates all danger of a collar catching an operator, and avoids delays or shut-downs for adjustment.

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*Superintendent, Silver King Coalition [illegible], Park City, Utah

There have been considerable discussion and some doubt in the minds of engineers as to the success and dependability of the fleeting device on rolls, and whether such device would prevent flanging and corrugating of the tires. This can now be answered in the affirmative, as the Silver King rolls have never shown any signs of corrugation or flanging. It is important that, in using rolls equipped with the fleeting device, the lateral movement of the shaft should be in proportion to the size of rock to be crushed. It is well known that coarse ore makes wide corrugations and fine ore proportionately narrow ones. A lateral movement, therefore, to prevent corrugation must be of a length not less than 65% of the distance from apex to apex of the corrugation formed.

With these rolls the following points of superiority have been demonstrated: The cost of upkeep is less than for our other type of rolls, or Huntington mills; power required is less; there is a saving of one man's labor on each shift, and most important is the difference in recovery from the material treated by them. This difference amounts to 0.1% lead and 1 oz. of silver per ton. As the product amounts to 9 tons per hr., it will be clearly understood why I am taking the trouble to place this matter before those who are striving to do the best possible work in saving values.

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Reducing Camshaft Vibration

For reducing the vibration of camshafts with heavy stamps when the two shafts come together, as in a 10-stamp battery, success has followed the use of a wrought-iron ring 1½ in. wide and ½ in. thick, the inside of which was bored out 1/64 in. larger than the diameter of the camshaft. This ring has two oil holes with a spiral groove for lubricating. The camshaft boxes are turned out to fit the ring.

The ring acts like a sleeve joining the two shafts, loose and free to turn in either direction, the shafts also being free to run independently. When either shaft has a tendency to lift, the weight of the other, connected by the loose collar, holds it down. In this way most of the vibrations are eliminated.

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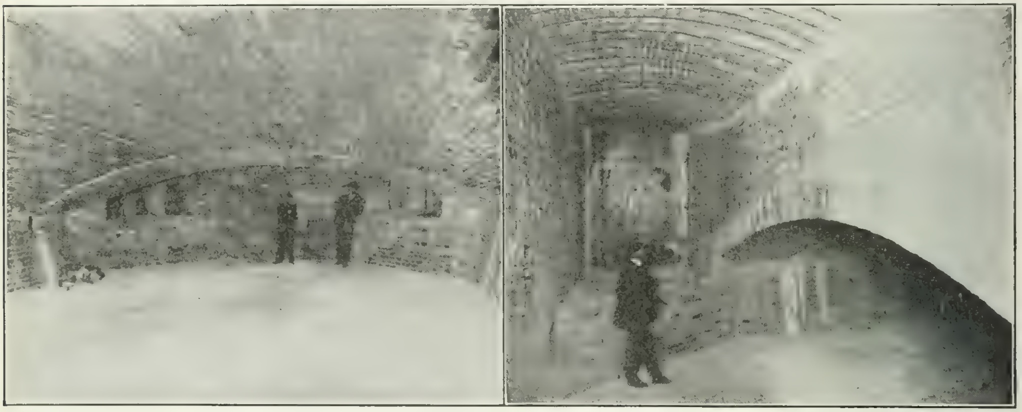
Interior of Anaconda Reverberatory

The accompanying photographs show two interior views of the skimming end of the No. 6 reverberatory furnace at Anaconda. These photographs were taken at the Washoe reduction works on Mar. 18, 1915, and show some of the details of construction embodied in the recent remodeling of the Anaconda reverberatories for coal-dust firing. The increased tonnage smelted in the No. 8 and No. 5 furnaces, which were first remodeled for coal-dust firing, has resulted in the decision to remodel all of the reverberatories for this form of fuel. The furnaces have been lengthened and widened, as the fettling will be dropped through the roof instead of being thrown in through the side doors as heretofore. Most of the fettling will, of course, consist of the charge which is dropped along the side walls from openings left in the roof for the entire length of the furnace on both sides.



Two Views of Interior of Anaconda No. 6 Furnace Skimming End

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The Utilization of Exhaust Steam from simple noncondensing engines may make up a power deficiency that sometimes acts as a deterrent of further improvements. In the report of the St Joseph Lead Co. it is noted that a low-pressure turbine, bought from the Doe Run company, was installed to utilize the exhaust steam from all the simple engines theretofore exhausting into the atmosphere at the smelting works at Herculaneum, Mo. A preliminary test made at the time of the report indicated that the new installation would be successful. The low-pressure turbine was expected to run the matte crusher, the limerock crusher, the baghouse, the Wedge roaster, the Holthoff roaster and the town lights from alternating current supplied by this low-pressure turbine, thus relieving the load on the direct-current generators. It may be mentioned in passing that the company moved a motor-generator set from Leadwood to Herculaneum to be used as a balancing set, in case more alternating current was generated than needed, and should the turbine be shut down for any reason, this set can be reversed and alternating current supplied from it to take care of the baghouse motors and other equipment ordinarily supplied by the turbine.

Company Reports

Osceola Consolidated

The Osceola Consolidated Mining Co., Houghton, Mich., reports a production of 14,970,737 lb. of copper for 1914, which was sold for an average of 13.14c. per lb., making total receipts $1,967,725. Expenses were $1,615,139 and consisted of $1,425,205 for mining, milling and transportation, $21,109 for construction, $167,734 for smelting, freight, commissions, etc., and $1091 for interest. The net profit for the year was $352,786, and dividend payments totaled $288,450, leaving $64,136 to be added to surplus. Total dividends to date amount to $12,179,675.

There were 1,136,118 tons of rock hoisted, of which 2.436%, or 27,671 tons, were discarded as waste. The mill treated 1,108,447 tons yielding 20,997,900 lb. of mineral which yielded 71.296% refined copper. This is equal to a yield of 13.5 lb. of refined copper per ton of rock treated. The following table gives a comparison of costs for the last four years:

	1911	1912	1913	1914
Tons rock treated....	1,246,596	1,246,557	735,044	1,108,447
Yield, lb. of refined copper per ton.....	14.8	14.8	15.4	13.5
Cost per lb. copper.				
Mining, milling and transporting	(a) 7.73c.	(b) 8.34c.	(c) 10.39c.	9.52c.
Construction	0.49c.	0.95c.	0.77c.	0.14c.
Smelting, freight, commissions, etc..	1.06c.	1.07c.	1.14c.	1.12c.
Interest	...	...	...	0.01
Total cost per lb. copper	9.28c.	10.36c.	12.30c.	10.79c.
Development included in above costs:				
Shafts, ft.	306	59	88	255
Openings, ft.	6738	7071	4591	4581

(a) 63,449 tons North Kearsarge ore stamped at a cost of 27.28c. per ton

(b) 77,937 tons North Kearsarge ore stamped at a cost of 24.32c. per ton.

(c) 13,339 tons North Kearsarge ore stamped at a cost of 27.88c. per ton.

On Sept. 1 wages were reduced about 10% and salaries 15% and the mine operated on a three-quarters time basis. On Feb. 1, 1915, the North and South Kearsarge went back on full time. Full time was resumed on the Osceola branch in December at a reduced scale of wages, and on Feb. 1, 1915, the wages were increased to rates existing before the cut in December.

⁂

Temiskaming

The report of the Temiskaming Mining Co., Cobalt, Ont., shows an operating profit of $81,122 for 1914. Earnings from ore amounted to $144,399 and other earnings brought the total up to $146,649. Operating expenses aggregated $288,071. After charging off depreciation the total debit for the year was $105,169. The property was closed down in August on account of an attempt to reduce the scale of wages to conform with the wage scale of the camp. Operations were resumed in October at the reduced scale of wages, but owing to conditions brought on by the European war only partial operations were resumed. The company is now practically under the same management as the Beaver Consolidated, which adjoins it, and a system of inspection and sanitation has been introduced similar to the one which has been in force at the Beaver. Some work is being done through the Beaver property to follow an oreshoot into the Temiskaming property. Apparently this work has proven the extension of the orebody, and it is stated that a number of tons of 1000- to 10,000-oz. ore have been extracted. The vein has been drifted on for 60 ft. and is about 4 to 5 in. wide.

The mill-ore reserve is now being added to and was estimated to contain 5000 tons at the end of the year. The new management has stopped certain undertakings of the former management to develop the North Dome and the Duchess properties. It will acquire the North Dome company by a court sale and through the fact that it is the largest creditor of the North Dome Mining Company.

⁂

National Lead

The National Lead Co. of New Jersey reports net earnings of $2,476,293 for 1914, after deducting maintenance, repairs, etc. It paid $2,325,394 in dividends, of which $619,662 was on common stock. An analysis of the figures given in the report shows that the balance of receipts over all expenditures was $2,092,976, or $232,418 less than dividend payments, which balances with the decrease shown in quick assets on hand. The profit therefore as stated was disbursed as follows: $2,092,976 toward dividends, $240,614 in plant investment and $142,703 in other investments; total profit for the year, $2,476,293. The balance of quick assets over current liabilities at the end of the year was $10,642,723, of which $7,164,475 was in stock on hand. It is stated that only the cost of new plants is added to the plant account.

There were 6859 stockholders on the books at the close of the year and of this number 48% were women. The products of the company consists of painters' materials, bearing metals, plumbers' materials, printers' metals, canners' materials, lead oxides, sheet lead, glaziers' lead, bar lead, lead wire, lead sash weights, piano-key leads, brown sugar of lead, white sugar of lead, linseed oil cake and meal and castor oil. The company is continuing its policy of safeguarding the health of its employees, giving compensation for injuries and maintaining a pension system for aged employees.

Brunswick Consolidated

The Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., in its report for year ended Jan. 28, 1915, states that the results during 1914 were better than in any previous year. The total production was $288,391 from 16,237 tons of ore, or at the rate of $17.76 per ton. The expenditures were $165,956, so that the net realization was $122,435. Adding income from other sources, total profits for the year were $123,964. Dividend payments for the period aggregated $94,868, making a total of $132,163 to date. The cost figures include expenditures for improvements and repairs, $22,966 for new shaft and over $20,000 for unproductive development work. Development work totaled 2702 ft. The new shaft was sunk 240 ft. deeper at a cost of $91.94 per linear ft.

The average extraction at the mill was 93.9% and the average milling cost was 92.6c. per ton, including 34c. per ton for freight and treatment of bullion and concentrates. Concentrates produced amounted to 288 tons and the cost of treating them, including an 8% loss in value, was $16.61 per ton. It is estimated that a saving of $9 per ton could be made by cyaniding these concentrates, and the erection of a plant to cost about $5000 is contemplated for this purpose. The stamp duty was 0.0965 tons per hr. and 14,756 oz. of quicksilver were fed to the batteries, which was equal to about 1 oz. per 1.1 tons of ore. The value of bullion recovered per ounce of quick amounted to $18.21. The total cost per ton was $10.221, made up as follows: Mining, $6.053; milling, 92.6c.; new shaft, $1.359; repairs, 18.1c.; improvements, 40.8c.; and general expenses, $1.294 per ton.

Homestake Mining Co.

According to the annual report of the Homestake Mining Co., operating at Lead, S. D., the property during 1914 produced the greatest tonnage of ore in its history. There were milled in that period 1,587,774 tons for a bullion yield of $6,160,161, or an average of $3.88 per ton. Compared with the previous year the bullion yield and average value were lower; in 1913 1,540,961 tons yielded $6,186,652, an average of $4.01 per ton. Dividends during 1914 were the greatest in the mine's history, totaling $2,210,208, against $2,146,225 the previous year.

Richard Blackstone, superintendent, reports that the operations of the company for 1914 have been normal, there being no interruption to continuous operation.

The principal betterments consist of a completely equipped central boiler plant of six 600-hp. boilers; an electric generating station having a maximum capacity of 4000 kv.-a., consisting of two units of steam turbines, condensing, direct connected to generators; a compound condensing steam hoist, designed to handle two 6-ton skips from a maximum depth of 4000 ft., skips dumping direct into two No. 8 Gates crushers, and a compound condensing air compressor with a capacity of 3000 cu.ft. free air.

The B. & M. shaft was sunk from the 1550-ft. level to the 1700-ft. level and the Golden Star shaft from the 1250-ft. level to the 1400-ft. level, while 17,809 ft. of drifting was done during the year.

Receipts of the company for the year are given at $7,736,970, including the bullion as above, a balance of $1,428,248 carried forward from the previous year; sales of quicksilver, $17.75; blacksmith-shop labor, $1363; discount and interest, $42,114; foundry castings, $96,836; candles, $5281; sundry sales of material, $523; and wood, $2425. Disbursements totaled $6,839,374, leaving a balance to be carried forward of $897,595.

The report does not give unit costs, but the various items are about as follows:

	Total	Per Ton
Mining	$2,792,330.19	$1.759
Stamp milling	597,326.99	0.376
Regrinding	24,288.68	0.015
Cyaniding	294,547.51	0.185
General expense	501,233.23	0.315
	$4,209,726.60	$2.650

In addition to expenditures which have been considered in computing the above costs, there was expended for construction of steam-electric power plant, $81,263, central steam plant, $117,364, and recreation hall, $110,629; expenditures of $13,652 for aid fund, $2800 for benefices; $10,234 and $83,498 for timber lands were also in addition to above table of costs.

Nevada Hills

The Nevada Hills Mining Co., Fairview, Nev., reports a production of 64,348 tons of ore in 1914, averaging $7.86 per ton, or a total gross contents amounting to $505,798. The mill recovered 88.8%, or $6.98 per ton, making total receipts from ore $449,239. Miscellaneous earnings were $12,033. The net profit for the year, not including depreciation, was $67,036. A summary of the costs per ton follows:

		Total per Ton
Mining.		
Development	$0.758	
Stoping	1.733	
Dump ore	0.203	
Total mining (labor, $1.7333, supplies, 75.8c.; power, 20.3c.)		$2.694
Milling.		
Labor	$0.721	
Supplies	1.081	
Power	0.440	
Total milling		2.242
Marketing:		
Concentrates	$0.313	
Cyanide bullion	0.121	
Slag	0.002	
Total marketing		0.436
General expenses		0.405
Property tax		0.044
Bullion tax		0.021
Income tax for 1912-1913		0.058
Old litigation settled		0.043
Current construction charged to operations		0.005
Ore purchased		0.179
Total		$6.127
Net recovery from ore		6.981
Profit from ore		$0.854
Miscellaneous		0.187
Total profit per ton of ore		$1.041

Development aggregated 5697 ft. and the detailed costs show that the average cost of drifting and crosscutting was $8.15 per ft.; of raises, $6.30; of winzes, $15.27; and of shaft sinking, $62.48 per ft. The milling capacity was increased from 145 tons to 200 tons per day and the average treated during the year was 176 tons per day.

Ore reserves are estimated to contain about a seven months' supply, or about 40,000 tons, but the margin of profit is expected to be less than $1 per ton. The property produced about 600,000 oz. of silver during 1914 which sold for about 6c. less than the price received during 1913.

Winona Copper Co.

The Winona Copper Co., Houghton, Mich., showed net assets over liabilities on Jan. 1, 1915, of $92,649, of which $37,162 consisted of unpaid assessments. Rock stamped in 1914 amounted to 123,339 tons, from which 2,239,170 lb. of mineral was produced. This, when refined, yielded 1,352,084 lb. of copper. This is equivalent to 18.15 lb. of mineral and 10.96 lb. of copper per ton of rock stamped. There were 771,442 lb. of copper sold at 14.2c. per lb., and 580,643 lb. remained unsold. The mine was shut down in August, after reaching the greatest monthly output in its existence in July, and remained closed until October, when 35 of the best workmen resumed work on a tributing arrangement, by which the company receives 50% of the returns over the wages.

Correspondence and Discussion

Pine Oil Supply for Flotation Concentration

We note in the JOURNAL of Mar. 6, p. 462, an editorial on "Flotation Oils." We believe that the estimate of the amount of pine oil is high. At the present time there is not produced in the United States in the form of steam pine oil, which is considered a high-class flotation medium, in excess of 200,000 gal. per annum, and not so much of what is known as destructively distilled pine oil. In my opinion these figures are high and the facts probably are that there is not within 75% of the above amounts produced at the present time. By this we mean the material which is commercially known as pine oil. As the JOURNAL correctly says, however, there is not and would not be a scarcity of pine-tar oils, which can be produced in much larger quantity and materially cheaper. We believe, however, it would be safe to say that were three or four of the largest mines of the country to use flotation processes on all of their ores, adopting steam pine oil as a suitable material, they could not get enough to take care of their requirements.

I made an extensive trip last summer through the entire West and made a point of emphasizing these facts. For your information I wish to say that few if any of the people who have made pine oil have even done so profitably by the methods used in the past, and of the resinous constituents of our fat pine but about 3% is pine oil.

PENSACOLA TAR & TURPENTINE CO.,
F. E. MARINER, President.

Gull Point, Fla., Mar. 16, 1915.

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Do We Want Mexico?

"Do we want Mexico?" is the dominant note of many a conversation inspired by the policy of "watchful waiting." Answers to this question range from the shocked and peace-at-any-price attitude of the 1845 Horace Greeley type, through the Daniel Websterian disdainful contempt for all things Western, to the rampant braggadocio of the land-grabbing jingo element as personified by pseudo-Texans.

But let me give you what should be the firm and unhesitating answer of the mining engineer and his brother the prospector. We want Mexico! Yes, we want Mexico. We want Mexico peaceful or peaceably. We want Mexico happy or happily for all concerned. But we want Mexico honestly governed under the Constitution of 1857 and the laws of Mexico. The laws are excellent, and the mining laws are in very many respects better than our own. But we want Mexico to have a square deal from all the world, and particularly from the Mexicans themselves.

If at length we find Mexico in the position of a family of our neighbors, where the adult parents have fought to the death and have left a brood of helpless and ignorant children to play with the weapons which made them orphans, then we may still wait watchfully. Our position is not that of a landlord. We may have furnished some of their household goods on credit, with some of the installment payments now overdue. If so, our rights must be protected—must and shall be protected; but always in a legal manner.

If we see in control an element comparable to the *serape*-clad toiler whose drudgery provided the sustenance of the family in *tortilla* days, we should pause a moment. Then we may extend our hand, not in anger, but rather as a kind-hearted creditor who proffers assistance in restoring the furniture to its accustomed place and in making proper arrangements for educating the children of the disordered household. We want Mexico to put its house in order. Incidentally, we do not relish having any holes punched, kicked, cut or shot through the walls of our own house.

WILLIAM B. MCKINLAY.

New York, Mar. 24, 1915.

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Copper Output of Gatico Company

No. 2 of Vol. 99 of the JOURNAL arrived here safely this week and its contents were perused with much pleasure, giving as it does, so early in the year, the approximate production of the metals of the world for 1914. I am curious to know why the Gatico company and smeltery are not mentioned in the review of Chilean mining on p. 129, for the production of that company has steadily increased for many years past, and while it is still by no means a large producer, when compared with the large copper mines in the United States, it produced last year 2,414,506 kg. of converter bars containing 98.5 and 99.5% Cu, or approximately 6% of the total copper produced in Chile as given on p. 51 of the same JOURNAL, and more than at least one of the companies mentioned on p. 129. The Gatico company produced more in the last half than it did in the first half of 1914, and is probably in the first hundred copper mines of the world, giving them rank by a comparison of their productions for last year.

GEORGE W. WATERS.

Santiago, Chile, Feb. 11, 1915.

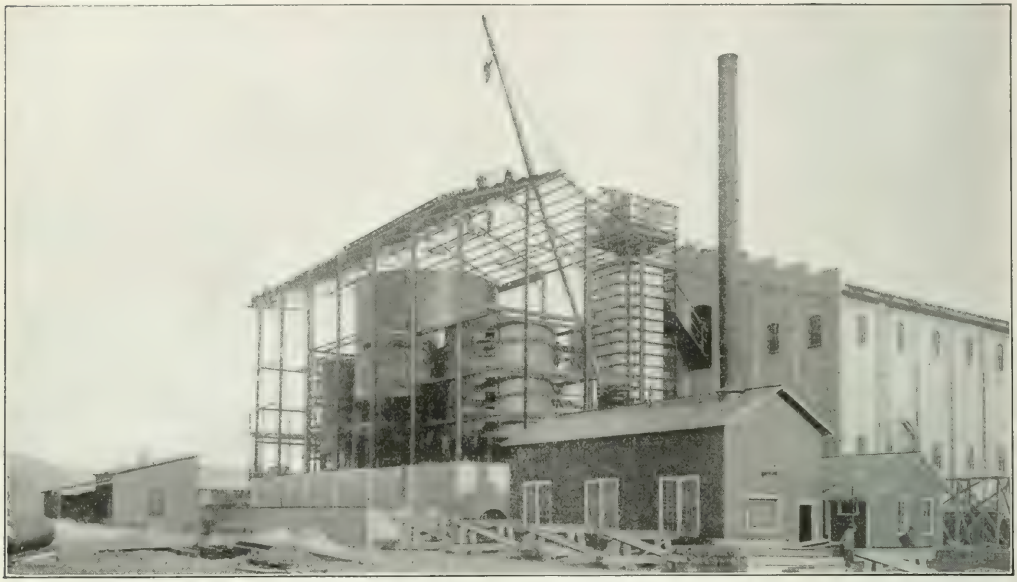
[No mention was made of the operations of the Cia. de Minas de Cobre de Gatico by any of our correspondents in Chile, and no reply was received to our own letter of inquiry to the company, hence the omission.—EDITOR.]

⁂

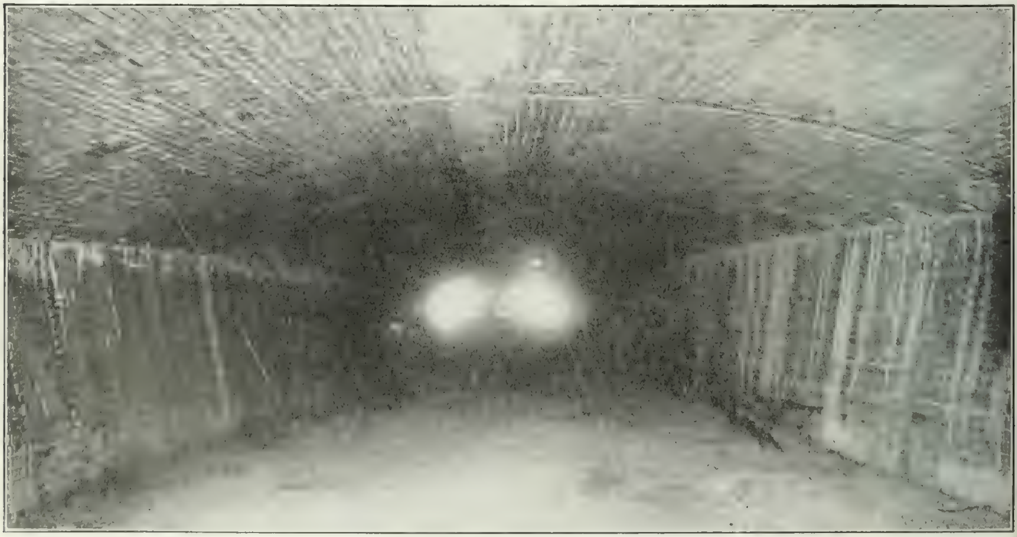
Hydro-Electric Plant at a Bolivian Tin Mine

Mark B. Lamb writes us that the article on a "Hydro-Electric Plant at a Bolivian Tin Mine," published under his name in the JOURNAL of Jan. 2, 1915, should have been credited to Oscar von Chrismar. The article was sent to us by Mr. Lamb and by an unfortunate misunderstanding in this office it was supposed to be his article. We regret the error.

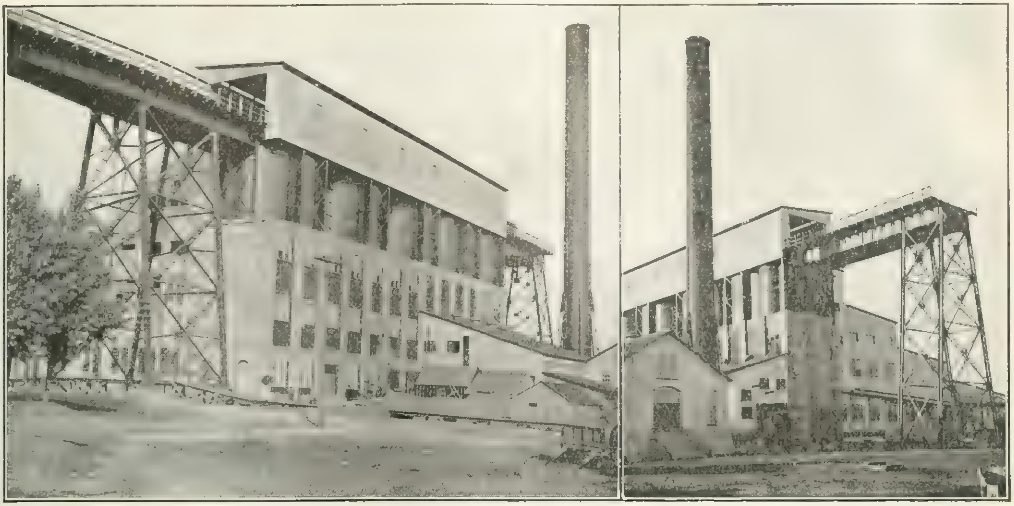
Photographs from the Field



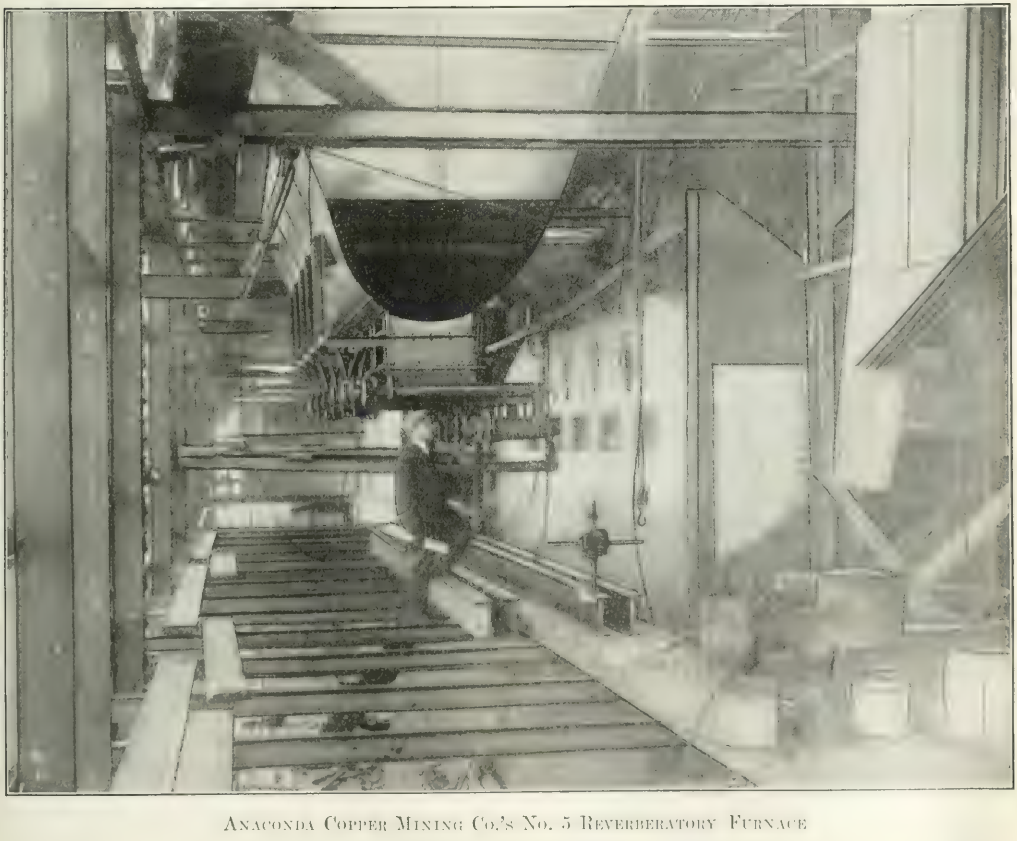
ANACONDA COPPER MINING CO.'S 100-TON ACID PLANT
Furnaces, dust catcher and Glover tower



INTERIOR OF NO. 5 REVERBERATORY OF ANACONDA COPPER MINING CO.
Looking toward the firing end



Two Views of the New Ahmeek Copper Mill, Mich.



Anaconda Copper Mining Co.'s No. 5 Reverberatory Furnace

Coal-dust storage and burners

Second Pan-American Scientific Congress

The Second Pan-American Scientific Congress will be held in Washington, D. C., Dec. 27, 1915, to Jan. 8, 1916, under the auspices of the Government of the United States. The general purposes of the Congress are the presentation and discussion of matters of scientific interest, especially those that bear most directly on industrial progress, and the formation of personal acquaintances among representatives of the American republics, with the intent of increasing the exchange of knowledge and bringing about a better understanding of the ways in which the several republics can work to the advancement of science and the promotion of trade, commerce and mutual helpfulness. The Congress will be divided into sections, as follows:

I. Anthropology.
II. Astronomy, Meteorolgy, and Seismology.
III. Conservation of Natural Resources, Agriculture, Irrigation, and Forestry.
IV. Education.
V. Engineering.
VI. International Law, Public Law, and Jurisprudence.
VII. Mining and Metallurgy, Economic Geology, and Applied Chemistry.
VIII. Public Health and Medical Science.
IX. Transportation, Commerce, Finance, and Taxation.

Section VII, Mining and Metallurgy, Economic Geology, and Applied Chemistry, will consider especially the mineral resources of the several republics, the methods by which these resources can be developed and used and the manifold applications of chemistry in the production and utilization of materials of benefit to man, as set forth in the preliminary program issued by the Executive Committee of the Congress.

To facilitate the preparation, assembling, and presentation of papers, committee members have been appointed for the section as follows: Hennen Jennings, mining engineer, Washington, D. C., member of the Executive Committee of the Congress, president; John Barrett, director-general of the Pan-American Union, secretary-general of the Congress, member ex-officio; S. Sanford, mining engineer and editor, U. S. Bureau of Mines, Washington, D. C., recorder.

MINING

Dr. J. A. Holmes, director of the U. S. Bureau of Mines, Washington, D. C., chairman; J. F. Callbreath, secretary of the American Mining Congress, Washington, D. C.; Dr. C. H. Lindley, lawyer, authority on mining law, San Francisco, Calif.; E. W. Parker, statistician, Mineral Resources of the United States, U. S. Geological Survey, Washington, D. C.; H. C. Perkins, mining engineer, Washington, D. C.; G. S. Rice, chief mining engineer of the U. S. Bureau of Mines, Pittsburgh, Penn.; W. L. Saunders, engineer, president of the American Institute of Mining Engineers, New York; B. B. Thayer, past president of the American Institute of Mining Engineers, New York.

METALLURGY

W. R. Ingalls, president of the Mining and Metallurgical Society of America and editor of the ENGINEERING AND MINING JOURNAL, New York, chairman; Dr. F. G. Cottrell, chief chemist of the U. S. Bureau of Mines, San Francisco, Calif.; Dr. R. H. Richards, professor emeritus of Mining Engineering and Metallurgy, Massachusetts Institute of Technology, Boston, Mass.; former president of the American Institute of Mining Engineers; Bradley Stoughton, metallurgical engineer, secretary of the American Institute of Mining Engineers, New York; Dr. L. D. Ricketts, mining and metallurgical engineer, New York, N. Y.; Karl Eilers, metallurgical engineer, New York; W. R. Walker, metallurgist, New York; Dr. G. H. Clevenger, Professor of Metallurgy, Stanford University, Calif.

ECONOMIC GEOLOGY

Dr. Geo. Otis Smith, director of the U. S. Geological Survey, Washington, D. C., chairman; Dr. J. C. Branner, president of Stanford University, Calif., former president of the Geological Society of America; Dr. J. F. Kemp, professor of geology, Columbia University, New York, former president of the American Institute of Mining Engineers; Waldemar Lindgren, professor of economic geology, Massachusetts Institute of Technology, Boston, Mass.; C. R. Van Hise, president of the University of Wisconsin, Madison, Wis., former president of the Geological Society of America; David White, chief geologist of the U. S. Geological Survey, Washington, D. C.; Dr. I. C. White, state geologist of West Virginia, Morgantown, W. Va., formerly chief of the Brazilian Coal Commission; Dr. Bailey Willis, consulting geologist to the Argentine Government, geologist, U. S. Geological Survey, Washington, D. C.

APPLIED CHEMISTRY

Dr. Charles E. Monroe, authority on explosives, dean of graduate studies, George Washington University, Washington, D. C., former president of the American Chemical Society, chairman; Dr. Carl L. Alsberg, Chief of the Bureau of Chemistry, Department of Agriculture, Washington, D. C.; Dr. C. H. Herty, President of the American Chemical Society, Chapel Hill, N. C.; Dr. B. C. Hesse, chemist, New York, N. Y.; Dr. W. F. Hillebrand, chief chemist of the U. S. Bureau of Standards, Washington, D. C., former president of the American Chemical Society; F. A. Lidbury, electrochemist, president of the American Electrochemical Society, Niagara Falls, N. Y.; Dr. P. C. McIlhiney, chemist, chairman of the New York Section, Society of Chemical Industry, New York, N. Y.; Dr. Harvey W. Wiley, chemist, former president of the American Chemical Society, Washington, D. C.

As shown in the preceding statement, John Barrett, Director-General of the Pan-American Union, Washington, D. C., has been appointed secretary-general of the Congress. The duties of the committee members will be to render such aid as they can in furthering the purposes of the Congress by contributing papers and participating in discussions. Suggestions regarding the preparation of papers and more explicit information on the organization and work of the Congress will be given in later notices.

* * *

New Rules for Bonded Smelters

After several months spent in preparation, the Treasury Department has promulgated elaborate regulations covering the establishment of bonded smelting and refining warehouses under subsection 1 of paragraph N of section 4 of the Tariff Act, according to Washington dispatches. Copies of the new regulations are being sent out to officers of the customs and to smelters throughout the country. Besides providing for the establishment of warehouses, the rules make provision for entry for warehouse, materials, renewals of bond, discontinuance and other details relating to the receipt of ores or crude metals in bonded warehouses.

Among other things, it is provided that manufacturers engaged in smelting or refining or both shall immediately notify the Secretary of the Treasury regarding any material change in the character of the ore or base bullion processed. Manufacturers must also file with the Secretary an annual statement showing the quantities of ore and bullion on hand at the beginning of the period covered by the statement and the lead contents of the products. Representatives of the smelters who have seen the new regulations are of the opinion the rules call for much extra bookkeeping, with a corresponding increase in clerical hire.

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Starting of White Pine Operations

HOUGHTON CORRESPONDENCE

On Apr. 15 the White Pine mill will be completed. From Apr. 15 until May 1 it will be running intermittently, testing out and adjusting the machinery. On May 1 the mill will go into regular commission. So May 1, 1915, will go down in the history of Lake Superior mining as marking the birth of the latest, one of the largest and in many respects the unique mine of the district. In one long jump, it extends the copper-producing section westward for a distance of over 15 miles from the Victoria mine, the next producing property to the east. It marks the first attempt at mining on a large scale along the western extension of the copper belt. It also marks the second attempt at mining copper from a sedimentary bed, the Calumet & Hecla being the first in mining the Calumet conglomerate.

FOUR OPENING SHAFTS

The White Pine mine is opened by four shafts, two of which are equipped with five-ton skips and will be the principal producing shafts. There are over 14,000 ft. of drifts opened up to date. The principal pay rock occurs in a zone between two faults that are parallel to the shales and sandstone. These two faults are about 19 ft. apart. Included between the faults are two beds of sandstone separated by a bed of shale. These two beds of sandstone are called veins No. 1 and No. 2. Vein No. 1 is about 6 ft. wide and is near the hanging. The shale bed between the two is often highly mineralized with native copper, in some places running as high as 4 to 5%. Vein No. 2 is about 8 ft. wide and is below the shale to the foot. As a usual thing vein No. 1 carries the higher values, at places running as high as 15%, or 300 lb. to the ton. At some places the mineralization extends through both veins and the included bed of shale. At other places the two sandstone beds and the included shale bed carry, relatively to the richer portion, but a small amount of copper. It is not these excessively rich portions and the relatively leaner portions that can be used to arrive at the value of the rock.

The White Pine ore averages 5% for a width of 8 ft. It will probably be rock of this grade that will go to the mill for the first three years and there is sufficient of it opened to date to supply the mill for this period. The copper values are not confined between the walls of the two principal faults but extend into the slate that forms the hanging of vein No. 1 and into the sandstone that forms the foot of vein No. 2. However, the copper values gradually diminish in a direct ratio to the distance into both the hanging and foot from the principal hanging- and foot wall faults. Into the hanging-wall slate, at a distance of about 15 ft. from the hanging-wall fault, the copper values will diminish from about 30 lb. at the hanging-wall fault to about 12 lb. Into the foot wall the values will drop from about 30 lb. to the ton at the foot-wall fault to about 9 lb. in a distance of 10 ft.

A cross-section of the White Pine copper zone can be described as 15 ft. of copper-bearing slate in the hanging, with copper values starting at 12 lb. and increasing to 30 lb. at this hanging-wall fault; vein No. 1, 60 ft. wide, of exceptionally high copper values; 5 ft. of high-grade copper shale between veins Nos. 1 and 2; vein No. 2, 8 ft. wide, of copper-bearing sandstone, not so rich as vein No. 1, and in most cases not so rich as the included bed of shale; then 10 ft. of sandstone in the foot ending in copper values of about 9 lb. to the ton, giving a total width of copper-bearing rocks of 44 ft. The copper in the hanging-wall slate, the included shale between the two veins and in the foot-wall sandstone is of a much finer nature than the copper in veins Nos. 1 and 2.

Besides the two veins previously described there is another, known as vein No. 3, which lies into the foot wall at a distance of about 45 ft. at right angles to the bed from vein No. 2. This vein has been passed through in several crosscuts, and at each place where it has been cut it shows copper which will probably prove commercial after further development. Up to the present time no drifting has been done on vein No. 3. At the surface the dip is only 5°, increasing sharply from the second level until it reaches a maximum dip of 45° at the present bottom of the mine, which is 1100 ft. from the surface on the incline.

The recovery of copper will be at least 75%, and it is possible that it will reach 85%. The capacity of the mill is estimated at 1000 tons per day, but it will be operated at the rate of 500 tons daily for the first six months. If it is assumed that the rock will carry 4%, or 80 lb. to the ton, and that the recovery will be 75%, the daily output in copper will be 60,000 lb., or 18,000,000 lb. on a 300-day year when working normally. The rock is soft, cheap to mine and crush and the milling costs will be low; so this 18,000,000 lb. of copper should be made at a low cost.

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Big Pine-Lake Superior & Western Consolidation

EDITORIAL CORRESPONDENCE

An interesting consolidation of two Arizona mining companies is being effected through the efforts of Herbert C. Shotwell, a mining engineer, of Prescott, Ariz. The companies consolidating are the Big Pine Mining Co. and the Lake Superior & Western Mining Co. The former company, with about 200 stockholders, was promoted in New York about six years ago. The latter, with about 1200 stockholders, was promoted in the Lake Superior region three years ago.

The Lake Superior & Western Mining Co. has spent about $250,000 on the Mascot mine near Crown King, Ariz. A portion of this amount was spent for a 100-ton cyanide plant; but the ore supply proved to be of too low grade to pay. The Big Pine company, with property situated about 12 miles south of Prescott and about 50 miles from the Mascot mine, has been developing orebodies in a small way for the last six years. At present there is developed by adits, pits, raises and winzes about 48,000 tons of ore, having a gross value of $427,000. The ore occurs in a mineralized fracture in quartz diorite, having a width of from 3 to 4 ft. The content is gold, easily treated by cyaniding with a high percentage of extraction.

The consolidation will be effected as follows: The Big Pine Consolidated Mining Co. will be formed with a capital stock of 500,000 shares, $1 par value. Of this, 200,000 shares will be issued for the Big Pine properties and 200,000 shares to the Lake Superior & Western Co. for its mill and $32,150 in cash. The funds furnished are to be spent in installing the Lake Superior & Western mill on the Big Pine claims and doing further development work there. To finance this consolidation the Lake Superior & Western company has called an assessment of 10c. per share on its outstanding stock, which is now 50c. paid, the remainder being subject to call up to $1. This company also has outstanding bonds amounting to $136,000 which are held in small amounts by about 900 of its stockholders. The Lake Superior & Western company has a liberal contract and is given ample time in which to raise the funds required. The first payment on the contract has been made and work will soon be progressing rapidly at the Big Pine mine. Engineers have reported favorably on the latter property.

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New Silver Discovery in Canada

Special Correspondence

A persistent report of a silver strike that is said to be greater than Cobalt is causing much excitement in western Canada now. The situation of the discovery is said to be at Fond du Lac, a point at the northeastern end of Athabasca Lake, in northwestern Saskatchewan.

Prospectors on the Athabasca River

Large numbers of prospectors are now outfitting at Edmonton and other points, intending to make the trip as soon as the ice on the lakes and rivers goes out, which will probably be in the fore part of April, about a month earlier than usual, due to the mild winter. The accompanying photograph shows a party of prospectors *en route* for the silver country. They left early last fall. The illustration gives an idea of the rough water likely to be encountered in the trip down the Athabasca River.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINUM—Treatment of Aluminum to Render It Unalterable. Francesco Pucillo, Genoa, Italy. (U. S. No. 1,130,196; Mar. 2, 1915.)

ALUMINUM ALLOY. Alfred Wilm, Schlachtensee, near Berlin, Germany. (U. S. No. 1,130,785; Mar. 9, 1915.)

AMALGAMATING MACHINE. William Carson, Sydney, N. S. W., Australia. (U. S. No. 1,128,847; Feb. 16, 1915.)

AMALGAMATOR—Agitating Electric Amalgamator. Leon St. D. Roylance, San Francisco, Calif. (U. S. No. 1,128,905; Feb. 16, 1915.)

COPPER AND NICKEL—Process of Circulating Solution for Electrolysis. Noak Victor Hybinette, Christiania, Norway, assignor to Pacific Securities Co., Ltd., Toronto, Canada. (U. S. No. 1,128,315; Feb. 16, 1915.)

CRUSHER—Gyratory Crusher. Thomas L. Smith, Milwaukee, Wis. (U. S. No. 1,132,984; Mar. 23, 1915.)

CRUSHING—Ring-Roll Crusher and Pulverizer. Henry J. Shelton, St. Louis, Mo. (U. S. No. 1,132,042; Mar. 16, 1915.)

DRILL BIT. George Watson McAllister, San Francisco, Calif. (U. S. No. 1,133,161, and 1,133,162; Mar. 23, 1915.)

DRILLING—Direction-Indicating Attachment for Drilling Machines. Roy Addison Bowen, Commonwealth, Wis. (U. S. No. 1,131,596; Mar. 9, 1915.)

DRILLING—Dust Collector for Rock Drills. Emmet F. Galligan, Idaho Springs, Colo., assignor of one-half to Henry E. Woodward, Denver, Colo., and one-fourth to William H. Galligan, Idaho Springs, Colo. (U. S. Nos. 1,128,437; 1,128,674; and 1,128,675—Feb. 16 1915; and 1,131,052, Mar. 9, 1915.)

DRILLING—Dust Collector for Rock Drills. Frank Rylander, Dumont, Colo. (U. S. No. 1,131,009; Mar. 9, 1915.)

ELECTRIC FURNACE. John Blatchford, Oak Park, Ill. (U. S. No. 1,129,842; Mar. 2, 1915.)

ELECTRIC FURNACES—Process of Cooling Electric Furnaces by Air. Henri Magron Fos, Haute-Garonne, France. (U. S. No. 1,131,609; Mar. 9, 1915.)

ELECTRIC ZINC FURNACE with Integral Condenser. Charles Victor Thierry and Michel Thierry, Paris, France. (U. S. Nos. 1,122,663; and 1,122,664; Dec. 29, 1914.)

FERTILIZERS—Process of Separating Phosphorus from Its Phosphate Combinations. Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corporation, New York, N. Y. (U. S. No. 1,129,504; Feb. 23, 1915.)

FURNACE GRATE. Thomas M. Kekich, Chicago, Ill. (U. S. No. 1,131,524; Mar. 9, 1915.)

HOISTING—Controlling Device for Hoisting Engines. Sven T. Nelson, Chicago, Ill. (U. S. No. 1,129,045; Feb. 16, 1915.)

HOISTING BUCKET. Daniel B. Youngblood, Charlotte, Mich. (U. S. No. 1,128,397; Feb. 16, 1915.)

HYDRAULIC SEPARATOR for Phosphate Rock. Frank K. Hoover and Arthur J. Mason, Chicago, Ill. (U. S. No. 1,128,875; Feb. 16, 1915.)

IRON ALLOY. Walter Rübel, Charlottenburg, Germany. (U. S. No. 1,128,726; Feb. 16, 1915.)

IRON-ORE REDUCTION—Fuel-Briquet Composition for Iron-Ore Reduction. William Loesch, Chicago, Ill., assignor of forty one-hundredths to George B. Storer, Chicago, Ill. (U. S. No. 1,131,531; Mar. 9, 1915.)

JIG. John H. Magee, Carthage, Mo. (U. S. No. 1,128,807; Feb. 16, 1915.)

MINER'S CANDLESTICK. Theodore D. Lance, Butte, Mont. (U. S. No. 1,131,528; Mar. 9, 1915.)

ORE TREATMENT—Process for Treatment of Precious-Metal Ores for Extracting Their Values. Edward L. Dufourcq, New York, N. Y. (U. S. No. 1,133,110; Mar. 23, 1915.)

PHOSPHATE ROCK—Process of Treating Natural Phosphate Rock. Frank K. Hoover and Arthur J. Mason, Chicago, Ill. (U. S. No. 1,128,874; Feb. 16, 1915.)

POTASH RECOVERY from Natural Silicates. A series of patents on this subject, granted to Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corpn., New York. (U. S. Nos. 1,129,224, 1,129,505, 1,129,509, 1,129,510, 1,129,721; Feb. 23, 1915.)

REDUCTION FURNACE—Plant for the Reduction and Smelting of Ores. Edward D. Kendall, Elizabeth, N. J., assignor of one-half to Louis T. Haggin, Closter, N. J., and Margaret V. Haggin and Allan McCulloh, New York, N. Y., and H. Esk. Moller, Montclair, N. J., executors of James B. Haggin, deceased. (U. S. No. 1,131,709; Mar. 16, 1915.)

SCREENING—Vibratory Screening and Sizing Device. Arthur E. Custer, Salt Lake City, Utah. (U. S. No. 1,131,478; Mar. 9, 1915.)

SEPARATION—Screen for the Separation of Ores. Alfred H. Kidney, Orange, N. J. (U. S. No. 1,131,710; Mar. 16, 1915.)

SEPARATOR—Gravity-Trap Dry Separator. David F. Platner, Monterey, Calif., assignor of one-fourth to Ernest Michaelis and one-fourth to C. N. Tibbits, Monterey, Calif. (U. S. No. 1,131,081; Mar. 9, 1915.)

STEEL—Vacuum Process for Production of Steel. Eugen Dolensky, Frankfort-on-the-Main, Germany. (U. S. No. 1,131,488; Mar. 9, 1915.)

TUYERE CAP. Karl Landgrebe, Ensley, Ala. (U. S. No. 1,129,993; Mar. 2. 1915.)

Editorials

The Situation in Copper

Six months ago the price for copper was about 11c. per lb., unsold stocks were large, the big producers had reduced to a 50% basis and pessimism reigned. Not even the most optimistic in the trade could see anything cheerful in the outlook, and the common idea was that if the war should be prolonged beyond six months nothing but disaster was to be expected. Today we see copper above 15c., stocks of refined copper practically nothing and the big producers on a 75% basis. What was the reason for the error in the forecasts of six months ago?

It was simply that the military requirements for copper were grossly underestimated. The crisis in copper last August was due to the sudden loss of our principal customer—Germany. It was not considered that any probable demand for military purposes would be anywhere near the normal German demand for peaceful purposes. It was indeed foreseen that Germany's exports of copper manufactures would be replaced by exports from other countries to which we should supply the copper as previously we had supplied it to Germany; but even allowing for that it was considered by the big producers to be best to shorten sail and reduce production by about 50%. This was wise, although in looking backward we are able to see how mistaken was the diagnosis of all the doctors. Yet as things were then a maintenance of the production at the July rate or a general curtailment of only 25% might have precipitated the price to a level far lower than that to which it actually fell and might have led to disasters before readjustments could be effected.

About Nov. 1 large buying began and has continued ever since, with but slight interruptions. This has not reflected any noteworthy increase in purely domestic consumption, but has been chiefly for military purposes, cakes, ingots and wirebars being shipped directly abroad, or else to domestic manufacturers and thence abroad in manufactured forms. Not long ago there appeared about contemporaneously a German statement that the copper consumption of the German army was at the rate of about 100,000 metric tons per annum; and a British estimate that the Austro-German consumption must be at the rate of 112,000 long tons per annum. Germany and Austria-Hungary are not obtaining their copper from the outside, but the figures cited are indices that the copper consumption of the Allies is at least as great, and their copper is being supplied chiefly by America. The opinion is held in well informed quarters that all of these estimates are too low rather than too high.

Besides the buying for domestic consumption and for foreign consumption, military and industrial, there has been some speculative buying on marginned transactions anticipatory of the ending of the war and some advance buying for domestic consumption. Altogether the absorption of copper during the last six months has reduced the stocks at the disposal of American refiners to a very small quantity, and it is probable that there has also been a reduction in the stocks of blister copper. While there are no longer statistics about these, the statements of the refiners may be accepted freely, inasmuch as the advancing price and the willingness to increase production are confirmatory of them. Indeed, it is possible that the curtailment of production by 50% was carried on a little too long and that there may be temporarily a shortage of supply while the increased output of the mines is on the road to the refineries and while the refiners' vats are being restocked. Anyway, the situation is so developing that the new production of Inspiration and Chuquicamata, of which we shall begin to hear a good deal about the middle of this year, will be regarded with equanimity. Contributory, also, to the strength of the present situation is the fact that the copper ouput of Mexico is now reduced to a very small figure.

The Position of Amalgamated

The position of Amalgamated, now that it is reduced to a mere holding company, is of considerable interest. On Jan. 1, 1914, the Amalgamated Copper Co. held 3,070,784 shares of Anaconda stock and had outstanding 1,538,879 shares of its own. It, or rather the United Metals Selling Co., also held 42,570 shares of International Smelting & Refining Co. By the exchange of Anaconda stock for International, the Metals Selling Co. must have received 141,900 shares of Anaconda. In the recent sale of assets by the United Metals Selling Co. to Anaconda this stock was excluded, so that Amalgamated should now own about 3,212,684 shares of Anaconda.

On Jan. 1, 1913, the cash and cash assets of Amalgamated were $19,212,885. Its notes payable and current liabilities together were $24,427,524. However, we believe that it is necessary to add $2,308,318 to these liabilities to find the true cash position of Amalgamated, for the February dividend of Amalgamated was to be paid from these assets. Consequently it may be said that there was an excess of $7,522,957 of current liabilities over current assets. This amount should have been decreased in 1914. For each dividend paid by Amalgamated almost exactly the same amount was received from Anaconda dividends—in fact, after the exchange of Anaconda for International stock the amount received would be in excess. Therefore, against the Amalgamated's expenses would be applicable the two dividends received from International, interest on its Butte, Anaconda & Pacific holdings and the profits and commissions from its United Metals Selling operations. Yet, after all, the difference between these debits and credits cannot be great.

Against this what has the Amalgamated after liquidation of the liabilities? It receives about $6,000,000 cash for the United Metals Selling, stock and good will; it disposes of $4,769,900 of its fixed assets (Inspiration, Greene-Cananea, Mountain Trading Co. and other stocks) for cash, and it takes over about $1,600,000 in metals from the United Metals Selling Co. This gives it about $12,370,000 to apply against $7,523,000 of liabilities. So that

Amalgamated should now show an excess of current assets over liabilities of $4,847,000.

Consequently Amalgamated shows assets of 2.09 shares of Anaconda and $3.20 (approximately) per share. Therefore if Anaconda sells at 28¾, Amalgamated should sell at about 63¼.

Amalgamated is now purely a holding company, without that diversity of interests which is usually put forward as the reason for holding companies. As a collector of Anaconda dividends it must of necessity transmit them to Amalgamated shareholders less the payment of Amalgamated salaries and a rather burdensome Federal excise tax. As a market leader, it is thoroughly understood by everyone to be entirely wagged by the Anaconda tail, and it is, as a speculative stock, completely overshadowed by at least half a dozen others.

* * *

The American Mining Engineer and His Field

The American mining engineer has enjoyed an enviable reputation both as an examining engineer and as an efficient operating official. He has obtained in some instances eminent recognition outside his country, but as a rule his field has been the United States and Mexico. Must he not enlarge this field?

Long ago the British engineer found himself compelled to look to the world as his field of activity and we think the time is not far distant when the American mining engineer will also be forced to this view. We are not referring to the present surplusage of engineers, due largely to war in Europe and Mexico, but to the not-distant future when the scope of employment for mining engineers in the United States will find itself narrowing. There are still extensive mineral deposits to be developed in this country, but they will be, in the main, of low grade, involving larger operations than in the past, but fewer positions. There is no doubt that the cream has been skimmed off and it may be that the total number of positions open to mining engineers, as such, is declining rather than increasing in this country.

If the American engineer would remain in mining, he must consider the world his oyster, and prepare for its opening. Not only must he prepare himself, but he must educate our capitalists to a realization of the foreign opportunities; and our Government's weak-kneed policy in the protection of its citizens and their interests abroad must be altered. It is a well known and mortifying fact that American mining engineers abroad permit themselves to be mistaken for Englishmen, owing to the superior protection that the British government affords its people. Indeed, it has happened that American engineers have appealed for, and obtained, aid from foreign consuls, after being denied by our Government officials. Let us hope that the time will come when our Government will see to it that American citizens are accorded protection equivalent to that which British and German subjects enjoy in the pursuit of foreign trade.

The American nation up to this time has been busy with the development of its own country and has not ventured far afield in its investments. There are noteworthy exceptions to this, but in general it is true. At present only a comparatively limited number of our mining engineers direct their attention to the mineral possibilities of Central and South America. Then there are the enormous mineral resources of the Orient. We have in Asia today two striking examples—the Ridder mines in Siberia and the Bawdwin in Burma—where modern metallurgy has unlocked some remarkable deposits that were too refractory for the ancients. To be sure, American engineers are connected with both of the enterprises cited, but these engineers represent a comparatively small group who have recognized the extraordinary mining opportunities in some of the little-developed countries of the world.

The diversity and extent of the mineral resources of this country have afforded an excellent training ground for our engineers. Their efficiency, both as examining engineers and as operating officials, has been proved, but were 100 new mines opened in this country tomorrow, we would still have an excess of engineers. Is not the time at hand when the American engineer must take a major in foreign languages and geography, and follow his British brother into foreign lands?

* * *

The Shortage of Ships

One of the serious features of international business at present is the shortage of ships. Of the capacity existing before the war some has been destroyed, some has been interned, and much has been engaged in military operations. This has resulted in an ocean shortage that is calculated by London *Engineering* at 10 million tons.

The effect of this is felt acutely in the trade in metals, so much so that the European and American markets for copper, spelter, lead and tin are completely out of joint. Thus copper, spelter and lead sell in London at prices far above ours, and remain at an extraordinary disparity, for there are no free means for sending our products thither. The export business has become to a large extent a speculation in freights. The trader who has freight room under contract may reap large profits, while the buyer and seller who have been less forehanded can not tell how their transactions are going to result. We have heard of a sale of spelter to France, the seller to ship either in April or May at his option and to one of three ports at his option. Thus the buyer did not know when he was going to get his metal or where he was going to get it.

To make good the deficiency in ocean-carrying capacity sailing vessels have been returned to service and steam freighters are being transferred from the Great Lakes to the Atlantic, such of them as may pass through the Welland Canal, which admits the passage only of vessels of 14-ft. draft. While these additions help, there is no good prospect of an important amelioration of existing conditions so long as the war lasts.

* * *

The calcination of calamine used to be practiced generally by the zinc smelters of Kansas, but many years ago was abandoned as useless under their conditions. European producers of calamine have always continued this practice, however, especially for saving freight. It is interesting to report that the operators of the Potosi mine in the Yellow Pine district of Nevada are now calcining their ore, using crude oil for fuel. This ore has to be hauled 22 miles to a railway, and thence nearly 2000 miles to the smelting works, wherefore saving in, carting and railway freight is a very important consideration.

BY THE WAY

The recent murder of John B. McManus in Mexico City has inspired the verse artist of *Financial America* to the following:

A hundred Zapatistas are smashing in my door.
(The Stars and Stripes wave bravely just above it.)
A bomb is lying smoking close by me on the floor
(This watchful waiting's pleasant—how I love it!)

They've ripped the Grand Old Rag from the place it hung so long—
(That is, since Carranzistas trampled on it.)
I'd like to feel my Colt in the place it should belong.
(But watchful waiting will not let me don it.)

They've set my house afire; they're swiping all my goods
(I've heard at Vera Cruz our ships are lying.)
I'd give a million pesos to beat it for the woods.
(This watchful waiting's grand—but, Lord, it's trying.)

They've got me in a corner, a bullet's plugged me through.
(I hope my Uncle Sam will hear about it.)
They've kicked me and they've knifed me for cursing all their crew.
(They've fooled you, Woodrow Wilson, don't you doubt it.)

They had murder in their hearts, and now the murder's done.
(I'd hoped that Uncle Sam would show his face up.)
But I'll smile within my grave to hear the greasers run
When Uncle Sam comes down to clean the place up!

* * *

We have several times referred to the main obstacle to tin smelting in the United States being the unwillingness of Bolivian producers to make any long-time contracts here. Nevertheless it does not seem possible that we must always admit our inferiority to German and English smelters, and it is certain that if we can beat them on low tolls, tin concentrates will follow the usual laws of economics. But the more we look at the matter, the more we believe that success will eventually be obtained by a small smelter rather than a large one. The technical results obtained by some of the present junk smelters we have more than once touched upon. Possibly one of these will decide on trying tin smelting, and the following conversation would ensue between owner and foreman: "I want you to smelt down a lot of tin concentrates." "How will I do it?" "Aw, go do it yourself!" And he does it. The large smelter would sent out a committee composed of three directors, a superintendent, two chemists and a stenographer. This committee would visit all available plants and return with the report that it entirely depended on the man in charge, together with a bill for $19,360.17, from which the conclusion would be drawn that the enterprise did not promise a fair return on the capital expenditure necessary for investigation.

* * *

Cananea is still idle and no one ventures even to prophesy when work will be resumed there, the political situation being chaotic. At Nacozari, on the other hand, work goes on, but shipments are frequently interrupted, depending upon which party of combatants intermittently holds the railway. At present one party holds one end of the line and the opposite party the other end, and it does not always suit one party or the other to let trains move. On the whole, affairs at Nacozari have been quite amicable as between the company and the rival factions. The general manager of Phelps, Dodge & Co., in his annual report for the year 1914, says "The production of the Moctezuma Copper Co. has been curtailed by military measures affecting transportation in November and December. But that there may be no misapprehension as to existing conditions regarding our relations with the conflicting political parties in Sonora, it is my pleasure and duty to state that railroad transportation of materials and supplies has been interfered with solely for strategical reasons, and that invariably we have been treated with courtesy and consideration by the officers and troops of both sides." Only once—at the time of the occupation of Vera Cruz—was there advice that the Americans would best withdraw. They retired from the district, leaving the whole of the costly and complicated mining and milling plant in the hands of the Mexican staff, which continued the operation without interruption. During their absence of eight days the returns from the mines and mill were slightly in excess of the average. The Americans had reason to congratulate themselves that their Mexican assistants had shown themselves such apt pupils.

* * *

March Mining Dividends

Dividends paid in March, 1915, by 29 United States mining companies making public reports amount to $4,922,039, as compared with $7,098,732 paid by 27 companies in March, 1914. Industrial and holding companies allied to mining paid $5,317,112 as compared with $12,133,015 in 1914. Canadian and Mexican mining companies paid $630,382 in March, 1915, and $1,950,786 in March, 1914.

United States Mining Companies	Situation	Per Share	Total
Argonaut, g. . . .	Calif	0.10	20,000
Bingham-New Haven	Utah	0.10	22,869
Brunswick, g	Calif	0.06	23,717
Bunker Hill, g. . . .	Calif	0.02½	5,000
Bunker Hill & Sull., l	Ida	0.25	81,750
Butte & Superior, z	Mont	0.75	203,351
Caledonia, l.s	Ida	0.02	52,100
Calumet & Arizona, c	Ariz	0.50	308,693
Calumet & Hecla, c	Mich	5.00	500,000
Chino, c	N. M.	0.50	432,410
Duluth & Utah, l.s	Utah	0.01	2,250
Fed. M. & S., l	Ida	1.00	119,861
Golden Cycle, g	Colo.	0.05	75,000
Hecla, l.s.	Ida	0.01	10,000
Homestake, g	S. D.	0.65	163,254
Jumbo Ex., g.s.	Nev	0.05	48,584
Nevada Con., c	Nev	0.25	499,864
North Star, g	Calif.	0.20	50,000
Old Dominion, c	Ariz	0.50	81,000
Quincy, c	Mich.	1.00	100,000
Seven Troughs Coalition, g.s	Nev	0.02½	37,500
St. Joseph, l	Mo	0.05	70,470
Superior & Pittsburgh, c	Ariz	0.20	299,958
Tom Reed, g	Ariz	0.06	51,541
Utah Con., c	Utah	0.50	150,000
Utah, c	Utah	0.75	1,218,367
Yellow Aster, g	Calif.	0.02	2,000
Yellow Pine, l.z.s	Nev	0.03	30,000
Yukon, g	Alas	0.07½	262,500
Iron, Industrial and Holding Companies			
Amer. Sm. & Ref. Co., pfd	U. S.	1.75	875,000
Amer. Sm. & Ref. Co., com	Mex	1.00	500,000
Inland Steel	U. S.	1.00	78,836
International Nickel, com	U. S., Can.	2.50	948,133
Lackawanna, pfd	U. S.	1.75	612,115
National Lead, com	U. S.	0.75	154,915
National Lead, pfd	U. S.	1.75	426,436
Old Dominion of Me., c	Ariz	0.50	146,677
Phelps, Dodge & Co., c	U. S. Mex	3.50	1,575,000
Canadian, Mexican and Central American Companies			
Esperanza, s.g	Mex	0.24	165,848
Hedley, g	B. C.	0.50	60,000
Hollinger, g	Ont.	0.20	120,000
Kerr Lake, s	Ont	0.25	150,000
Lucky Tiger, g	Mex	0.10	71,534
Peterson Lake, s	Ont.	0.01¼	63,000

The totals for the first three months of the year are as follows: Mining companies, 1915, $9,520,928, as against $16,271,164 in 1914; metallurgical and holding companies, 1915, $15,896,449, as against $15,828,130 in 1914; Canadian and Mexican mines, 1915, $2,151,364, as against $5,365,157 in 1914.

Fatal Snowslide at Britannia Copper Co.'s Mines

SPECIAL CORRESPONDENCE

Serious loss of life was caused by a slide which occurred at the Britannia Mining & Smelting Co.'s copper mines on Britannia Mountain, near Howe Sound, Vancouver mining division, British Columbia, shortly after midnight of Sunday, Mar. 21.

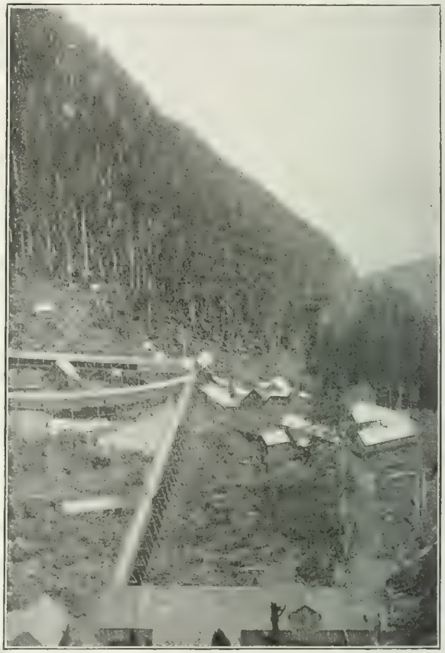
The group of mineral claims on which the company has opened several mines is situated in mountains of the Coast Range east of Howe Sound, about 20 miles directly north of, and 28 miles by water following the coast line from, Vancouver. Howe Sound is an irregular fiord, cutting well back into the Coast Range, and is bordered along its whole length by rugged mountains and high ridges. The Fairview mine, now being worked, is in the steep mountain ridge which separates Britannia Creek from Furry Creek and is about 4300 ft. in height. The principal workings are in the north slope of the ridge at a distance of three and a quarter miles from the coast and at an elevation of 3275 to 3775 ft. above sea-level.

A great mass of rock, earth and snow slid down from the mountain above the Fairview mine and swept through the camp, and thence down the valley to Britannia Creek, more than a mile away from the mine. Trestles carrying the tracks from the mines, rock-crusher and upper terminal of the aërial tramway, one bunkhouse, cookhouse, stores, offices and officials' cottages and other structures were crushed and either buried deep below a great mass of débris or carried down the valley in the slide. At the time of writing (three days after the slide) 25 bodies have been recovered, among them being those of a woman and her two children. Thirty-three persons are reported missing, including three or four women and several children. Those rescued include two dangerously, eight seriously, and thirteen slightly injured. An official report stated that there were known to have been in the upper camp 163 persons—137 men, 15 women, and 11 school-children. The above-cited figures, therefore, make it appear that the known dead, the reported missing and the recovered injured together number 81, so that 82 persons appear to have escaped. These probably were the men on night-shift underground and other persons living in the eight buildings, among them two bunkhouses, which were not touched by the slide. No such slide has ever been known in the camp before, although work has been going on here for at least 15 years.

The company for years has had its own well equipped hospital at Britannia Beach, with resident doctor and trained nurse always in attendance. Another company doctor lived in the upper camp, where there were several cots, a dispensary, etc. Only a few days before the accident a provincial government official was at the property giving company employees instruction in the use of pulmotors, three of which had been added to the mine equipment.

The Fairview mine is opened by six adits, with from 100 to 250 ft. between levels, with connecting raises from the 1050-ft. level, which is practically at the level of the camp. All ore from above the 1050-ft. level is dropped down the raises to that level, whence it is hauled by a three-ton electric motor to the rock-crusher at the upper terminal of an aërial tramway, the length of which from the upper camp down to the concentrating mill at Britannia Beach is 16,800 ft. This tramway is in two sections. The upper section is 5800 ft. long, with a drop of 1400 ft. to a reloading or transfer station, and thence the distance to the mill is 11,000 ft., with a drop of about 1900 ft.

During the last two or three years improvements have been made with the object of overcoming transportation difficulties attendant upon surface operations at the higher level where the deep snow impedes work in winter. A crosscut adit, known as the 2300-ft. level, starting a short distance from the intermediate station of the aërial tramway, was driven 4336 ft. into the mountain and an 8x12 raise driven to the 1050-ft. level above. A three-compartment shaft, 10x20 ft., starting 3922 ft. in from the portal of the new adit, was sunk to the 1050-ft. level. From the face of this adit a 3-ft.-gage track with 45-lb. rails has been laid to the portal, which is 2100 ft. above sea-level. From there haulage over three and a half miles of side-hill railway will be by electric locomotives. This railway has a maximum grade of 3% and leads to the head of an incline 5500 ft. long, with an average grade of approximately 30%, down to the concentrating mill 1600 ft. below. These late improvements, however, are not yet available for mine use, and the aërial tramway remains the chief means of communication between mines and mill.



SCENE PREVIOUS TO SNOWSLIDE. ALL EQUIPMENT AND BUILDINGS AT ANGLE OF COVERED TRACKS WERE WRECKED

In 1911 the company milled 240,000 tons of ore, from which 12,000,000 lb. of copper were recovered. Crude ore and concentrates amounting to 38,750 tons were shipped to the Tacoma Smeltery.

The Britannia Mining & Smelting Co. is controlled by the Howe Sound Copper Co.

PERSONALS

M. L. Requa is in New York in connection with the Alaska-Juneau flotation.

F. Close has left London for the Caucasus. He expects to return early in May.

H. W. Gepp, general manager of the Amalgamated Zinc Co. of Broken Hill, N. S. W., is visiting New York.

B. B. Thayer is going to Montana on a tour of inspection. He expects to return to New York about the middle of May.

E. P. Mathewson, who has been in hospital in Montreal, has enjoyed a complete recovery and has returned to Anaconda.

Charles Mentzel will leave New York on Apr. 3 for an exploration in the Republic of Panama. He will take with him a party of about 50 men.

Dwight E. Woodbridge, mining engineer, Duluth, Minn., recently returned to that city from a professional trip to the northeastern part of Washington.

H. E. Tuttle, formerly with the Edgar Zinc Co. at Cherryvale, Kan., is to be with the American Zinc, Lead & Smelting Co., at Caney, Kan., after April 1.

T. H. Jenks has returned to Denver from Central City, Colo., where he has completed some examinations, and left last week for New Mexico on professional work.

Joseph W. Boyle, general manager of the Canadian-Klondike Mining Co., was in New York this week, on his way from London to the company's property in the Yukon.

S. H. Brockunier of Nevada City, Calif., who has been in Pittsburgh for several months on business, visited Livingstone, Mont., to examine a mine in that vicinity.

F. H. Sistermans, who has been in Nicaragua for the Mines Management Co., has retired from that company and gone to El Paso, Tex., which will be his headquarters until further notice.

G. G. S. Lindsey, of Toronto, president of the Canadian Mining Institute, who recently returned from Europe has gone on a six-months' visit to China in connection with mining business.

Pope Yeatman will remain in Chile until about the end of May, when it is expected that operations will be going on regularly at Chuquicamata. He is expected back in New York about the end of June.

Leslie H. Webb, secretary of the Wedge Mechanical Furnace Co., was recently at San Francisco where he stopped to see the Panama-Pacific Exposition on his way from Montana to Philadelphia and New York.

Edw. W. Lawler has just completed a trip through the copper district of Michigan and the gold and silver camps of Porcupine and Cobalt, Ont., in the interest of the Jeffrey Manufacturing Co., of Columbus, Ohio.

T. H. Sheldon, who has been connected with the Portland Gold Mining Co., Victor, Colo., for 15 years, has been appointed purchasing agent of the Vindicator-Cresson consolidation, and has offices at 603 Symes Building, Denver.

OBITUARY

G. E. Copeland, of Los Angeles, Calif., was at the Britannia Mine, Howe Sound, British Columbia, at the time of the recent disastrous snowslide, and has since been missing. It is believed that he was lost in the slide.

W. C. Green, well known to the Western mining trade for the past 25 years, and for the past six years representative of the mechanical goods department of the Diamond Rubber Co., died Feb. 13, from an attack of pneumonia. Mr. Green's work will be carried on by C. A. Tracy.

Frank L. Clerc died last month at Denver, Colo. He was born in Pennsylvania in 1861. Graduated from Lehigh University, he engaged in zinc smelting at Bethlehem and became a considerable authority in this art. For the first volume of the "Mineral Resources of the United States" he wrote a monograph on the practice of zinc smelting in the United States which was the best contribution on that subject in its time and is still a valuable work for reference. Also he contributed the article on the metallurgy of zinc to the 10th edition of the "Encyclopedia Brittanica." He was one of the early experimenters upon zinc smelting in the blast furnace. During recent years he was a resident of Colorado and was not actively engaged, but he maintained his interest in his specialty, and only last winter was in New York exhibiting a model of a new form of distillation furnace that had occupied his attention for several years.

Joseph Obalski, president of the Montreal Chambre de Commerce Française, and for 28 years director of the Bureau of Mines of the Province of Quebec, died at his residence in Montreal Mar. 25 after a short illness. He was born in France in 1852, his father being a Pole and his mother a French woman, and educated at the High School of Mines in Paris, beginning his career as a mining engineer in 1877, and shortly after going to Canada. In 1881 he was appointed director of the Quebec Bureau of Mines, which position he resigned in 1909. He devoted much time to exploration and was the author of many reports and monographs on mining matters. He was also for some time a professor in the Ecole Polytechnique of Laval University, Quebec, and served a term as vice-president of the Canadian Mining Institute. After resigning as head of the Bureau of Mines, he removed to Montreal, where he practiced as a consulting engineer. Mr. Obalski made many explorations in Northern Quebec, especially around lakes Chibougamou and Obatagamou, and was keenly disappointed when the government abandoned the proposal to extend the coloniztion road from Lake St. John north into the Chibougamou country. He was also much interested in the exploitation of the iron sands of the north shore of the St. Lawrence. He adhered naturally to the French school of geologists in his general work. He was a man of strong character and held decided opinions, which he was always ready to defend; those who opposed him usually found they had a formidable antagonist in discussion. His opinions however, did not affect his friendships, and his death will be regretted widely in Canada.

SOCIETIES

American Institute of Mining Engineers—A meeting of the Southern California Section will be held at the Hotel Clark, Los Angeles, Apr. 8. Algernon Del Mar, of Los Angeles, will read an important paper on the "Mechanics of Crushing."

A meeting of the New York Section will be held Apr. 7, at the Machinery Club, 50 Church St. The meeting will be preceded by a dinner. Following the dinner there will be a discussion of the "Economic Side of Safety and Sanitation" as applied to the mining and metallurgical industry, in which a number of prominent members have already promised to take part.

Institute of Metals—The annual general meeting was held in London Mar. 18 and 19. Routine business was disposed of, but the annual dinner was omitted. The following papers were submitted and discussed: "Some Experiments upon Copper-Aluminum Alloys," by J. H. Andrew; (2) "The Constitution of the Alloys of Copper with Tin. Parts I and II," by J. L. Haughton; (3) "Etching Re-Agents and Their Applications," by O. F. Hudson; (4) "The Effects of Heat and of Work on the Mechanical Properties of Metals," by Professor A. K. Huntington; (5) "The Quantitative Effect of Rapid Cooling upon the Constitution of Binary Alloys. Part III (Conclusion)," by G. H. Gulliver; (6) "The Properties of Some Nickel-Aluminum and Copper-Nickel-Aluminum Alloys," by Professor A. A. Read and R. H. Greaves; (7) "Some Appliances for Metallographic Research," by W. Rosenhain; (8) "The Micro-Chemistry of Corrosion. Part III. The Alloys of Copper and Zinc," by S. Whyte.

TRADE CATALOGS

Frenier & Son, Rutland, Vt., Catalog Frenier Spiral Pump. 12 pp., illus., 3x9 inches.

Automatic Steam Trap & Specialty Co., Detroit, Mich., Catalog 8. 16 pp., illus., 6x3½ inches.

The Lunkenheimer Co., Cincinnati, Ohio. Spanish Catalog Number 41. 128 pp., illus., 9x6 inches.

The Lagonda Mfg. Co., Springfield, Ohio. Booklet, Lagonda Boiler Room Specialties. 14 pp., illus., 6x3½ inches.

A reprint of the National Founders' Association rules for the safe operation of cranes has been prepared by the Whiting Foundry Equipment Co., Harvey, Illinois. This reprint is of size suitable for posting on the wall and will be sent free on request.

Editorial Correspondence

SAN FRANCISCO—Mar. 25

Improved Conditions in North End Comstocks are reported. Consolidated Virginia has a fine prospect on the 2500-ft. level where pay ore was disclosed in the northeast drift. Extension of the drift shows a strong quartz vein 30 to 36 in. wide assaying $1 to $4 per ton. This is in hitherto unexplored territory and is considered especially important on this account. Union Consolidated work is being carried forward both north and south on the vein from the west crosscut on the 2650-ft. level, showing streaks of good ore. Mexican is stoping on and under the 2300-ft. level. Satisfactory progress is reported in the new 2700-ft. drainage work and the recovery of the level is expected soon. The pumping association reports progress. Heavy winches for handling the centrifugal pumps in the Con. Virginia winze have been removed to the joint Mexican and Ophir winze and placed on heavy concrete foundations. Compressed air hoist for handling men and materials also placed in the winze.

Brunswick Consolidated Gold Mining Co. operations at Grass Valley, Nevada County, for the last year were interesting not so much for the increased yield and constant payment of large dividends as for the methods of mining and the per ton cost of production. The mine produced 16,237 tons of ore at a cost of $10.221 per ton, yielding $17.76 per ton. The cost of production per ton of ore mined and treated was equal to the gross value per ton of ore produced in a great many mines of the state. In fact $10 ore in most of the mines of the Mother Lode region would be considered bonanza ore, and if the cost of mining and treatment exceeded $3 per ton it would be considered excessive. Even $17 ore in the ordinary course of mining would not be expected to stand a cost of $10 per ton. But the making of a mine has been the policy strictly adhered to and the results amply justify the practice. The report of the general manager states that the per ton cost of production could have been reduced to $7.50 if the management had been content to suspend operations at the new shaft and reduce the dead work to a minimum, and keep the mill going with ore from the stopes above the 1250-ft. incline level. The new vertical shaft was deepened 240 ft. at a cost of $91.94 per ft. The total depth of the new shaft is 1100 ft. The company expended in the year about $45,000 for development and improvements, and the contemplated development and new metallurgical equipment in 1915 will probably exceed this sum.

SALT LAKE CITY—Mar. 26

The Zinc Ores of the Tintic properties as well as mines in other parts of the state are being given considerable attention. Among the properties shipping this class of material are the Colorado, Iron Blossom, May Day, Uncle Sam, Yankee, Sioux Consolidated, Beck Tunnel, Godiva, Gemini, Ridge Valley and Chief Consolidated in Tintic. The present output of this camp is between 1350 and 1500 tons of zinc ore a month. The average grade is about 28 or 29% zinc; the lowest grade that can be marketed carries 24 or 25% zinc, and the higher grades 35 up to 40%. The ore is largely oxidized, consisting principally of the carbonate, smithsonite. Most of the shipments are made to Iowa and Altoona, Kansas. The Bullion Coalition and D. W. Lynch at Stockton, and the Ophir Hill Consolidated at Ophir are shipping zinc ores. The Cedar-Talisman, Hornsilver and other properties in Beaver County are also shipping. Some of the Beaver County zinc shipments go to Bartlesville, Oklahoma.

The Growth of the Mining Industry in the intermountain states during the last five years is shown by data compiled by the National Copper Bank of Salt Lake City. The production of silver, copper, lead, zinc and gold from 1910 to 1914 in Utah, Idaho, and Nevada is given, together with the value of this production for the period. The value of the metal output of Utah in 1910 was $31,655,049; for 1911, $34,325,503; for 1912, $42,922,302; for 1913, $44,858,210; for 1914, $38,000,000. In addition to the above, a table showing the production of other minerals including coal, asphalt, cement, stone, clay products, hydrocarbons and rare metals is given. The value of this output in Utah ranged from $7,578,657 in 1910 to $8,748,310 in 1913, the latest figures obtainable. From a table giving the production from the rest of the country, including Alaska, during the same period it is shown that Utah mines have more than held their own, having gained 12.8% during the period 1910-1914, whereas the rest of the country increased only 10.8%. Taking the three leading metals, silver, copper and lead, there has been a gain of 30.8%, as compared to a gain of 8.4% for the rest of the country. The gold production, always the smallest but one, was the only one that has steadily fallen, and this is explained by the decrease in the output of Mercur, Utah, and the decrease in shipments of outside ores principally from Goldfield, Nevada. This is much more than offset by the increased production of other metals. The production of silver, lead and zinc has advanced steadily each year beyond the preceding one. The growth of the industry is such that what is called a poor showing in 1914 exceeds the high output of 1910 and 1911. Attention is called to the stabilizing and energizing effect on every local industry by the constant inflow of cash from the sale of Utah's mine and smelter products.

The Muddle in the University of Utah Affairs continues. A suit to forfeit the charter of the university has been prepared by members of the alumni association, alleging that the enabling act reserving Federal land for the institution has been violated, by reason of the University having become a sectarian institution. Col. E. A. Wall has withdrawn the Wall scholarship maintained by him in the metallurgical department. Various meetings of alumni, and Salt Lake clubs, including the Federation of Women's Clubs, have been held to discuss this situation and to urge a public investigation of university conditions. A meeting of 350 students was held to ascertain the number who intended to return next year. Almost everyone signified his intention to have returned had no trouble in the faculty arisen, but only 34 announced their intention to return next year, in the event that the professors who have submitted their resignations are not retained. The president of the University asserts that there will be no trouble in filling the vacancies on the faculty, but those of Salt Lake citizens who have the interest of the University at heart are not so sanguine about this. The Federation of Women's Clubs has wired to all state universities in the country asking them not to employ any of the resigned professors until they have received a full statement of conditions and they have passed resolutions demanding the reinstatement of the resigned members. Charges of political and church influence are rife. Of the 13 regents of the University, nine are members of the Mormon Church. Three out of the four members of the executive committee are also members of the Mormon Church. The four members of the faculty dismissed, and the ones demoted are all Gentiles. The man elected to succeed to the head of the department of English is a Mormon bishop, who is said to have had no experience in university work. It is alleged that the professors were forbidden to discuss either religion or politics in their class work. The president of the University combats the accusation that the institution is dominated by the Mormon Church, by quoting figures to show that 75% of the population of the state is Mormon, and that the percentage of Mormons on the faculty is, therefore, not out of proportion. Former U. S. Senator Joseph L. Rawlins is said to have been active in the matter of the proposed suit against the University to have the Federal Government take away the grant giving land to the university. This suit, it is feared, will bring many complications because all land grants given to the State were included in the enabling act which gave the land allotment to the University. A prominent member of the Alumni Association suggests that the president be made president emeritus, for two years, which would enable him at the end of that time to retire on the Carnegie pension fund, which action, he believes, would remove the stumbling block and enable a satisfactory solution of the problem.

SEATTLE—Mar. 22

That the New Tolovana District gives greater promise of becoming a scraping or dredging than a drift-mining camp is the opinion of many Fairbanks mining men. Pay running from 60c. to $3 per sq. ft. has been reported from several claims, but nothing definite will be known until water runs and sluicing commences in the spring. The most recent report of pay is from the mouth of Gertrude Creek, which enters Livengood at 4 above Discovery. The depth to bedrock is 50 ft. and the pay goes $1 per sq.ft. Below Discovery nothing of importance has been found. Prospects are also reported from various other creeks, including Cacy, Wilbur, Ruth, and Mike Hess. Over 200 claims have been recorded from the district to date and many others have been staked. The general belief at Fairbanks is that, although nothing of startling richness has yet been discovered, there is still an excellent chance that a permanent camp will be developed.

The Second Territorial Legislature of Alaska, now in session at Juneau, will probably make short work of the so-called Roden mining law, which was passed two years ago to supplement the Federal law. Two bills have been introduced looking to the repeal of the law, known as the Act of Apr. 30, 1913, either of which will leave the situation exactly as it was before the first legislature met. The Roden law had some good points but was generally unpopular throughout the Territory, and in view of the failure of the first attempt to improve on the Federal law it is likely that the present legislature will repeal the old act and go slowly in the making of new supplementary regulations. Another bill of interest to miners is one introduced by Senator Aldrich of Nome to provide for the care of aged and penniless prospectors. These are now sent to the Pioneers' Home in the abandoned army barracks at Sitka, where the cost to the Territory for each inmate is $29 a month. The Aldrich bill provides for a cash allowance, or pension, and permits the prospector to reside in his home district, where he can contribute to his own support by trapping, hunting, etc. In this way it is hoped to remove the stigma of pauperism and at the same time to decrease the cost to the Territory.

WALLACE—Mar. 25

Zinc Mining in the Coeur d'Alenes has come to be an important factor in the life of this district, and it is possible that it may supplant lead in the position of first importance. A few years ago zinc was a positive detriment to the district, but owing to its new importance on account of the effect of the war on foreign production, it is no longer the subject of anathema for the miner. The state mine inspector is authority for the statement that the third largest zinc mine in the country is in Idaho, the Interstate Callahan which by the way is doing considerable new construction and expansion. The Frisco mine abandoned years ago because of the increased zinc content in its lead ore has been reopened for its zinc. Thus times change.

GOLDFIELD—Mar. 26

No New Development in the apex litigation between the Booth and the Jumbo Extension has occurred this week. Both companies are cleaning out the old workings in their mines to facilitate the work of the experts in their investigations, and the Booth is sinking a new inclined shaft for the sole purpose of establishing clearly its claims to extralateral rights on this vein. During the week, a meeting of the directors of the Merger was held, and the question of the validity of the sale of the Velvet claim to the Jumbo Extension by the Merger was raised by the minority directors, Ericson and Smith. Practically all of their motions relative to investigations and criticisms of this sale were voted down by the other three directors and the two minority directors left the meeting. Subsequently the majority of the board passed a resolution declaring the sale by the company was valid, and expressing willingness to have the validity of the sale investigated or tested, apparently accepting responsibility therefor. Mr. Smith was served with notice the day before the meeting of a suit brought by a Goldfield bank to recover upon his promisory note for $16,610, dated Apr. 29, 1911. The note was for six months, and no part of it has been paid. Just why action was not brought before is not stated, and whether it has any connection with the differences in the board of directors is also not stated but Smith's holdings in the Merger have been attached in connection with this note suit. The management of the Lone Star Consolidated has suspended operations in shaft No. 2 on the extreme southwestern section of their property on account of the uncertainty which has arisen through the apex litigation which is now disturbing the camp. All of this muss and the pending and threatened litigation over apex of various veins here and in Tonopah argue very strongly for the repeal of the present apex law and the establishment of vertical boundary lines which would eliminate all of this costly, unproductive, and uneconomic litigation.

LORDSBURG, N. M.—Mar. 27

The Local Mining District is holding its place as the second largest producing area of copper in the State and according to present plans the output will be largely increased. The obstacle of ore-transportation from the mines to the railroad, a distance of over three miles, is being removed. A caterpillar tractor with hauling capacity of 60 tons, will be put to work next week, the operators have sub-leased all ore freighting contracts. Men from Clifton, Ariz., are promoting the project. The Arizona & New Mexico R.R. has notified intention to build a spur from its lines to the mines, protecting its right-of-way with the state corporation commission. During February 143 carloads of ore were shipped to El Paso and Douglas smelteries from Lordsburg. The 85 Mining Co. has finished its new power house and has ordered a double-drum electric hoist to be installed in the main tunnel level, replacing the gasoline hoist. It has also contracted for air drills and is making preparations for a larger output. The Bonnie Mining Co. has finished its new power house and is now operating two shafts. During development in the No. 2 shaft a blind ledge showing better ore than any other place on the property, was encountered. The intentions are to sink 500 ft. and connect with the No. 1 shaft, farther down the hill. In general, the producing mines of the camp are in an excellent condition. The Lees' Peak mines are being developed and are making encouraging progress.

The Discharge of Tailings from the mills of the Socorro Mining & Milling Co., the Ernestine Mining & Milling Co., and the Deadwood Mining & Milling Co., of Mogollon, Socorro County, into the 'Frisco River must stop or the state will take action toward abating the nuisance. Complaints have been made by the farmers of Greenlee and Graham counties in Arizona that the tailings discharged by the Mogollon companies are carried through irrigation canals and deposited upon the land of private owners and that the sediment thus deposited is injurious to both the lands and the crops growing thereon. The state also complains of the nuisance on the account of state land being under cultivation and irrigated by waters from the streams carrying the Mogollon mill tailings. The Attorney General of Arizona who made the notification states that the Socorro Mining & Milling Co. is making an effort to abate the nuisance but that the other companies have made no effort to end the trouble and that unless something is done at once he will take legal action. In his letter to the companies he refers to the case of the State of Georgia vs. the Tennessee Copper Co. and the Arizona Copper Co. vs. Gillespie. In the first case the United States Supreme Court enjoined the Tennessee Copper Co. and the Ducktown company from discharging noxious vapors into the atmosphere to the detriment of the crops in Georgia, across the line. In the same court the Arizona Copper Co. was enjoined from discharging its tailings into the San Francisco River which supplied the irrigation waters for the settlers holding lands in the Gila valley.

HOUGHTON—Mar. 31

In the Kearsarge Lode the most important physical development since its commercial exploitation by the Wolverine was the footwall development inaugurated in the South Kearsarge shafts three years ago. Formerly the foot wall was considered the outside limit of commercially possible rock. In 1913 two-thirds of the tonnage was mined from the footwall and during 1914 the same proportion was secured from the footwall. The rock is averaging close to 18 lb per ton. The tonnage from the shafts, 1 and 2, will run close to 40,000 during March. Not only is this rock showing the highest copper contents of any mined by this company, but it is the cheapest mined. Notwithstanding the impression that the South Kearsarge is about ready for abandonment, the fact is that active mining operations from practically all openings continue in both shafts and while the drifts have been extended to the property limits in most instances, the lower levels have by no means been worked out.

Every Producing Mine in the Copper District is turning out all of the copper it is possible to produce without increasing its working forces. The total output of copper for April will be larger than for March although the figures for March will show large increases. Lake Superior mines are profiting substantially from the European war. Whether the demand for copper will continue at the close of the war or whether the market will fall to pieces is concerning the mine managers deeply. There are numerous instances of the spread between the prices secured for Lake Superior's best brands of metal and its poorest brands. And the spread between Lake brand and electrolytic brand is greater than it has been in years, to the advantage of Lake. The spread has been so noticeable that some of the inferior brands have been re-smelted in order to bring them up to the qualifications required for the government contracts. The fact that there is such a premium for Calumet & Hecla and other high grade Lake Superior brands and that the market is pretty well cleaned of these brands at a season of the year when the docks usually are loaded with copper, indicates conclusively that this is due to the continuance of the war and the manufacture of war munitions by concerns in the United States.

Annual Report of Isle Royale shows that there is but one solution of the problem of making this property over into a paying mine—that is a great increase in production. Two years ago plans looking toward that consummation were made. With copper at 13c. it is just possible for Isle Royale to get a new dollar for an old dollar. The margin is close. Last year there was practically no profit; the cost of copper was 13.05 and the copper brought 13.16c. per lb. Isle Royale, like Quincy, is a very low grade proposition, and requires the closest economy to make it pay. And it cannot be operated on a small scale under any circumstances without a loss. On a daily rock tonnage of 2000 tons Isle Royale must sell its copper at 14c. to make a profit. An average of 14c. for the output cannot be figured on. If the rock tonnage can be maintained at 3000 or better Isle Royale can make a profit on a 13c. metal and pay dividends on 14c. And that is what may be expected in the latter half of 1915 if present plans mature. The rebuilt stamp mill will be able to care for about 2000 tons daily, which is a large demand for continuous performance for a three-stamp mill. And two heads in the Point Mills plant will be ready for use for this company at that time. The openings in the mine are extensive enough to enable a production of 3000 tons per day. The present year ought to see Isle Royale get into her stride and 1916 ought to see her come into her own again.

The Question of Wages is one that will have to be met very soon. There is no doubt at all that every mine would increase wages if there was any reasonable surety that the metal prices would remain where they are. A wage-scale increase does not, in reality, influence the pocket books of such a large number of men as is generally supposed. At the Calumet & Hecla and all its different mines and subsidiaries, both the trammers and miners are on contract systems. This contract system has been the vogue at the Calumet & Hecla for many years and has worked out satisfactorily to the men and to the company. When the Calumet & Hecla interests took over the Bigelow mines they put the contract system more generally in force in those mines. The men get larger pay checks and the company gets a larger tonnage of rock. With this system operating on at least 10,000 underground employees it is creditable to the management that there is so little friction and such general appreciation of its advantages. When the European war broke out and different plans were put into effect at different mines the Calumet & Hecla reduced wages 10%, putting the pay back to the rate in effect when copper is under 15c. per pound and the mines worked three-quarters time. Officers and salaried men were cut 15 per cent. The result was that every underground man speeded up and the contract miners were able to make their monthly income show pretty close to regular figure, even on part time. Since then the salaried men have had their pay restored and the presumption is that the 10% raise will be made to the miners just as soon as the stability of the metal situation seems assured and some substantial sales are made at the higher prices for delivery within 30 or 60 days. Outside of the Calumet & Hecla and subsidiaries there have been some instances of increases in pay, bringing the scale up to that which now is paid at the Calumet & Hecla, but there are others which continue to operate at a scale lower than that. So far as the employees are concerned there is no talk of any further labor trouble. The Finns have established themselves solidly against the red socialists, and the Croations likewise have held meetings and have gone on record as opposed to the United Mine Workers or any other labor organization. The mining companies have not added to their working forces to any extent as yet and there is plenty of labor to be had. Practically all of the agitators have left the district, finding it rather unhealthy.

DULUTH—Mar. 27

A Bill to Limit the Per Capita Expenditures of any village or city in the State of Minnesota to $25 has been introduced in the state legislature by the mining companies owning properties on the Mesabi range, who have risen in arms against the extravagant expenditures of money by villages on the range. The bill has been reported on favorably by the committee to which it was referred and will undoubtedly become a law. In the majority of villages on the Mesabi the mining companies pay about 95% of the taxes and they have been objecting strenuously to the way money has been squandered. They presented many pages of evidence before the committee, and the legislators from districts where the per capita tax is only $5 and $10 were amazed at the startling figures from the Mesabi. It was shown that the village of Buhl spent $125 per capita in 1914; Keewatin, $374.10; Mountain Iron, $120.21; Hibbing, $85.36. The figures for the other towns was just as startling. The village of Hibbing had 1318 votes at the last election, but there has been an average of 852 persons on the village pay roll during the last 14 months. Hibbing has 668 metal ornamental lighting poles, more than the city of Cincinnati, installed at a cost of $81,833. Hibbing employed 40 policemen during 1914, while Duluth, with 10 times the population, had only 80. Hibbing levied a village tax in 1914 of $750,000 and spent $1,169,733, and had on Feb. 1, 1915, outstanding warrants amounting to $1,252,596. Hibbing has a population of about 11,000 inhabitants. The village of Chisholm, with only a few thousand inhabitants, levied for village purposes only in 1914, not including school taxes, the sum of $319,483, and in eight months of that year spent $475,280. On Mar. 1, 1915, the town had outstanding warrants amounting to $495,131. Public improvements in Chisholm since 1908 have cost $1,002,086. The village of Buhl cast 172 votes at the last election, and has had 113 persons on the pay roll during the past 13 months. Keewatin cast 143 votes in the spring election of last year, and had 161 men on the village pay roll in July. Hibbing has paved virtually every street to the village limits and nearly all of the alleys. The township of Stuntz spent in 1914 more than $900 for every voter. During the past winter Chisholm established a conservatory in her palatial high school and grew tomatoes that ripened at a cost of $30 each. When Chisholm wanted a ball team she put her hired ball players on the municipal pay roll. The village of Buhl uniformed its village band out of the village treasury and sent it through Minnesota in a private car. The new Chisholm high school, which was erected at a cost of $268,000, will this year graduate a record class of 10 or 11 pupils. It is said that Hibbing employs a bright young man who devotes his time to thinking up new jobs for the faithful. If the city of Minneapolis had as many city employees in proportion as Hibbing, her pay roll would carry fully 30,000 men. It is not surprising that the mining companies should object to the way that money has been squandered, when it is remembered that the mines have to stand most of the taxes. The per capita tax in towns on the Michigan ranges is only about $8 to $10 and the towns there are just as well off as in Minnesota where money has been thrown away. The towns in Michigan have fine streets, good lighting, water and sewer systems and everything else that is necessary, but they have received full value for the money which they have to get these improvements. The same is true in the sections outside of the mining regions in Minnesota, and the legislators from there were surprised at the way matters have been handled on the Mesabi range.

GALENA, KAN.—Mar. 20

The Old Cyclone Mine, situated on the Land and Cooley land northeast of Galena, is again being put into operation. It once was one of the richest mines in the district, but the former operators had a cave-in and operation ceased. The mine has been idle for 25 years. J. Franklin Smith, of Joplin, Mo., has purchased a quarter interest in the mine and believes it will only be a matter of a few weeks until an excellent mill proposition will be developed, as a good run of ore has already been encountered.

CHIHUAHUA, MEX.—Mar. 23

The Viewpoint of an American, a long time resident in a peaceful section of Mexico, would be different than that of one viewing the situation with the perspective of greater distance; nevertheless, the following correspondence is of value and, seeming to bear out his optimism, is the fact that the letter of date arrived on practically schedule time:

Mining Operations in Northern Mexico have been greatly hampered during the past few months by a shortage of labor and freight handling facilities. In many of the smaller camps, away from the railroads, it has been impossible to get labor, while even in the larger camps some of the mines have had not more than half the men needed. In the state of Chihuahua, mines having railroad connections have been reasonably well served in the way of transportation, but where mule or wagon freighting has to be depended upon it is very difficult to get supplies to the mines or ore to the markets. How long the present conditions are going to continue is impossible to foretell, but the belief seems to be general that, if the party now in control of all northern Mexico is as successful during the next few weeks as can reasonably be expected, conditions will soon become better. Even now, confidence seems to be reviving, and a number of American companies have sent their engineers into the state of Chihuahua in search of favorable investments, and a number of properties have been bonded and some have been purchased outright. At Santa Eulalia, Parral and Santa Barbara the mines are operating about as usual. The mines and mills at Batopilas are producing about 30,000 oz. of silver monthly. The Chihuahua plant of the American Smelting & Refining Co. is operating a sufficient number of furnaces to handle the ore of the district, and will blow in other furnaces as needed. It is reported that the government has taken over the smelting plant at Santa Rosalia and is operating it on local ores. The smelting works at Torreon has resumed operations and at least one mine in this district has made shipments of ore to it.

The Mining News

ALASKA

THE CHICAGOF MILL will be increased to 25 stamps. About 108 men are employed at mine and mill and 40 more on Monroe & Barker timber contract.

ENTERPRISE (Limestone)—This company doing development work on holdings at Limestone, plans installation of five-stamp mill. W. A. Irwin is superintendent.

SHROPSHIRE, ZUBER & CAMERON (Ruby)—Operators found pay on Little Pup, tributary of Poorman, and are driving tunnels and laying in supply of wood for summer.

CONSOLIDATED MINES (Fairbanks)—This San Francisco company will send engineer to examine 2000 acres of ground in Tatlanika placer district. Tract is known as Timmons property and lies near cañon; suitable for dredging, hydraulicking, or scraping.

VAN CURLER (Fairbanks)—Van Curler spent most of winter prospecting ground on middle fork of Big Chena River, but had much trouble with water in shafts. On Palmer Creek, Fred Struthers and partners have prospected ground thoroughly and constructed bunkhouse, messhouse and boilerhouse in preparation for busy season.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Directors have voted to resume operations at mine.

Gila County

OLD DOMINION (Globe)—Conditions improving slowly in mine water situation. Pumps gaining on water below 1400-ft. level. Rainy season apparently over; no further difficulty expected.

Maricopa County

RUSSIAN (Phoenix)—Carl M. Hooper will install a new hoist and other equipment on group of claims in Congress district.

Yavapai County

GRAY EAGLE REDUCTION (Mayer)—Reported will build plant near here for treating ore by means of electric reduction.

FORTUNE (Prescott)—Two 50-hp. gas engines freighted from Prescott to 10-stamp mill on Big Bug Creek. When they are installed stamps will begin dropping.

CALIFORNIA

Butte County

STAMP MILL INSTALLATION contemplated by L. E. Osborn at his mining property at Deer Lake.

BELL (Forbestown)—New five-stamp mill nearing completion. Lower tunnel encountered oreshoot 1000 ft. in from the portal. Raise at this point will be driven for ventilation.

Eldorado County

IVANHOE (Garden Valley)—Stamp mill removed from Georgia Slide mine to this mine where quantity of good ore is ready for crushing.

RISING HOPE (Placerville)—Development of this drift gravel mine reported to warrant installation of crushing mill built by the Placerville foundry. Air shaft from lower drift to surface is completed.

OTTER CREEK (Georgetown)—J. B. Kelliher is operating one of largest shooters in this region. Is installed on creek at intersection of Quartz cañon and Deadman's gulch, and sets on bedrock extending 30 ft. along stream. Is 16 ft. wide at bottom and 96½ ft. wide at top. Height from bedrock to bottom of bulkhead 25 ft. 4 in. Gate 30 ft. wide, 6 ft. high and hinged every 6 ft. With several hundred feet of backing it discharges approximately 23,000 in. of water for five minutes.

Santa Clara County

QUICKSILVER MINING (New Almaden)—Proposed new reorganization under Virginia laws to own total stock of New Almaden company owner of 25-year lease on quicksilver mines. To receive 20% royalty from latter company. Company operated at loss for several years.

Shasta County

MOUNTAIN COPPER (Keswick)—New concentrator has started operation. At mine 265 men employed, largest force in five years.

COLORADO

Lake County

EMPIRE GOLD DREDGING (Leadville)—Has leased from Derry Mining & Land Co. 1500 acres of Derry ranch, about 10 miles from Leadville, in the Arkansas River Valley. Proved area containing coarse gravel consists of 125 acres approximately 35 ft. deep, disclosed about 20c. per cu.yd. The New York Engineering Co. will furnish 6-cu.ft. electric-driven dredge, wood hull, all-manganese-steel buckets.

IDAHO

Shoshone County

HYPOTHEEK (Kingston)—Plans for long aërial tramway and new mill completed. Funds provided by recent bond issue.

MICHIGAN

Copper

NEW ARCADIAN (Houghton)—At 900 ft. showing of vein matter is better than at any point in development of this property, particularly to the north, where drift is in 150 ft. At this point character of rock is similar to that shown at 250 ft. Vein has widened out to 12 ft. and commercial rock shows a good portion of that distance.

QUINCY (Hancock)—Production continues at maximum capacity for three shafts. Have been no difficulties with air-blasts for five months. Liberal use of rib-work for back filling in lower levels proving an effectual barrier. First series of air blasts were nine years ago. Rock packs used in small way and stood test for three years. In 1914 air-blast troubles brought about thorough eramination of general conditions. Management satisfied that rib-work system is best means of limiting damage done.

Iron

MUNRO (Iron River)—Now working full crews at all its mines in Iron River field. Operations resumed two months ago after a shut-down of five months.

INDIANA (Iron Mountain)—This is first mine on Menominee range to ship ore this spring. About 125 cars being sent out daily to Thomas Furnace Co., Milwaukee. Mine was opened only a few months ago. Flow of water has increased to 700 gal. per minute.

BALKAN (Alpha)—Winston Bros. are assembling their forces and will start stripping within a few days. Part of overburden was removed last summer with drag-line buckets and by fall most of dirt will have been removed. No ore will be shipped this year.

BRISTOL MINING CO. (Crystal Falls)—Several drills are still being operated between Crystal Falls and Fortune Lake. Results of work are not being given out. Churn drills are being employed to test ledge. Deeper holes will be put down with diamond drills after preliminary drilling is completed. Territory has always been considered promising for iron ore.

CRYSTAL FALLS (Crystal Falls)—Detroit parties have secured an option on this mine, which has been idle for sometime, and will start development work. Old north workings will be thoroughly explored. It is believed that orebodies of Hilltop and Victoria mines form a junction at north end of Crystal Falls property. Shaft may also be put down deeper to reach a small orebody known to exist below bottom level.

MONTANA

Silver Bow County

BUTTE DULUTH (Butte)—Property closed down. Doors and windows boarded up. Throws 110 men out of work. No explanations made by receiver or management.

TUOLUMNE (Butte)—Plans made for early resumption of deepening of shaft to 2800-ft. level which will be 100 ft. below adjoining North Butte 2800-ft. level. Both mines lost Jessie and Edith May veins at 2200 ft., North Butte finding better ore on 2800-ft. level.

NEVADA

Douglas County

RUBY HILL (Gardnerville)—Property in Pine Nut range, 14 miles west of Gardnerville, bonded and work started. Incline shaft, 140 ft. deep, equipped with gasoline hoist and pump. Some lateral development on two levels and in two tunnels. Small tonnage good copper ore opened. Considerable churn-drill prospecting done in surrounding territory.

Esmeralda County

SIMMERONE (Goldfield)—Shaft will be sunk 200 ft. deeper.

GREAT BEND (Goldfield)—Small mill will be enlarged, making possible treatment of all ore, and eliminating costly wagon haul. Regular shipments from 150-ft. level being made.

ATLANTA (Goldfield)—Recent strike 1750-ft. level raise making good. Twelve feet of 30-ft. vein averages $30 and remainder $10 per ton. Have shipped five carloads ore from this strike this month.

GOLDFIELD CON. (Goldfield)—Annual report 1914 shows 338,192 tons ore produced; 332,750 tons averaging $12.57 milled and 5442 tons averaging $29.01 were shipped. Total net operating costs $5.91 per ton. Net profit $1,036,533 against $1,486,013 last year.

Humboldt County

PLACER GOLD AT BUFFALO PEAK, 30 miles from Lovelock, discovered. Gold pannings made for distance of one mile along gulch. Scarcity of wood and water will make prospecting difficult.

ROCHESTER MINES CO. (Rochester)—New 10-stamp mill, expected capacity 100 tons daily, began operations Mar. 13; first mill in this camp. Stated 100,000 tons milling grade ore on dumps of Rochester. Extension of railroad from mill to mines at head of Rochester cañon will be started soon.

Lincoln County

PIOCHE ORE SHIPMENTS for week ended Mar. 25 amounted to 80 cars estimated 1000 tons valued at [illegible], compared with 84 cars for each of the two weeks previous. Shippers were Prince Consolidated, 73 cars; Amalgamated-Pioche, 6 cars zinc ore, and Big Four Exploration, [illegible]

Lyon County

NEVADA-DOUGLAS (Ludwig)—Stockholders meeting held recently and voted to reorganize. New company, to be known as Nevada-Douglas Consolidated Copper Co., incorporated under laws of Utah for 1,000,000 shares, $5 par value. Nevada-Douglas share holders receive share for share in new company. Moore Mining Co., included in consolidation, will receive 10,000 shares. Indebtedness of both companies assumed by consolidated company.

Mineral County

ESMERALDA COPPER CO. (Luning)—Compressor will be installed and more extensive work done.

LUCKY BOY (Hawthorne)—Tunnel now under Hubbard shaft. Crosscuts will be driven and raises lifted to old workings above. Small seams silver ore opened.

GIROUX (Luning)—Operations resumed on this group 14 miles north of Luning. New compressor will be installed and shaft sunk to water level, 600 or 700 ft.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 20 was 10,940 tons estimated gross milling value $222,880. Producers were: Tonopah Belmont, 3910; Tonopah Mining, 2950; Tonopah Extension 1730; West End, 998; Jim Butler, 1150; Tonopah Merger, 150 and Montana-Tonopah, 52 tons.

HALIFAX (Tonopah)—Three machines started development work recently on 1050-, 1161- and 1200-ft. levels.

NORTH STAR (Tonopah)—Winze from 1050-ft. level cut 2½-ft. oreshoot of good grade at depth of 35 ft. Raise now being lifted from level below to connect.

TONOPAH BONANZA (Tonopah)—Power line 4000 ft. long from Nevada-California company's main transmission line being built to provide power for pumps and compressors. Steam will be used for hoisting until depth of 900 ft. is reached.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—Company is building a first-aid house, 30x60 ft., to be fitted up with latest apparatus for use in case of accidents. Dr. F. P. Wilbur of Franklin Hospital will give lectures and demonstrations to employees on first-aid work.

SOUTH DAKOTA

Lawrence County

MOGUL (Terry)—Capacity of mill has been gradually increased to 120 tons daily, best previous month's run averaged 100 tons daily. An additional agitator will be installed.

NEW RELIANCE (Trojan)—During past fiscal year stamp mill treated 23,088 tons ore, average 63.1 tons per day. Bullion recovery $3.12 per ton, or 91.8%. Sand is leached; slime treated by continuous decantation, followed by dewatering and washing on Portland revolving-drum filter.

GOLDEN REWARD (Deadwood)—During past few months considerable work of remodeling has been done at cyanide plant. New equipment includes Dorr and Trent apparatus in steel tanks, circular steel ore bins, tube mill and crusher. Continuous decantation will be tried. No changes made in sand treatment. Plant operating at 150 to 200 tons daily capacity.

UTAH

Beaver County

MOSCOW (Milford)—Lead-silver ore has been opened in another place in the Back vein, by a winze from the 100-ft. level.

CEDAR EXTENSION (Milford)—Stock of this company recently listed on local exchange. Last shipments made in 1906. Joseph Geoghegan is president.

CEDAR-TALISMAN (Milford)—Several cars of zinc ore have been shipped recently. Underlying the zinc, in the mine 2½ ft. of silver-lead ore has been found, and under the lead is zinc, again.

LEONORA MINING & MILLING (Milford)—Silver-lead ore has been opened for 195 ft. on the strike at this property in Star district. There is some zinc along border of the lead.

HORN SILVER (Frisco)—The recent strike of lead-silver ore in the Clayton lease on the 150-ft. level has been opened 100 ft. on the strike and five sets in width. This ore is about 125 ft. from King David line. Horn Silver has taken a year's lease on part of neighboring ground.

Juab County

TINTIC ORE SHIPMENTS for week ended Mar. 19 totaled 96 cars, estimated at 4800 tons, valued at $120,000, compared to 74 cars previous week. Shippers were: Centennial-Eureka, 20; Iron Blossom, 18; Eagle & Blue Bell, 9; Chief Consolidated, 8; May Day, 8; Gemini, 7; Lower Mammoth, 5; Dragon Consolidated, 4; Beck Tunnel, 3, Sioux Consolidated, 3; Victoria, 3; dumps, 3; Gold Chain, 2; Colorado, 2; Uncle Sam, 1 car.

TINTIC STANDARD (Eureka)—Silver-lead ore is being mined on 1200-ft. level. Another 200 ft. of sinking may be done. E. J. Raddatz is manager.

MAMMOTH (Mammoth)—After having been tied up for the winter, water line owned by this company supplying the town of Mammoth was placed in commission the week ended Mar. 13. Work at the mine has been resumed with 20 men. Development is being done on the 600 ft. level.

Salt Lake County

CARDIFF (Salt Lake)—Shipments being made irregularly on account of condition of roads.

MONTANA-BINGHAM (Bingham)—Ore running unusually high in copper was cut by lessees in north drift in Bingham Amalgamated ground.

MAXFIELD (Salt Lake)—Payment made on this Big Cottonwood property under bond and lease by F. H. Vahrenkamp. Electrically driven pumps being installed to unwater old workings. Car lead-silver ore shipped from above tunnel level.

Summit County

SNAKE CREEK TUNNEL (Park City)—Average monthly advance during 1914 was 341 ft. Face of tunnel now under backbone of ridge at depth of 2500 feet.

Tooele County

CLIFF (Ophir)—Zinc ore has been developed at this property and shipment will soon be started.

WASHINGTON

GOLDEN KING (Spokane)—Plans erection of new milling plant near Oroville, Wash.

IDAHO PLACER (Spokane)—Company owning about 1000 acres placer ground in Idaho and Washington reported, by Pohlman Investment Co., agents, ready to invest $18,000 for machinery and equipment.

WASHINGTON & NEVADA DEVELOPMENT (Bellingham)—Having plans prepared for number of improvements at its mining properties near Virginia City, Idaho. Property will be equipped with 50-ton concentrator, 10-stamp mill, cyanide tanks, etc.

CANADA

Ontario

REA (Porcupine)—Has stopped underground development and let contract for diamond drilling.

KRIST (Porcupine)—Will be developed this year by an English company. The property adjoins the Porcupine Crown.

LALLY (Porcupine)—Will carry on more extensive development work this season. Main vein on 100-ft. level shows 12 ft. of $5 ore.

NIPISSING (Cobalt)—Production cost per ounce for past year was 18c. which is about 6c. lower than for preceeding year. Earnings for year about $1,600,000.

TEMISKAMING (Cobalt)—Rich vein coming in from Beaver continues to show improvement. Opened up for 80 ft. on 400-ft. level and 125 ft. on 500-ft. level.

PETERSON LAKE (Cobalt)—Statement for quarter ended Jan. 31 shows surplus of $182,380 as compared with $208,471 for previous quarter. During period 20 sacks of ore were obtained.

CANADIAN COPPER (Copper Cliff)—Has authorized the expenditure of $500,000 to sink new shaft at Creighton Mine and to erect 85 workmen's houses and several new mine buildings.

HOLLINGER (Porcupine)—Regular 4-weekly statement for period ended Feb. 25, shows gross profits $154,714, from 22,438 tons of ore, average value $11.39 per ton, working costs $3.98 per ton milled. Mill ran 96.3% of time. Motor cars equipped with storage batteries have been installed in mine to convey ore from working shafts.

COBALT TOWNSITE (Cobalt)—Solid piece of high-grade silver ore about 4 ft. square and 10 in. thick weighing approximately 2600 lb. and assaying 4000 oz. per ton, found in doing surface work on vein located about a year ago. Was concealed by an overburden of 4 ft. of earth. Vein has been stripped for some distance.

MEXICO

Chihuahua

CIENEGA (Ocampo)—Second payment on this mine, made by Qualey Bros., of New York, purchasers; about 100,000 tons of $20 ore are blocked out above 500-ft. level. Are installing cyanide plant, 2000 tons, monthly capacity. Adit will be driven to explore mine at depth.

YOQUIVO IMPROVEMENT (Yoquivo)—Is operating its mines and 20-stamp mill at practically normal output. Company has hydro-electric power plant five miles from mine which supplies 175 hp., which is a little short of requirements; deficiency is supplied by 175-hp. Corliss engine. Wood is used for fuel.

CUSI MEXICANA (Cusihuiriachic)—Has its mill about ready to operate, and the Cusi Mining has started work on a 100-ton mill in which it is said flotation process will be used to treat large tonnage of lower grade ores that have accumulated during last six years; no ores carrying less than 60 oz. silver per ton having been shipped.

CORRIGAN & McKINNEY (Concheño)—This firm of Cleveland, Ohio, is doing great deal of development work on their mines in western Chihuahua. Tunnel several thousand feet in length being driven to develop orebody at depth of about 600 ft. below present workings. Mine equipped with large mill and cyanide plant has for years been steady producer of gold and silver. Reported to have recently purchased the Hidalgo mine 15 miles northeast of Concheño, from which place transmission line will be built to carry current from hydro-electric power plant of the Concheño mines.

Hidalgo

UNITED STATES S. R. & M. CO. (Pachuca)—Real del Monte and Pachuca properties handling 1400 tons per day, short while ago tonnage down to 400, normal mill capacity 2000 tons. Comparatively little hostility shown by insurrectionists at any time. No property damage.

CHILE

CHILE COPPER (Chuquicamata)—Cable from Pope Yeatman quoted announcing expected starting up of power plant middle of April. Plant will then be ready to supply current to mine and mill.

The Market Report

METAL MARKETS

NEW YORK—Mar. 31

Copper, tin, lead and zinc have all been higher, the strength of copper being especially noteworthy. The tin market is in a condition which causes it to experience erratic fluctuations.

At the annual election of the New York Metal Exchange, Mar. 29, the following officers were chosen: President, A. B. Hall; vice-president, Edwin Groves; treasurer, Chas. S. Trench. Members of the board of managers, H. W. Hendricks, Emil Baerwald, W. Parsons Todd, Erich Benjamin, L. Vogelstein, Julius Loeb, Edward W. Starke, Tobias Wolfson. Arbitration committee, Charles J. Marsh, J. H. Lang, R. F. Pearson, Edwin J. Keane, C. M. Loeb. Inspectors of election, C. H. Bolles, Jr., Fred Steiner, J. J. Archer; C. Mayer, secretary.

Copper, Tin, Lead and Zinc

Copper—The situation in this metal is just as we summarized it last week, viz., a strong statistical position and producers well sold ahead, wherefore the market exhibits a rising tendency upon a relatively small demand. Business during our last week of record was of only moderate volume and even so the sales of producers were largely in foreign markets. Yet there was a sharp advance in price. At the beginning of the week some round lots were sold to domestic consumers at 15⅜c., regular terms, corresponding to about 15.20c., cash, New York. By March 29, 15¾c. was realized on some small business, but there were free sellers at 15½@15⅝c., regular terms. Toward the end of March 30, sellers realized 15⅝c., regular terms, on some substantial sales, and on March 31, the market was about 15⅝@15¾c., regular terms. Higher prices have been realized on sales for delivery to certain non-competitive points and upon sales in London which at the moment is the best copper market. On March 30-31, copper was quoted in London at £76¼, and sales were effected there at £76, equivalent to about 16¼c. per lb. Such a price was realized, however, only on copper already over there or by shippers who could make quick delivery from here. However, shipments cannot be freely made on account of the scarcity of freight room, which, of course, is the reason why the London market is entirely out of joint with New York.

There were some peculiarities in the domestic market last week. Sellers who were able to make deliveries abroad or to non-competitive points in this country were indifferent with regard to the Eastern market, and asked prices considerably above the figures at which there were free sellers. Among the latter there was reported in some quarters an inability to sell at the prices that were reported realized in other quarters. It was rumored that some copper previously bought speculatively was being offered for resale by second-hands.

Exports of copper from the United States for the week ended Mar. 13 are reported by the Department of Commerce at 19,039,265 lb. The larger items were 9,222,174 lb. to Italy, 8,332,748 lb. to Great Britain and 1,121,155 lb. to France. Imports included 2,677,313 lb. metal and 5,017,044 lb. in ore and matte; 7,694,357 lb. in all. The greater part came from Chile.

Copper sheets were advanced ¼c. on Mar. 25 and again ¼c. on Mar. 27; the base price is now 20¾c. for hot rolled and 21¾c. for cold rolled. Usual extras charged and higher prices for small orders. Copper wire is quoted at 16½@16¾c. per lb. carload lots at mill.

Tin—This market has continued to be only a nominal affair, the price being swung cents per pound by selling offers or buying orders of only a few tons. At the beginning of March, the stock on hand was 2000 tons, and 2100 tons was imported during the month, making a total supply of 4100 tons. Atlantic Coast deliveries were 2300 tons and Pacific Coast deliveries, 900 tons, a total of 3200 tons, leaving a stock of 900 tons on hand at the end of March.

The British Government has prohibited the exportation of tin from the Straits to other than British ports. Efforts are being made to obtain special permits for shipments to consumers in the United States.

The British Board of Trade states that applications for licenses to export to the United States tin, chloride of tin, and tin ore (recently placed in the British embargo list) will in general only receive consideration when shipments are to be consigned to the British consul general at New York. Shipment of these products to the Netherlands will only be permitted when consignment is to the Netherlands Oversea Trust, and exportation is only allowed to such of the other neutral European countries as have placed an embargo on tin, chloride of tin, and tin ore.

Lead—Sales for export were again large, although the participation in this business was not so general is in previous weeks. The business was hampered by inability to obtain sufficient freight room. Buying for export in St. Louis has raised the price in that market almost to even terms with New York. There were some domestic inquiries for tonnages in the

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Mar.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb.
25	4.7950	50½	15.20 @15.25	*46	4.15 @4.20	4.10 @4.20	*8.17½ @8.92½	*8.00 @8.75
26	4.8000	50½	15.25 @15.30	*47	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
27	4.7988	49½	15.25 @15.35	*47	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
29	4.7950	50⅛	15.35 @15.55	*53	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
30	4.7988	50¼	15.45 @15.55	*52	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75
31	4.7975	49⅞	15.50 @15.60	*52	4.15 @4.20	4.10 @4.20	*8.42½ @8.92½	*8.25 @8.75

* Nominal.

The quotations herein are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts, and represent, to the best of our judgment the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Mar.	Silver	£ per Ton	Cts. per Lb.	3 Mo	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
25	23 13/16	68½	14.88	69¼		162½	161½	23⅛	5.02	44½	9.67
26	23¾	68¾	14.94	69⅝		165¼	164	23⅛	5.02	44½	9.67
27	23⅝										
29	23⅝	68½	14.88	69⅛		170	166½	23⅛	5.02	44½	9.67
30	23¾	69	14.99	69⅝		172½	168¾	22½	4.80	44	9.56
31	23⅝	69¼	15.05	69⅝		171	168¾	22½	4.80	44	9.56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver, which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £15 = 3.21c.; £20 = 4.28c.; £30 = 6.42c.; £40 = 8.56c.; £60 = 12.84c. Variations, £1 = 0.21⅜c.

market but whether they reflected an ultimate use of the metal in this country, or not, is another matter. However, there were some moderate inquiries for municipal work, which is to be expected at this season of the year.

Spelter—Business amounting to some hundreds of tons of spelter for April-May delivery was done during the week, first at prices of 8@8¾c., according to delivery, then at 8¼@8¾, the range showing a tendency to contract. This market is not, however, upon a wholesale basis, producers being unable to dispose of round lots at the present level. Domestic consumers show no interest whatever in deliveries beyond May, and scarcely any interest in April and May. Nor does Europe exhibit any disposition to buy at present prices. The market holds up simply for the absence of any pressure to sell, producers waiting to see whether Europe is going to buy at the present level or not. During the last week some small sales were made to France. Some producers are entirely sold out for April, but others have considerable April spelter available. For May the position is undoubtedly easier. The test of this market will come when either sellers or buyers try to put it on a wholesale basis.

Zinc sheets are quoted today at $13.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The manufacturers are receiving a number of inquiries from abroad.

Other Metals

NEW YORK—Mar. 31

Aluminum is a little more active than it has been, but still rather quiet. Prices are unchanged, at 18¾@19c. per lb for No. 1 ingots, New York—**Antimony** is scarcer and future supplies uncertain, owing to foreign embargoes and war demand. Ordinary brands bring 21½@23c. per lb., and an advance is expected. Cookson's is nominal and hard to get; 31@32c. per lb. has been paid—**Nickel** is unchanged, ordinary forms being 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. higher—**Quicksilver** is still in rather short supply. For large lots in New York the price is nominally $67 per flask of 75 lb., with no sales reported. Small lots have sold at $75@80 per flask. San Francisco price is reported at $62.50@65 per flask for domestic orders; market quiet. London price is £12 10s. per flask, with £12 5s. named from second hands.

Gold, Silver and Platinum

Silver—The market has been more erratic the past week resulting in a decline. Reports from London, however, are to the effect that allowing for reactions the outlook for silver is considered rather favorable.

Platinum—The platinum market remains dull and quiet, with small business reported. Prices are unchanged at $38@40 per oz. for refined metal and $43@47 per oz. for hard metal, according to grade.

Our Russian correspondent writes that there is little change in the market. From Ekaterinburg it is reported that firm holders are gradually concentrating the offerings of platinum made by small producers and speculators. Prices quoted for crude metal, 83% platinum, are 8 rubles per zolotnik at Ekaterinburg, and 31,000 rubles per pood at Petrograd—equal to $30.08 and $30.38 per oz., respectively.

A general meeting of Russian gold and platinum producers is being held at Petrograd. A special report on the platinum industry and the effects of the war thereon is to be presented.

Zinc and Lead Ore Markets

JOPLIN, MO.—Mar. 27.

Blende, high price, $63; assay base, 60% zinc low in lead, $60@58; with increase of lead base declined to $48; metal base, $52@46; calamine base, 40% zinc, $35@30; average, all grades of zinc, $59.84. The apparently high average is caused by over half the shipment being purchased one week ahead of settlement. Lead, high price, $53; base, $50 per ton of 80% metal content; average, all grades of lead, $50.99 per ton.

The shipment is an increase of 900 tons blende and a decrease of 350 tons of calamine. Buying orders for blende were largely increased at the lower level of prices.

SHIPMENTS, WEEK ENDED MAR. 27

	Blende	Calamine	Lead	Values
Totals this week	10,583,140	194,370	1,313,060	$361,940
Totals this year	127,315,570	11,157,010	19,028,200	4,542,800

Blende value, the week, $323,050; 3 months, $3,883,410

Calamine value, the week, $8110, 3 months, $208,650.

Lead value, the week, $33,480; 3 months, $450,710

PLATTEVILLE, WIS.—Mar. 27

The base price paid this week for 60% zinc ore was $58@60 per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS, WEEK ENDED MAR. 27

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	3,298,710	61,000	387,730
Year to date.....................	47,572,970	679,390	4,359,330

Shipped during week to separating plants 3,072,030 lb. zinc ore.

Iron Trade Review

NEW YORK—Mar. 31

The iron and steel markets continue to show a cheerful tone. Domestic orders have been moderate only, but export business is heavy, and the mills are kept up to a good average.

The pig-iron market has been stirred up by large sales of foundry iron by the Buffalo group of furnaces. The iron was offered at a reduction, $12 per ton at furnace for No. 2X foundry, and found many buyers both in small and large lots. Sales were made covering second and third quarters.

There is some talk of speculative buying, especially of Southern iron, but nothing at all definite has been brought out.

Steel Rail Production in the United States in 1914, according to the preliminary statement of the American Iron & Steel Association, was 1,945,095 long tons. This compares with 3,502,082 tons in 1913, and with 3,977,887 tons in 1906, the year of greatest production.

PITTSBURGH—Mar. 30

Unofficial estimates are that the export bookings of the Steel Corporation since the first of the year have been running at close to a quarter million tons a month, and while such estimates may possibly be excessive the total bookings, including the unusually large proportion of export business now being taken by the independent steel interests, are in all probability more than double the rate at which export shipments were actually made during the first six months of the war.

In all branches of the finished steel trade bookings of domestic orders have lately been fully as great as at any time since the general improvement started four months ago and in the past two or three weeks the majority of mills have had better bookings than at any previous time in the movement. For two months those who at first doubted the genuineness of the steel movement have been looking for signs of a falling off in demand and have found none.

The steel mills are operating at between 65 and 70% of their ingot capacity, and in several branches of the finishing trade, such as wire, tinplate, steel pipe and merchant bars, operations are almost normal. The structural business has been extremely dull, but is looking up somewhat. Specifications are now beginning to come in at a fair rate against rail contracts placed some time ago.

IRON ORE

A few cargoes of Cuban and Swedish iron ore have arrived at Philadelphia and Baltimore, but imports so far this year have been light.

Nothing has been done yet as to Lake ore prices for the season. It is expected that the opening of the season on the Lakes will be late.

COKE

Coke production for the week in the Connellsville region is reported by the "Courier" at 279,442 short tons; shipments, 281,384 tons. Production in the Greensburg and upper Connellsville districts, 37,176 tons.

Chemicals

NEW YORK—Mar. 31

The general market shows rather more firmness, though business is rather irregular in most lines.

Arsenic—Demand is not large, but supplies are only moderate and rather uncertain, at least so far as importations are concerned. Quotations are about $4 per 100 lb., for both spot and futures.

Copper Sulphate—Business continues steady. Prices have been again advanced 25c. and are now $6 per 100 lb. for carload lots and $6.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business has been fair. Prices are rather firmer, and 2.30c. per lb. is quoted for all positions this year.

Pyrites—Imports at Baltimore during the past week included two cargoes, 8198 tons, of pyrites from Huelva, Spain.

PETROLEUM

Exports of mineral oils from the United States in February were 151,742,942 gal.; an increase of 1,199,509 gal. over February, 1913. For the two months ended Feb. 28 the total exports were 313,836,208 gal. in 1914, and 298,512,643 gal in 1915; a decrease of 15,323,565 gal., or 4.9%, this year.

Assessments

Company	Delinq.	Sale	Amt
Big Elk, Ida	Apr. 15	May 15	$0.001
Bobby Anderson, Ida	Apr. 12	May 3	0.0025
Caledonia, Nev	Mar. 8	Mar 31	0.05
Challenge, Nev	Mar. 31	Apr. 21	0.05
Confidence, Nev	Mar. 11	Mar 31	0.10
Copper King, Ida	Mar. 1	Apr 1	0.005
East Hercules, Ida, (post.)		Apr 7	0.001
Eastern Star, Ida	Mar. 25	Apr. 25	0.002
Emerald, Utah (three instal.)		June 9	0.01
Enterprise, Ida	Mar. 20	Apr. 20	0.002
Florence, Ida	Apr 15	May 4	0.001
Galena King, Utah	Mar 25	Apr 25	0.0075
Gethin Le Roy, Utah	Apr 21	May 6	0.01
Giant, Ida	Apr. 9	May 14	0.002
Great Falls, Utah	Mar. 18	Apr. 22	0.01
Idaho-Nevada, Ida	Mar 10	Apr. 2	0.002
Indiana, Mich	Feb. 4	. .	1.00
Ivanhoe, Ida	Apr. 10	May 10	0.002
Jack Waite, Ida	Mar. 1	Mar. 24	0.01
Kentuck, Nev	Mar. 18	Apr. 7	0.02
Keystone, Utah (post)	Feb. 23	Mar. 23	0.02
Laclede, Ida	Mar 20	Apr. 6	0.003
Lucky Boy, Nev	Apr. 9	Apr. 28	0.01
Majestic-Idol, Nev	Dec. 15	Jul. 20	0.005
Nabob, Ida	Mar. 18	Apr. 12	0.005
Neva, Utah	Mar. 18	Apr 12	0.002
Nevada-Douglas, Nev	Apr. 24	....	0.10
Oreano, Ida	Mar. 25	Apr. 26	0.0015
Pandora, Ida	Apr. 15	May 7	0.003
Pioche Metals	Mar. 20	Apr. 20	0.0025
Rio Grande, Utah	Mar. 25	Apr 17	0.003
Saltese, Ida	Mar. 1	Apr. 1	0.002
Samson, Ida	Apr. 3	May 3	0.002
Selma, Utah	Mar. 20	Apr. 6	0.0025
Silver Cliff, Ida	Apr. 3	Apr. 24	0.0025
Smuggler	Apr. 17	May 17	0.0025
Sonora, Ida	Mar. 15	Apr. 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Syndicate, Ida. (post.)	...	Jan. 28	0.001
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Utah, Nev	Mar. 25	Apr 15	0.02
Wolf Mountain, Utah	Mar. 15	Apr. 14	0.0015

Stock Quotations

There was a slight reaction in stocks last week, followed by advances to new high levels. Bethlehem Steel was the market feature.

COLO. SPRINGS Mar. 30	
Name of Comp.	Bid.
Acacia	03¾
Banner	.01¼
Cripple Cr'k Con	.008
C. K. & N	.05
Doctor Jack Pot	.08
Elkton Con.	.45¾
El Paso	1.35
Findlay	.03¾
Gold Dollar	.02
Gold Sovereign	.05⅛
Isabella	.15
Jack Pot	.06
Jennie Sample	.02
Jerry Johnson	03¼
Lexington	005
Mary McKinney	.32
Pharmacist	.01
Portland	1.17
Raven B. H	.03¾
Vindicator	1.55

SALT LAKE Mar 30	
Name of Comp.	Bid.
Beck Tunnel	06
Black Jack	11½
Colorado Mining	10
Crown Point	01
Daly-Judge	5.00
Gold Chain	17
Grand Central	54
Iron Blossom	1.02½
Little Bell	15½
Lower Mammoth	06
Mason Valley	1.10
May Day	12
Opohongo	00½
Prince Con	38½
Seven Troughs	02¼
Silver King Coal'n	2.97½
Silver King Con	1.72½
Sioux Con	03½
Uncle Sam	04
Yankee	04

TORONTO Mar 30			
Bailey	02¾	Dome Exten	.13
Coniagas	4.75	Foley O'Brien	25
Peterson Lake	.20	Hollinger	24.00
Right of Way	02	Imperial	01½
Seneca Superior	1.25	Jupiter	13
Silver Queen	.01¼	McIntyre	44
T. & Hudson Bay	20.00	Pearl Lake	02¾
Timiskaming	.33	Porcu. Gold	‡ 25
Wettlaufer-Lor.	05	Preston E. D.	02
Big Dome	13.00	Rea	20

SAN FRANCISCO Mar 30			
Comstock Stocks		Misc. Nev. & Cal	
Alta	80	Belmont	4.60
Belcher	‡ 30	Jim Butler	84
Best & Belcher	.06	Lone Star	06
Caledonia	22	MacNamara	03
Challenge Con	06	Midway	17
Confidence	.15	Mont.-Tonopah	.37
Con. Virginia	06	North Star	15
Crown Point (Nev.)	‡ 32	Rescue Eula	.11
Gould & Curry	04	West End Con	61
Hale & Norcross	04	Atlanta	39
Julia	‡ 01	Booth	‡ 30
Mexican	27	C. O. D. Con	03
Occidental	.79	Comb. Frac	08
Ophir	05	Jumbo Extension	1.05
Overman	‡ 10	Pitts.-Silver Peak	12
Potosi	.01	Round Mountain	36
Savage	.04	Sandstorm Kendall	09
Sierra Nevada	.05	Silver Pick	08
Union Con	.10	Central Eureka	‡ 25
Yellow Jacket	‡ 47	So. Eureka	‡2.25

N. Y. EXCH. Mar 30	
Name of Comp.	Clg.
Amalgamated	62¾
Am Sm. & Ref., com	68¾
Am. Sm. & Ref., pf	103¼
Am. Sm. Sec., pf. B.	78
Anaconda	28¾
Batopilas Min	50
Bethlehem Steel	88¼
Bethlehem Steel, pf.	104½
Chino	39½
Colo. Fuel & Iron	26½
Federal M. & S., pf.	28
Great Nor., ore., ctf.	35
Guggen. Exp	54
Homestake	114
Inspiration Con	24⅝
Mex. Petroleum	73
Miami Copper	24½
Nat'l Lead, com.	63
National Lead, pf	107½
Nev. Consol	12½
Ontario Min	2
Phelps Dodge	‡175
Quicksilver, pf	.75
Ray Con	19½
Republic I&S, com	22½
Republic I&S, pf	78¾
SlossSheffi'd, com	29
Tennessee Copper	29¾
Utah Copper	56¼
U. S. Steel, com	48⅞
U. S. Steel, pf	105¾

BOSTON EXCH. Mar 30	
Name of Comp.	Clg.
Adventure	2¼
Ahmeek	320
Alaska Gold M	34
Algomah	¼
Allouez	45¼
Am. Zinc	30
Ariz. Com., ctfs	4¾
Bonanza	.55
Butte-Balaklava	2¼
Butte & Superior	48½
Calumet & Ariz	60½
Calumet & Hecla	463
Centennial	19
Copper Range	45¼
Daly West	2¼
East Butte	10¾
Franklin	7¾
Granby	72¾
Hancock	14
Hedley	26¾
Helvetia	.75
Indiana	7¾
Island Cr'k, com.	43
Island Cr'k, pfd	86½
Isle Royale	23½
Keweenaw	2½
Lake	11⅞
La Salle	5¾
Mass	8¾
Mayflower	5½
Michigan	1½
Mohawk	62½
New Arcadian	6¾
New Idria Quick	‡3½
North Butte	27¾
North Lake	2¾
Ojibway	1½
Old Colony	5⅝
Old Dominion	45½
Osceola	72
Quincy	67½
Santa Fe	1¾
Shannon	6¾
Shattuck-Ariz	26
Superior	32¾
Superior & Bost	1¾
Tamarack	37½
Trinity	4
Tuolumne	.27
U. S. Smelting	23¾
U. S. Smelt'g, pf.	47¾
Utah Apex	3 7/16
Utah Con	11¾
Victoria	2
Winona	3⅛
Wolverine	48½
Wyandot	.80

N. Y. CURB Mar 30	
Name of Comp.	Clg.
Beaver Con	34
Big Four	.08
Blue Bell	.03½
Braden Copper	7½
Buffalo Mines	.50
Can. Cop. Corpn.	‡1
Can. G. & S.	04
Caribou	‡ 47
Cashboy	.08
Chambers Ferland	19
Con. Ariz. Sm	11/16
Con. Coppermines.	1 1/16
Davis-Daly.	1
Diam'field-Daisy.	06½
Dia. Black B	03
Florence	56
Goldfield Con.	1⅝
Goldfield Merger	25½
Greene Cananea	30¼
Kerr Lake	4 11/16
La Rose	11/16
McKinley-Dar-Sa	41
Mines of Am	2¼
Mutual Min., pf.	‡2½
Nevada Hills	23
New Utah Bingham	62
Nipissing Mines	6¾
Ohio Copper	12
Oro	12
Pacific Smelt	‡.09¾
South Utah	.25
Stand'd Oil of N.J.	395
Standard S. L.	1¾
Stewart	2
Tonopah	7½
Tonopah Ex.	2¾
Tonopah Merger	39
Tularosa	‡ 12½
West End Ex	07½
Yukon Gold	2¾

LONDON Mar 18	
Alaska Tre'dwell	£7 0s 7½
Camp Bird	0 6 3
El Oro	0 8 0
Esperanza	0 9 0
Mexico Mines	3 15 0
Oroville	0 11 9
Philippine Dr	1 0 0
Santa Gert'dis	0 8 0
Tomboy	1 3 6
Tough Oakes	0 14 3

BOSTON CURB Mar 30	
Name of Comp.	Bid.
Alvarado	70
Bingham Mines	‡3
Boston Ely	15
Butte & Lon'n Dev	26
Calaveras	1¼
Calumet-Corbin	12
Chief Con	99
Corbin	.40
Cortez	15
Crown Reserve	.80
Eagle & Blue Bell	91
First Nat. Cop	1¾
Houghton Copper	2¾
Iron Cap Cop., pf	3
Majestic	15
Mexican Metals	16
Nevada-Douglas	36
New Baltic	2
Oneco	1 1/16
Raven Copper	‡ 07
Smokey Dev.	19
So. Lake	6¼
Tonopah Victor	‡ 17
Trethewey	12
United Verde Ext.	3

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344	.	27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654	.	28.083	23.199	
November	58.995	49.082	.	27.263	22.703	
December	57.760	49.375	.	26.720	22.900	.
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.370	66.152	69.170	*
April	14.211	...	64.747	...	69.313	.
May	13.996	.....	63.182	.....	67.786	..
June	13.603	.....	61.336	.....	66.274	.....
July	13.223	.....	60.540	.....	64.955	....
August	*	.....	‡	......	‡	.
September	*	.....	‡	......	‡	..
October	*	.....	‡	.....	‡	..
November	11.739	....	53.227	.....	*	.....
December	12.801	...	56.841	.....	*	...
Year	.		..		...	..

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154		163.963	. .
May	33.360	.	150.702	.
June	30.577	. ...	138.321	. .
July	31.707	. ..	142.517	
August	*	.....	‡	. .
September	32.675	.....	‡	. .
October	30.284	.....	‡	. .
November	33.304	....	139.391	. .
December	33.601	......	147.102	.
Av. year	34.301		.	. .

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810		3.688		18.225	..
May	3.900		3.808	. .	18.503	. .
June	3.900		3.810	. .	19.411	.
July	3.891	.	3.738	.	19.051	. .
August	3.875	.	3.715		‡	..
September	3.828	...	3.658	....	‡	..
October	3.528	..	3.384	.....	‡	...
November	3.683	.	3.585	. .	18.500	..
December	3.800		3.662		19.097	.
Year	3.862		3.737		..	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113		4.963		21.569	
May	5.071		4.924		21.393	
June	5.000	.	4.850	. .	21.345	
July	4.920	.	4.770	. .	21.568	
August	5.568		5.418	.	‡	
September	5.380		5.230		‡	
October	4.909		4.750	.	‡	
November	5.112		4.962	.	25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			.

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.[illegible]	14.08	13.90
March	15.07	14.55	13.91	13.[illegible]	14.10	13.95
April	14.90		13.[illegible]		14.[illegible]	
May	14.90		13.90		14.[illegible]	
June	14.90	.	13.90		13.96	
July	14.90	.	13.90		13.90	
August	14.90	.	13.90		14.08	
September	14.90	...	13.90		14.03	
October	14.84	...	13.[illegible]		13.97	
November	14.59	....	13.43		13.83	
December	14.70	.....	13.[illegible]	.	13.83	
Year	$14.88	..	$13.78		$14.01	..

The Mining Index

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The Minerals of Santo Domingo

By F. Lynwood Garrison*

SYNOPSIS—The republic of Santo Domingo occupies part of the island of that name, the rest being included in the republic of Haiti. The inhabitants have predominant negro blood and simple character. Minerals occur in great variety but small quantities, and most of them have not been proven to exist in commercial quantities. The minerals of the country have been repeatedly used as a basis for unscrupulous promotions, but practically no real development work has been done.

Of all the fair isles in the sea none is more beautiful or potentially rich than Santo Domingo, known in the old Spanish days as Hispaniola, which then included the western section, now called Haiti. The present inhabitants of the whole island are negroes, or of predominating negro blood. In Haiti they are almost wholly black and are little better than their savage ancestors of the African jungle. France at one time owned this part of the island, but the only remaining evidence of her rule is the *patois* spoken by the inhabitants.

Basic Dike Rocks in the Bed of the Nigua River

Mixed Blood of Present Inhabitants

The eastern section of the island was once Spanish. Its people speak today only that tongue, and inasmuch as they did not kill off the whites, as did the Haitians, the mixture of white blood in the present inhabitants is evident, especially in some of the large towns on the coast. The original Carib Indians appear to have been completely wiped out or driven away by the early Spaniards and have left few traces behind them. In this connection it should be pointed out in studying Spanish-American affairs that there are in general two classes of people inhabiting Central and South America and Mexico—those whose origin is chiefly Indian and those of mixed negro, Indian and white blood, but predominatingly negro. The Indian strains are vastly greater in such countries as Mexico, Peru and the Central American states than in some of the other countries whose access to the sea is more easy or which had a smaller original Indian population. Of course, the South American peoples of today differ among themselves to a somewhat greater extent than did the original native stocks from which they were derived.

A Wide Variety of Minerals Exist

The mineral resources of Santo Domingo resemble those of the State of North Carolina in that almost anything of a mineral kind may be found in small quantities. Gold, platinum, silver, copper, lead, iron, coal, amber, sulphur, salt are evident of variety if not quantity. It is but reasonable to suppose that such an array of mineral wealth would have attracted attention in the past, and such has been the case.

However greatly we may idealize Columbus, it is nevertheless a fact that his voyages were instigated as much by a desire for riches as through mere hope of territorial acquisition and a pious desire to convert the heathen to Christianity. Hence when he founded his first settlement at Isabella, on the north coast of Santo Domingo, it was gold he sought and gold he got—to the tune of something like four or five million dollars, an enormous sum for those days. This historical circumstance and the fact that the gravels in certain parts of the island even today yield appreciable quantities of gold have been the cause of some erroneous assumptions regarding the gold resources of the country. It gave plausibility to the so called "red earth" swindling schemes referred to in the Journal of Jan. 26, 1907; Apr. 19, 1913; May 24, 1913; Jan. 24, 1914; Feb. 14, 1914; Feb. 21, 1914, and Feb. 28, 1914, and it also shows with certainty that the same old game can be worked again in the future with renewed disastrous results to a gullible public.

The Spaniards enslaved the original Indian natives and forced them to wash out this gold by primitive methods, which, however crude, are fairly efficient and cost little when the labor is unpaid and the workers not over-fed. The geologic conditions in Santo Domingo do not indicate that enough erosion has ever taken place to result in the accumulation of great beds of gold-bearing gravel similar to those in other gold-producing countries such as California, Alaska and Colombia, or that rich concentration in the form of "pay streaks" may ever be expected there to cover any considerable area. It is true that certain districts in the mountainous interior are composed of rocks which contain quartz veins carrying small quantities of gold. Years ago unsuccessful attempts were made to mine and mill these lodes. I remember accidentally coming across an old boiler and a stamp mill once used for this purpose buried in the jungle of the Upper Haina River, where it stands today, an enduring monument to the folly and technical ignorance of investors who built the mill first and searched for ore afterward. One is almost tempted to call this policy the besetting sin of American promoters.

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Copper Deposits Not of Commercial Grade

The existence of copper on the Nigua River near the town of San Cristobal was known as long ago as 1850, when an Englishman named Heneken spent large sums of money in its development, with unsatisfactory results. In 1902 a company was organized by some Bethlehem, Penn., people to develop these copper deposits and construct a railway from San Domingo City to the mine. The road was half finished and a small smelting furnace was shipped from New York to the railway's end, where today it lies buried in the jungle. Little development was done by the Bethlehem company, which subsequently went bankrupt. At the time of my first visit, which was in 1905, after this epoch, I found that the copper-bearing area had not been even superficially explored, for I discovered promising outcrops along the lines of contact between the hard, volcanic tuffs and the Cretaceous limestone of the district.

The history of this property from 1906, when I left there, has been one long tale of pretentiousness, litigation and misdirected effort that has resulted in little of value. The district appears to be tremendously faulted, although it is certainly promising, and consequently its development will require great skill, considerable time and abundant funds honestly spent and technically well directed. Scientifically these copper deposits are of great interest. The mineralization appears to be exclusively confined to the volcanic tuffs, in which the ores occur in veins that may be traced long distances and also in impregnations or zones near the contacts of the eruptives with the limestone rocks. Most of the ores are highly ferruginous, and consist mainly of bornite, chalcopyrite and their oxidized phases. Chalcocite probably occurs, but I have never seen it here in any quantity. The tuffs are cut by basic dikes which may be found in their unaltered condition on the bed of the Nigua River. Some of the dike rocks are spotted with large yellowish phenocrysts. Nothing resembling disseminated or porphyry copper ores has been found in the district, although the existence of copper in the rocks is common and apparently wide-spread.

Iron Ore in Various Parts of the Island

Iron ore has been reported found in several places in the island, and some samples I have seen are excellent in quality. The best known deposit is at a place called Hatillo Maimon, an inaccessible locality back in the high peaks of the Cibao. It has been supposed that iron-ore deposits similar to those in eastern Cuba exist in some parts of Santo Domingo, and I see no reason to doubt this hypothesis, for as I understand the geology of the island it contains some fairly large areas of basic peridotite rocks and their serpentine derivatives similar to those found near Nipe Bay, Cuba. The reports, however, lack verification, and even if true the deposits are likely to be in places remote from the sea or adequate transportation facilities.

Lignite coal occurs in many parts of the island. As might be expected, however, it is poor in quality and the seams are thin. Hence, considering the low prices at which good American coal may be laid down in Santo Domingo ports, it is highly improbable that these indigenous lignite fuels will ever be of much value.

A Dominican Mountaineer Fully Armed with Gun and Smile

Petroleum was struck some years ago near Azua on the south coast. One well gushed a considerable volume of oil for a short time, but it is, I understand, the only one of a number of wells drilled in that locality, or for that matter anywhere in the island, which produced any large quantity of oil. This well never yielded a steady supply of oil and has, according to report, long since ceased to produce.

Amber occurs in a number of places along the north coast, but the quantity is small, although the quality is good. Some years ago a large firm of smoking-pipe manufacturers of New York spent many thousands of dollars trying to develop these deposits under the guidance of a reputable mining engineer, but the results were so poor that further efforts to exploit the deposits were abandoned.

The other minerals I have enumerated above appear to have been found in a few scattered localities, but with the exception of salt they are probably of no commercial importance. It is therefore evident, as far as our present knowledge goes, that, with the exception of copper, Santo Domingo as a mineral-producing country holds little promise.

The History of a Geological Survey

An efficiently administered and properly equipped geological survey might reveal resources so far unexpected; and even if no other practical benefits were achieved by such an organization, the island would at least be well mapped and we would know what might be expected of its future. In 1869 a geological survey of the island was begun by a party of Americans under the leadership of William M. Gabb, a distinguished paleontologist. The maps of Santo Domingo which this party made are the only ones in existence that are in any way accurate or trustworthy. The results of the survey were published by the American Philosophical Society in 1872. A few years ago an American acquaintance of mine living in the island rescued Gabb's original maps from a dust heap, and I suppose they are still in his possession. Gabb's prefatory statement regarding the origin of the survey throws an interesting sidelight on the subject and is well worth quoting as showing what was expected of the mineral resources in his day—viz., 1869 to 1871:

An Abandoned Stamp Mill in the Jungle of the Upper Haina River

"The origin of the work is perhaps anomalous in the history of geological surveys. The Government, with an enlightened policy in advance of the majority of Spanish-American nations, felt the necessity of a careful geological examination of its territory, to ascertain the exact facts in regard to its mineral resources. At the same time, in consequence of the numberless revolutions through which the country has unhappily passed during the last three quarters of a century, it was so crippled financially, that it was clearly impossible to find the funds necessary for the expenses of such an enterprise. It is not necessary to record the details here. Suffice it to say that, finally, a contract was made with some gentlemen in New York, who pledged themselves to pay the costs of the work, receiving a grant of a portion of land belonging to the government to reimburse themselves."

Whether the gentlemen who backed this enterprise ever received the land grants above mentioned I have no means of knowing. If they did, it is not unlikely they were of little or no value, owing to the peculiar system of land tenure existing in the island. It appears that all the land was originally held in common (*communero*), and doubtless much if not most of it is still so retained. As there is no land tax in Santo Domingo, all the people in any particular district appear to possess equal share in all the lands of that section or commune, except what in one way or another has passed to individual or corporate ownership. These conditions have been the cause of serious losses to foreigners who have invested in Santo Domingo land. For example, I recall that in 1907 I went to the island to look over a large tract of 250,000 acres on the north coast which had supposedly been the possession of an old Philadelphia family for many years. These people originally paid $10,000 for it and naturally assumed that they had something of value. As a result of our investigation we found that this Philadelphia estate owned simply a common right in this 250,000 acres, which was apparently no more or less than that possessed individually by every man, woman and child living on the commune. Inasmuch as this land was covered in places with some fairly good pine forests, and hence possessed a potential value other than agricultural, it was worth having, but under the existing conditions it would appear almost impossible for any individual to get a valid title to this or any other similarly held tract in the island.[1]

Santo Domingo is so accessible from New York that it will doubtless continue in the future, as evidently it has for many years past, to be a favorite field for the concession hunter and promoter. We know it has tremendous agricultural possibility and some considerable timber reserves aside from mahogany and other tropical trees, but its mineral resources have so far proved a delusion and a snare and are likely thus to continue until the country is systematically explored, mapped and prospected by efficient geologists and mining engineers. It is evident, therefore, that the would-be investor in Santo Domingo cannot be too careful in his investigation of titles, laws and all other conditions which differentiate sound business and credulous folly.

American Exploitations Denounced

Despite their origin the Dominicans on the whole are better than one would expect. They are rather unsophisticated, but in the interior, at any rate, are hospitable and friendly, looking up to Americans as a superior race, who ought to bring them capital, good government and education. It is to be feared that the character of many of the Americans who have been identified with Santo Domingo has not been up to these specifications. It is difficult to write temperately on this subject, or restrain one's indignation with an American administration which dares to engraft some of the worst phases of our spoils system upon this weak, prejudiced and dependent people, whose failings are chiefly due to ignorance, oppression and a lack of moral stamina, the result of four centuries of misgovernment. When we consider that the ancestors of the present inhabitants were negro slaves and a small mixture of none-too-good Spaniards, the wonder is that they are as decent as we find them. Surely they do not deserve to have their country made a dumping ground for political henchmen and the exploitation of its natural resources left in the hands of conscienceless American schemers, who could not of themselves lend confidence and respectability to their projects. A word from our Government would have long since stopped this wretched business, for our officials in Santo Domingo are usually well informed regarding the Americans who sojourn there, but they appear never to have been given power to act.

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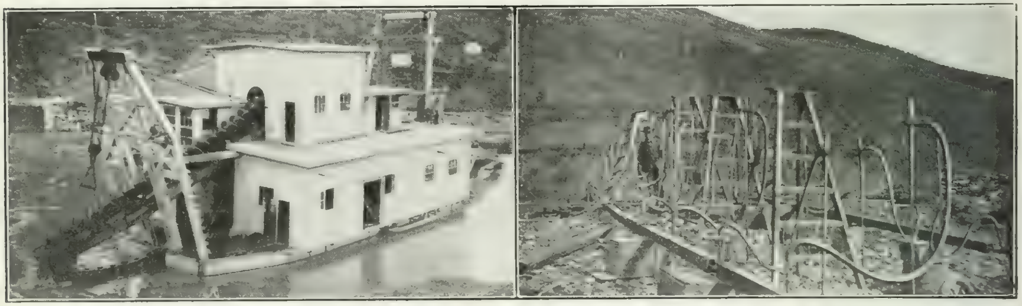
[1] It may not be generally known that both Cuba and Santo Domingo are covered in some elevated spots with quite large pine forests which resemble the so called short leaf pine of our Southern States. The Santo Domingo variety is Pinus occidentalis; the short leaf American, Pinus echinata.

Semi-Diesel Engines and Locomobiles for Alaskan Dredges

EDITORIAL CORRESPONDENCE

The semi-Diesel engine has been introduced in dredge practice in Alaska and proved efficient and economical. The engine was adopted after a thorough test and was installed on a 3½-cu.ft. bucket-elevator dredge equipped with close-connected bucket line, revolving screen and belt stacker. The dredge was designed to dig 35 ft. below water line, and provision was made in hull construction and gantries to accommodate an extension of the digging ladder to dig 50 ft. below water line. The makers of the engine, Bolinders of Stockholm, Sweden, guarantee an oil consumption not to exceed 0.65 lb. per hp.-hr. The preliminary tests were run on California crude oil, and the actual average consumption in the several tests was 0.44 lb. per hp.-hr. In the actual operation of the dredge these engines were run on a mixture of two parts crude oil and one part distillate.

The dredge was built by the Union Construction Co. for J. J Cole, John Brower and Charles Mitchell, of Nome. It was installed on Bangor Creek near Nome and started operation Aug. 26, 1914. The material was shipped in during the same season. This was the second dredge built within the year in Alaska by the Union Construction Company.



RILEY & MARSTON DREDGING OPERATION ON OTTER CREEK, IDITAROD DISTRICT, ALASKA

The first dredge built by this company in Alaska in 1914 was completed on Otter Creek, Iditarod district, on May 27. The material was shipped late in the season of 1913, and the construction crew went in over the ice in the spring of 1914. The dredge was contracted to be ready June 1. This also is a 3½-cu.ft. bucket-elevator dredge with close-connected bucket line, designed to dig 16 ft. below water line. It is of the flume type and is driven by a distillate engine. Digging was done in frozen ground, which it was necessary to thaw out with steam points. This dredge was built for Riley & Marston and had a successful season.

Material was also shipped in during 1914 for a steam-driven dredge to be installed at Circle City. It will be a 3½-cu.ft. bucket-elevator dredge equipped with a close-connected bucket line, revolving screen and two flumes. The power will be furnished by two Wolf locomobiles, which will be fired with local wood fuel. The makers guarantee steam consumption not to exceed 12½ lb. per hp.-hr. In actual tests of one of these locomobile plants (250 hp.) it was found that the steam consumption was 11½ lb. per hp.-hr. In the use of coal fuel the makers guarantee 1.5 lb. of coal to 12 lb. of steam per hp.-hr. (65-hp. unit). The engine cylinders are mounted directly on the boilers and operate under high pressure. The total weight of two 80-hp. engines, boilers and pump and full list of repair parts is 57,000 lb. Special provision has been made for extra-large fireboxes to accommodate wood fuel. This dredge is to be built for Clarence Berry, of California, and is to be installed during the coming season.

Gold in Australasia

We published on Mar. 27 the gold production of the various states of the Australian Commonwealth. The returns for New Zealand have since been published and show a heavy decrease. In 1913 the total was 343,795 oz., in 1914 it fell to 193,444 oz., a decrease of 150,351 oz., or 43.7%. Adding these figures we have the following totals for the year, in fine ounces:

	1912	1913	1914
Commonwealth	2,321,343	2,205,061	2,048,901
New Zealand	310,796	343,795	193,444
Total Australasia.....	2,632,139	2,548,856	2,242,345
Total value	$54,406,322	$52,684,853	$45,349,271

The heavy decrease in New Zealand brought down the results for 1914, the total decrease from 1913 being $7,335,582, or 14%, the largest proportional decrease for several years.

Wood as a Fuel for Mine Power Plants

BY E. A. HOLBROOK*

SYNOPSIS—A general tendency is to deprecate the use of wood as fuel in power plants, but in many cases it may be cheaper and more satisfactory than coal. All perfectly dry woods have about the same heating value per unit of weight, but green wood is expensive to burn, since the water in it must be driven off, wasting heat already generated. Proper methods of arranging boilers to burn wood are given.

Handbooks and other authorities likely to be consulted by the mining engineer for data on the use of wood as a fuel usually say that wood is no longer used to any considerable extent under boilers for the generation of steam. This statement is true as regards power plants in general, but the power plant of the small and isolated prospect or mine is and will always be an exception to this rule. There are hundreds of small mines in the wooded mountain country of the West and Northwest, in central and eastern Canada, and even in the Appalachians, where the small battery of boilers for mill, pump or compressor work burns local cord wood, of good, poor or indifferent grades as available. It seems to be a favorite theme with superintendents at most of these mines to imagine their fuel costs are exorbitant; even a reporting engineer often advises the use of coal or the development of a neighboring stream for power, without due consideration of the real cost and comparative value of wood as a fuel. Such cost must be compared with a long haul and high freight rate for good or inferior coal, or with the high capital cost involved and the heavy depreciation met with in the erection of a hydro-electric plant.

During the prospect stage of the isolated mine it is probable that wood of some sort has been used as a fuel. Consequently, when ready to call the prospect a mine, there is on hand a battery of boilers whose second-hand value is almost nothing. Is it good engineering to change our power to hydro-electric, with its high capital cost and usually insufficient data on stream flows, and is it economical to burn coal rather than wood? The last part of the problem might be stated as follows: With local cordwood at *a* dollars per cord, shall we use it in preference to a certain coal which can be delivered from the railroad as back freight at a total cost of *b* dollars per ton? It is a question of comparing cords of wood and tons of coal, *i.e.,* volume against weight, and a complete solution of the problem involves the understanding of a number of variables.

CHARACTER OF WOOD USED

Mines in the West commonly use bull or yellow pine, although in places fir and spruce are common, while in the desert countries even sage brush has been used. It is not uncommon in the Southwest to find isolated mines using as a fuel local greasewood, piñon or nut pine, or the huge roots of the mesquite. Central and eastern Canada have more hardwood; and maple, beech, birch and other broadleaf trees are possibly more used than the softer fir and poplar. Even in the Eastern states, oak, chestnut and other hardwoods are cut as cordwood for mine use.

Wood is always sold by the cord, and for convenience in handling and firing is cut into 4-ft. lengths. This is a rough measure of volume, and we must compare such an uncertainty with coal estimated by weight alone. The handbooks usually state that 2¼ cords of wood are equal to one ton of coal. This ratio will lead to considerable error unless more details are available.

It is well to remember that all dry woods, hard or soft, pound for pound, have about the same heating value, the principal divergences from this rule being in that part of the weight of the wood due to water or sap. In a less degree the rule varies with the presence of resin in pine and other coniferous woods, which tends slightly to increase their relative heating value. Thus, as is well known, hardwoods, such as birch, maple, oak, etc., have a considerably greater heating value per cord than the soft woods, since a cord of hardwood has greater weight. For instance, a cord of well-dried pine weighs from 1¼ to 1½ tons, while a cord of oak may weigh more than half as much again. Thus the comparative heating value of the two woods would vary in about the same proportion.

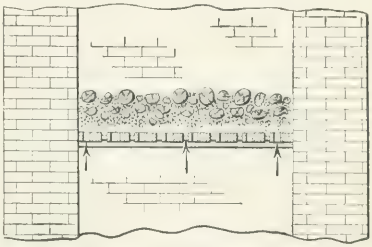


FIG. 1. BURNING WOOD ON A COAL GRATE

That no exact figures can be given for the above may be understood when it is stated that the amount of water in freshly cut cordwood ranges from 35 to 50% by weight, and the actual amount of solid wood in a cord varies greatly, being proportional to the size and straightness of the wood, as well as its freedom from knotty projections and irregularities.

Concerning the water in wood, the percentage by weight varies when first cut, as above stated, from 35 to 50, depending on the kind of wood, season of year, amount of sap or heart wood, etc. Thus, the sapless tree freshly cut in winter may contain 15 to 20% less water, *i.e.,* weigh 15 to 20% less for the same fuel value, than the same tree in spring or summer; hence the considerable advantage of cutting the wood in winter. This heavy water content of wood must be evaporated before the wood will burn to advantage, so that freshly cut wood, even when cut in the winter, is nearly useless as a fuel. In spite of this apparent reasoning, I have seen a number of mining plants struggle through a winter on green wood because it was cheaper to haul on the snow.

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Time Required to Dry Wood

A certain authority states that wood should be air-dried for two years before burning. Undoubtedly by so drying the moisture would be reduced to about 15 to 20% and the maximum theoretical heating value attained. Practically, the capital tied up and risk involved in keeping cordwood for a period of two years would much more than overbalance the loss in heating power by burning it sooner. Corded wood dries rapidly during the first three or four months after the frost leaves it, and if its extra weight is not too great a factor for economical haulage, it may then usually be burned to good advantage. Exposure through a single summer at least will take out 90% of the water possible.

The average mine superintendent is not getting the cord of wood he pays for. Perfectly straight, round, smooth cordwood occupies about 75% of the volume of the 128 cu.ft. in the cord. It is on this basis that calculations are usually made. As with all other trades, the woodchopper around a mining camp has his tricks, the chief of which are various devices to make his cord contain as little wood and as much space as possible. Rough knots not well trimmed, or a few crooked sticks judiciously placed, rapidly reduce the amount of solid wood in a pile to less than 60% of the total volume.

I have measured and paid for an apparently well-filled cord of wood, only to find afterwards that it had been skillfully draped around a stump or other obstruction, so that the cord was diminished to less than 50% solid wood before we were ready to burn it. In one of the Western camps the wood was cut by Indians. At certain times the squaws lent an ingenious hand in piling, thereby giving the local name of "squaw wood" to any which might be particularly small, ragged and crooked.

I emphasize these points as ones making the problem extremely variable. The size of the tree makes a considerable difference in the following ways: The sapwood or outside rings contain much more water than the inside ones. It is, in fact, the growing and living part of the tree. Consequently, if the wood is burned soon after cutting, small sticks, containing a large part of their volume as sapwood, have a decidedly less heating value than the heart wood. However, if the wood is thoroughly dried there is no reason why this sapwood should not equal the fuel value of the heart. It is also well to remember that the heating value of the coal available may vary from the West Virginia coals, with over 14,000 B.t.u. per pound, down to some of the Western lignites with less than half this value, and containing 30% or more of water. Practically the ratio between coal and wood may figure out as great as 3½ : 1 in favor of coal, or as low as 1 : 1—that is, cords of wood against tons of coal, this depending on the features already noted and on additional ones to be mentioned as regard to combustion and grate design.

Comparative Tests

Taking yellow pine as a basis, we may consider that a cord well piled and airdried will weigh perhaps 2800 lb. and have a fuel value of 5500 B.t.u. per lb., making 15,400,000 B.t.u. per cord. This is compared with first-class bituminous coal of 13,000 B.t.u. per lb., or 13,000 × 2000 = 26,000,000 B.t.u. per ton. In such a case a comparison of one cord of wood *vs.* one ton of coal gives 154 : 260 = 1 : 1.7 instead of 1 : 2¼, as mentioned in the handbooks, and this ratio is even taking the better grades of coal as a basis of comparison. When it is remembered that the coal available in many mining camps is sub-bituminous or even lignite, with a heating value of perhaps 7000 to 9000 B.t.u. per lb., as before mentioned, the comparison is even more favorable to wood.

As a definite illustration: At a Western camp the coal available was Cretaceous sub-bituminous, with 9000 to 10,000 B.t.u. per lb., costing about $5.50 per ton. The wood supply, although limited, was of good bull or yellow pine and cost $3.50 per cord, delivered. As near as rough comparative boiler tests could determine (using an improved wood grate, which will be discussed later) 1.6 cords of this wood equaled 1 ton of coal. It was thus $5.50 per ton for coal compared with $3.50 × 1.6 = $5.60 for an equal value of wood. However, the wood gave 1% of fine ashes, which were easily handled, while the coal gave 15% of a rubbery clinker and ash. Moreover, on account of the easier kindling and consequent more rapid combustion of the wood, two boilers over wood would do nearly the work of three over coal. Under these conditions the use of wood was continued in as many boilers as a supply could be obtained for. The writer was also at a mine in Montana the operators of which opened a small coal mine to supply themselves with fuel, but were obliged to go back to wood until additional boiler capacity could be provided. That is, the combustion of the wood was more rapid and the resultant horsepower of the boiler greater. My notes also mention a Nova Scotia mine that on a comparative boiler test found that one cord of local mixed wood (probably mostly hardwood) equaled ⅔ tons of bituminous coal, or 1 ton coal equaled 1½ cords of wood.

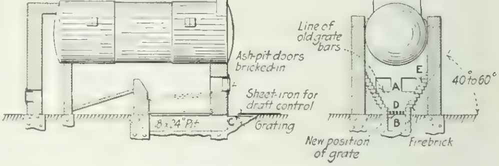

FIG. 2. BOILER ARRANGED FOR WOOD BURNING

Cost of Wood per Cord

Cordwood for a mining company is always cut by the cord, and not by the day, being measured and marked with daubs of paint by the engineer at irregular intervals and paid for according to the contract.

Where the timber was tall fir and pine, standing close together and ranging up to 12 in. in diameter at the butt and about 30 to 50 ft. high, free from knots, I have known a man to cut and pile four cords in a single day, and do it for a succession of days. For this he was paid $1 per cord in a country where labor was $3 per day. This, of course, means that a man performing an average day's labor should cut and pile three cords of wood. Again, where the timber was bull pine, with the trees large and scattering and with labor at the same price as above, $1.50 to $2 per cord was paid, the average chopper not making over $3 per day.

At mines in eastern Canada, on hardwood up to 9 to 10 in. thick, where labor is $2 per day, $1.50 per cord is paid, two average men working together cutting and piling three cords. In addition to the cutting cost, there is usually a stumpage to be paid to the owners of the land or to the Government. On the average for both cases this stumpage is 25c. per cord. Of course one may cut timber on one's own claims for mining purposes.

The third cost of cordwood is the haulage and piling, ranging from $1.50 up to $15 in rare cases. This factor must depend not only on the weight and kind of wood but on the price of labor, distance of haul, condition of roads, and whether wagon or sled can be used. Where wood is scarce it may be cut where the yield is only 5 to 10 cords per acre, and on good thick straight timber of cordwood size the yield per acre may run up to 60 cords.

Design of Grates for Burning Wood

Most boilers sent into mining camps by the manufacturers are fitted with grates designed to burn bituminous coal, and are quite unfitted for burning wood; that is, the grates have wide slots to allow free admission of air from below in case of clinkering, and to allow ash and clinker of considerable size to fall through. The grate also sits high, since coal needs a comparatively thin bed. When such grates are used with wood, whose mass in the grate consists of a few large pieces, a great excess of cold air is drawn up through the large air spaces of the grates, and much of this air never comes into close contact with the two or three loose irregular layers of cordwood present. The result is that the temperature in the combustion chamber and flues is lowered and uneconomical combustion ensues. This condition is illustrated in Fig. 1. Moreover, as soon as the wood burns and breaks up into red-hot coals, these drop through the large grate spaces and their heating value is lost.

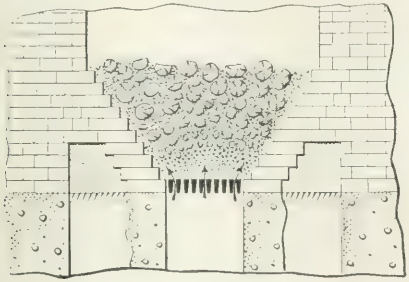

FIG. 3. GOOD ARRANGEMENT FOR BURNING WOOD

Having seen an improved wood grate used successfully in an old Western camp, the writer has since installed several of the same type, with a saving in wood of from 10 to 15 per cent.

Fig. 2 illustrates the improved wood grate and the method of changing a boiler from the ordinary grate to the improved one. After removing the old grates (*A*) a rectangular pit (*B*), is dug beneath the center of the ashpit as shown. It is best lined with concrete and finished about 16 to 20 in. wide, and of about the same depth. It should extend 2 to 3 ft. in front of the boiler, and this outside extension should have a sloping bottom (*C*), shown in Fig. 2, for convenience in removing the ashes. This section outside the boiler front can be covered with a removable grating and provided with a sheet-iron plate, which answers perfectly for draft regulation.

Of course, the regular ashpit doors are bricked up and closed, and the sides of the old ashpit filled in with rubble. Starting at the new grate level (*D*) firebrick (*E*) are laid on a step, inclined at about 45°, making what might be called a solid-step grate. We now have a firebox of V-shape, with two or three of the old grates forming the narrow new grate at the bottom of the V.

A grate so constructed is nearly ideal for cordwood. It allows the firing of as large sticks as the doors will take, no care is necessary to arrange the sticks side by side, as with the old grate, and thus we avoid having the firing doors open for long periods of time. We have a thick bed of burning wood and sufficient air space for the complete combustion without a great excess. Moreover, as the wood burns and red-hot coals form, these roll down the inclined wall of the firebox and, accumulating over the grate, heat the rising air before it strikes the wood or passes into the furnace. This point is the special feature in favor of such a grate, shown in Fig. 3. Other features are indestructibility and ease of air control. The walls of the grate, being of firebrick and becoming highly heated, aid by catalysis the rapid and complete combustion of the gases distilling from the wood.

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Probable Oil and Gas in Montana

By J. P. Rowe*

So far one is safe in saying that not a cubic foot of natural gas or a gallon of crude oil has ever been secured from wells in the State of Montana and sold in a commercial way. Seepages have produced a little oil, especially north and west of Belton, in the Sweetgrass Hills regions, and at several other localities; but as yet no producing oil or gas well has even been drilled in the state. Several years ago Butte men drilled in northwestern Montana, spending several thousands of dollars in the venture. So far as I know, neither oil nor gas in paying quantities was found. About the same time, nine or ten years ago, a company was formed at Bridger, Carbon County, in the south-central part of the state, and drilled at the base of a small anticline whose crest carried a small amount of rather highly bituminous shale. No oil or gas was struck, though a fairly good flow of water resulted. The formation was probably Jurassic. At about this time, or a year or two later, some oil excitement occurred near Dillon, Beaverhead County. Several claims were taken up and leases secured, but no well was drilled. The formation that was claimed to carry the oil sands was visited by me and found to belong to the Carboniferous period. A rather steep anticline was found, but nothing else indicative of gas or oil.

About two years ago a well was started at Glendive, Dawson County, in the extreme eastern part of the state. The company drilling this well doubtless took into consideration the Glendive anticline, and it is reported that it was advised by a well known Denver geologist to drill where it did. For this I cannot vouch. However, drilling was probably begun in the lower Fort Union or Upper Cretaceous slightly to the east of the crest of the anticline. Therefore, reasoning from the geological position and general conditions in Wyoming, Canada, and elsewhere along the Western States east of the Rocky Mountains, the striking of oil or gas or both would be probable. It is reported that gas has been struck. Just how much has not been learned, though letters of inquiry have been sent.

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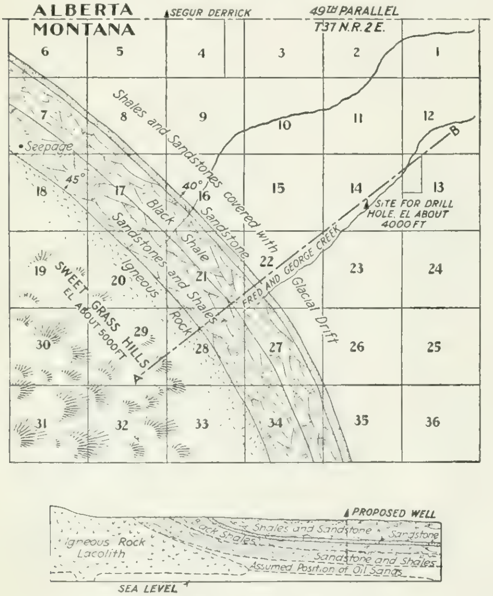
Not long ago a report came from Havre, the county seat of Hill County, in the extreme north-central part of the state, that gas had been struck within the city limits. Nothing definite can be learned at this time concerning it. However, it is claimed that the well has a pressure of 500 lb. per sq.in. and will yield 1,000,000 cu.ft. in 24 hr. The geological horizon at Havre is undoubtedly Upper Cretaceous. The country is level and the presence of anticlines or synclines is difficult to determine without detailed geological study, owing to the mass of glacial drift covering almost the entire surrounding country. There are several coal mines near Havre. These occur, according to Pepperberg, in the upper part of the Judith River formation (Upper Cretaceous) just a few feet below the Bearpaw shale. The country is greatly faulted. The faults of the Milk River field (which includes Havre), says Pepperberg, "are too numerous to be described individually." Hayden says: "The most remarkable feature of this basin is the wonderful disturbance of the strata." This would not appear encouraging from an oil or gas standpoint. However, the faults might not be large enough in their throw to prevent the accumulation of oil nor numerous enough to prevent the oil collecting in small pools. This does not say that oil or gas will or will not be found in this part of the state. It is merely a statement of the condition of the country. In Canada, not many miles north of Havre, gas is found in the rocks of the Belly River formation; not in the Claggett, but probably in the Cardium formation (Eagle sandstone of Montana). The Colorado has as yet produced no oil or gas in Canada, but in several localities the rocks of this period have a strong odor of petroleum and are often so impregnated that the shales will burn. Petroleum may be obtained from them by distillation.



GEOLOGY OF THE SWEETGRASS HILL REGION

This is the most promising region in Montana for oil and gas. Oil has been found just over the line in Alberta.

The greatest receptacle for gas, and probably oil, of any of the geologic formations in Canada is probably the Dakota sandstones. While they have not been definitely determined in northern or central Montana, in southern Canada they seem to have been identified. If this is the case, they probably extend down into northern Montana. However, according to Fisher, not more than a hundred or so miles south he did not find the Dakota where he studied the formations at Great Falls and north of it 25 or 30 miles, though he did find in his study of the Great Falls coal field that the Colorado rested unconformably upon the Kootenai. Havre is some distance north of Great Falls, however, and not many miles from the international boundary. Therefore, the Dakota might extend as far south as Havre. However, the chief reasons why the Dakota sandstones are sought after in Alberta, Canada, are: First, they are porous enough to hold the oils; second, they generally are capped with a shale that prevents the gas or oil from escaping; and third, they rest unconformably upon the Devonian rocks that apparently originally contained the oil and gas.

The oil-bearing horizons in Wyoming vary from the Upper Carboniferous to the Fort Union (Muddy Creek field). While Weed shows a small amount of Dakota sandstone and clay-shale north of the Little Belt Mountains near Belt, Cascade County, Fisher shows that this proved to be either Cascade or Colorado. Calvert shows the same in his study of the Lewistown district, where Weed has shown Dakota. Neither Fisher nor Calvert show the presence of the Dakota sandstones where Weed did. As a matter of fact, neither found Dakota in their study of these fields. Therefore, the desirable Dakota formation of Canada and Wyoming may not be found in the north and central Montana fields to any such extent as was heretofore thought. The formations seem to be more or less conformable, except that the Colorado rests unconformably upon the Cascade or Kootenai. This does not prove, however, that oil and gas cannot occur in the Havre or other north-central parts of Montana. In Wyoming oil has been found in the Upper Carboniferous (Dallas field), the Benton (Wall Creek sandstone), the Pierre Shannon sandstone of the Salt Creek field, etc. As all of these formations are doubtless found below the Havre surface stratum, either oil or gas or both might be found in the Havre field, other conditions being favorable. Besides, gas has been found in the Belly River formation at several places in Alberta, and as this corresponds somewhat to the Judith River formation of Montana, and as Judith River is found in the Havre field, gas might be struck there in that formation. I do not believe, however, that the Belly River formation is generally productive of a large flow of gas.

It is stated that just recently gas has been found at Conrad, Teton County. This does not seem unreasonable, as the formations are generally the same from southern Alberta to points farther south than Conrad. The exposure at Conrad is probably Bearpaw or Belly River.

There is now considerable excitement in the towns on the Glendive anticline, running from Glendive on the northwest to Marmouth, North Dakota, on the southeast. This is a pronounced anticline with the Pierre shales exposed at the crest. Marmouth, North Dakota, and

Baker, Fallon County, Montana, seem to be the center of the gas and oil excitement. I see no reason why gas and possibly oil might not be found at either of these places. However, should the Dakota sandstone be the container of the gas or oil, a considerable depth would probably have to be reached before striking it. To my knowledge there are no seepages or other indications of oil or gas on this anticline. That in itself does not pronounce entirely against its discovery, but merely goes on as negative evidence.

Another locality indicative of oil or gas is found near Ryegate, Rosebud County. The anticline found here is known as the Big Coulee. The exposure at the bottom of the Coulee is doubtless Bearpaw, with Lance as the cliffs on either side. Several Butte parties have been in this field for the past two or three months trying to get leases. It is understood that a company would have been organized some time ago and actual drilling started before this if leases upon all of the farms in the valley could have been secured. A few farmers are holding out and as a result everything is practically at a standstill. It is reported that gas in probably commercial quantity was struck some time ago by a farmer in drilling a deep well in this valley. He became frightened, thinking that perhaps the Government would set aside his homestead patent should the officials learn of the strike, and therefore sealed the well up. The gas is said to have been struck at a depth of about 250 feet.

Another well that is now being drilled, and is already down about 500 ft., is at Great Falls, Cascade County. This well is being sunk by the Power City Oil & Natural Gas Co. of Great Falls, a close corporation of public-spirited business men of that city. The well starts in the Missouri River alluvium, which rests at that point directly upon the Kootenai sandstones. Should gas or oil be struck here it would be either in the Jurassic or Paleozoic rocks. Judging from the geological formations carrying oil or gas both north in Alberta and south in Wyoming, the chances are against the Great Falls well. The men interested are putting in their own money and will give the locality a thorough test.

By far the most promising field in the state, as far as I know, is the Sweetgrass Hills region. This locality is directly south of Alberta and not more than 50 or 60 miles from the Bow Island gas field. The entire field is about 30 miles from east to west and about 10 miles from north to south. There are three distinct groups of igneous intrusions within this territory, known as the West Butte, composed of three or four distinct laccolithic (?) peaks; Middle or Gold Butte, a single dome-shaped laccolith (?); and East Butte, composed of three or four distinct peaks. The general formations of the region are greatly obscured by glacial drift. The Belly River is well exposed at the town of Sweetgrass and undoubtedly extends more or less over the entire Sweetgrass Hills field. Detailed geological work is difficult owing to the lack of exposures. The igneous intrusions are dome shaped with the strata dipping away from all sides (quaquaversal). Several seepages are found with both oil and gas showing rather strongly. Many of these are at or near the contact and indicate, somewhat, a supply beneath. From the sketch as shown here, taken from Professor Bard's report for the Montana-Canadian Oil Co., of Butte, it can be seen that the oil sands are capped by sandy shales tight enough to prevent the escape of the oil, and that [illegible] would naturally be near the contact. Evidently the position of the oil sands was based upon the seepages.

Mr. Segur is now drilling a well just over the line in Alberta, and undoubtedly based his location somewhat upon the splendid seepage that is found almost directly west of his rig. Mr. Segur's rig is one of the best in the country. The tower is over 100 ft. high, with every modern appliance. The drilling of this well will undoubtedly test, to some degree, the value of the field. Several other companies are securing leases all over the territory and the oil excitement is surely high. It is said that during 1915 five or six other rigs will either be built or in the process of construction. Several geological parties have been in the field during the past summer and careful and painstaking geological work is being done. One party of six geologists, one or two of whom have national reputations, have spent six or eight weeks in the field carefully studying and mapping the formations.

It would seem that here, as in most other places, the oil will be found largely in anticlines. The location of these anticlines, owing to the covering of glacial drift and consequent scarcity of exposures, is rather a difficult task.

From a general study of the district I do not believe that gas or oil will be struck within a depth of less than 2000 ft. and that chances of getting gas are much better than oil, though the general indications are good for both.

The worth of the field is bound to be proved soon. The Segur well is going down and others will be started within a short time. Prospects are indeed good for a new natural product in Montana. Should gas be struck in any of the wells in this field, unless it be a "wet" gas, and that is a splendid indication of oil, it will be of little commercial value. However, it will be an incentive to other localities in the state situated similarly geologically, etc., where the gas can be put to good commercial use.

Montana has been noted for years for her natural resources. Let us hope that oil and gas will be added soon. Her position between Alberta on the north and Wyoming on the south, both gas and oil producers, surely gives some hope, especially since her geological formations are almost identical.

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French Industries and the German Invasion

In a recent lecture given by Dr. Emil Schrödter before the Association of German Iron Masters it was stated that of the French metallurgical plants, 68.8% of the coal, 78.3% of the coke, 90% of the iron ore and 87% of the pig-iron producers had passed under German control. *The Iron Monger* of Mar. 13 publishes a carefully prepared table, taking up the French coal output mine by mine, in which it is shown that the total output of mines in invaded territory is 19,463,309 tons per annum, while the output of the territory in French hands is 21,158,691 tons per annum.

Of the French blast furnaces, 74 are situated in invaded territory and 87 are in the territory still held by the French. In the case of the coal mines, of the 19,463,309 tons of output placed within the invaded territory, no less than 5,773,000 tons are produced by mines which are in the firing line between the two armies, and therefore cannot strictly be said to belong to either side.

Copper Smelting in the Caucasus

SYNOPSIS—A review of the principal copper-smelting works in a region now much disturbed by the developments of the European war. The Caucasus Copper Co., a British enterprise, is the most important operation. A French company operates two groups of mines and smelting works, one near Allah-verdi and the other at Zangerour on the Turkish frontier. The Kedabeg properties, owned by the Siemens interests, are now about exhausted, but this company has another operation at Kwarzchana. The firm of De Boer & Gukossow contemplated the erection of a smelting plant at their mines near Chot Ulja, but this enterprise has doubtless been abandoned for the present.

In the Caucasus are a number of copper-mining operations in which British, German, French and Russian capital is invested. Probably all of these operations were suspended owing to the extension of the European war into this region, but it is understood that some have lately resumed. The following notes were written by a metallurgist who visited this section a few months before the war:

Caucasus Copper Co.

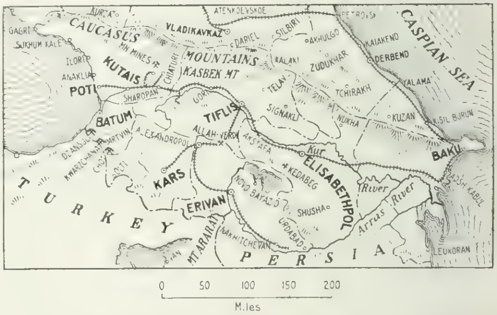
The Caucasus Copper Co., a British corporation, operates mines and smelting works at Dzansul in the Murgul valley, a branch of the Tschoroch valley. Dzansul is connected with Batum by a good road, the distance between these places being about 60 versts (43 miles). The company has a waterpower at Dzansul of about 1000 hp. and gets its fuel (crude oil from Baku) through a 4-in. pipe line from Batum.

The ore consists of quartz and silicates, intermixed with pyrite and chalcopyrite. A large quantity of this ore is in sight. The ore is mined by the opencut method and the cost of mining is low. An average analysis of the ore is: Cu, 3.14%; Fe, 8.8; S, 9.9; SiO_2, 70.2; Al_2O_3, 5.7; total, 97.74%. The ore is brought from the mines by means of an aërial ropeway to a dry-crushing plant, directly above the concentrator, a few versts from the mines.

The ore is crushed to about 5 mm. (¼ in.) and proceeds then to the wet concentrator. Both crushing and concentrating plants are built on a sloping site. The plant may be considered modern as far as equipment is concerned. In wet crushing, both Hardinge and chilean mills are used, the former giving better results. The copper losses in concentrating amount to 38% of the total copper contents of the ore, the copper contents of the tailings being 1.3%. Preliminary experiments on a small scale made in treating the mill tailings by the flotation process of the Minerals Separation company demonstrated that it would be possible to reduce the mill losses from 38 to 25%. Recently the Caucasus company decided to adopt this process for its mill tailings (leaving out the Frue vanners, which worked unsatisfactorily) and to install an experimental unit of this process. It is expected not only to get a better recovery but also to get better concentrates (13% Cu) with less silica, which means that less lime flux will be required in smelting. It should be mentioned that the flotation concentrates will be very fine, part of them 200-mesh and over, and this will involve new problems which will have to be overcome.

The concentrates together with 16 to 25% (average 22%) limerock are roasted in McDougal furnaces (2% of the copper in the ore is lost with dust), and the hot roasted concentrates, which contain 8.5% copper, are charged into a modern oil-fired reverberatory furnace of the Anaconda type. The waste furnace gases are utilized in generating steam. The oil is atomized with steam at a pressure of 80 to 100 lb. per sq.in. However, it is intended to replace the steam with air pressure. The oil consumption (Baku oil, sp.gr. 0.875, about 11,000 cal.) is about 12.5% of the total charge and sometimes goes down to 11%, this depending mainly upon the grade of matte made. The matte averages 50% Cu, and the following is an average analysis of the slag: SiO_2, 42.5%; CaO, 14; FeO, 34; Cu, 0.4. The slag is granulated. The matte is tapped into a cast-steel ladle mounted on a car and transported to the converter plant.

The converter plant consists of two blowing stands and converters of the barrel type with a capacity of about five tons of matte. Both acid- and basic-lined converters are used. Ore is used for the acid lining and as flux. The converter slag is taken to the reverberatory furnace by means of a ladle, mounted on a car, and poured into one of the side doors near the skimming door in order to get its matte contents settled. On account of its basic nature it is a welcome addition to the acid reverberatory slag, and moreover serves in warming up the bath at that part of the furnace. The blister copper from the converter is poured into molds and the resulting bars are charged cold into the refining furnace.



Map of the Caucasus, Showing Principal Mining Operations

There are two oil-fired refining furnaces, each with a capacity of about 10 tons per charge; one furnace is used at a time. A furnace can make two charges of 10 tons in 24 hr.; the oil consumption is about 11% of the charge. The copper is ladled from the refining furnace by hand and poured into commercial bars of about one pood (16.38 kg.). It does not contain enough gold and silver to pay for electrolytic refining, but it is pure enough for ordinary purposes, such as brass making.

The total smelting losses are about 10% of the copper in the ore. The capacity of the plant is 1000 tons of ore in 24 hr. It is intended to increase the capacity of the plant within the next few years to about 4000 tons of ore per day.

Société Industrielle et Metallurgique de Caucase

The Société Industrielle et Metallurgique de Caucase operates two groups of mines and smelting works—one near Allah-verdi, between Tiflis and Kars, and the other at Zangerour on the Turkish frontier. Allah-verdi is about four hours' ride from Tiflis, the mines being a few versts from the railway. The Allah-verdi mines are leased, and the lease was renewed in 1914 for a period of 30 years. The company has near Allah-verdi a 1000-kw. waterpower during three months and 400 to 600 kw. during the rest of the year. A 400-hp. Diesel motor is in operation and a second one of the same capacity was being installed. The following is an average analysis of the Allah-verdi ore: Cu, 4.2%; Fe, 30.1; S, 31.4; SiO_2, 18.5; Al_2O_3, 5.9; CaO, 1.8; Zn, 7.4; Pb, trace; Ag, 46 gr. per ton; Au, 0.8 gr. per ton.

Only a small part of the ore undergoes wet concentration; the main part is smelted directly, pyrite smelting n two operations being practiced. The raw smelting takes place at the mines at Allah-verdi up in the hills. The matte smelting, as well as converting and refining, is done at Manhès, at the railway station.

The ore is sized to about 6 in., being broken up by hand, and is sorted into three grades. Fines are sintered in heaps by means of pressure-air pipes passing underneath. Ores and sinter are smelted with limerock and quartz as fluxes in a round water-jacketed furnace. The limerock is a silicate, containing CaO, 38.9%; SiO_2, 27.4; FeO, 2.5, and Al_2O_3, 1.8%. A mixture of two kinds of quartz is used, the analysis of one being 73.2% SiO_2, 8.9 Al_2O_3 and 10% CaO; the other contains 97.4% SiO_2. Russian coke, having 10 to 20% ash and a combustion value of 5900 to 6300 cal. (calculated from the analysis), is used. There are two round water-jacketed furnaces, but usually only one is in operation at a time. The furnaces have two tiers of jackets, a diameter of 1860 mm. (73.3 in.) at the tuyeres, the distance from the charging floor to the tuyere level being 4600 mm. (15 ft.). The composition of the charge is 100 parts of ore, 15 parts of matte (20%), 8 parts of limerock, 4 parts of quartz and 5 parts of slag (all by weight). The capacity of the furnace is from 9000 to 10,000 poods (160 to 180 tons) of ore in 24 hr., making a 20% copper matte, as is the practice at Allah-verdi. The coke used is 4.33% of the total charge, or 5.5% of the ore. Part of the 20% copper matte is fed back into the furnace with the ore as mentioned above, and it is claimed to have a beneficial influence on the smooth running of the furnace, besides increasing the concentration of the matte. It might be mentioned here that in making a 30% copper matte the capacity of these furnaces goes down to 5000 to 6000 poods (90 to 110 tons) in 24 hr. The air pressure used is equivalent to 1000 to 1100 mm. (40 to 55 in.) of water. The following is an analysis of the slag in making a matte of 20% copper: Cu, 0.3%; SiO_2, 36; FeO, 30.3; Al_2O_3, 12.8; CaO, 11.2; ZnO, 6.6; BaO, 1.5; S, 1.5; total, 100.2%. The slag is granulated; the amount of water used for granulating is in weight about eight times that of the slag. The launders for granulating purposes are of sheet iron lined with slag, which is feasible with a slag of the above composition, and has proved a success. The low-grade matte is poured into beds, broken up after cooling and shipped to Manhès.

The concentration furnaces used at Manhès are also of the circular water-jacketed type. They have a diameter of 1000 mm. (39.4 in.) at the tuyeres, the distance between charging floor and tuyeres being 3500 mm. (11.5 ft.). There are three of these furnaces, only two being in operation at a time. They run smoothly on a constant charge of 100 parts of matte (20%), 15 parts limerock (47% CaO), 40 parts quartz (93% SiO_2) and 30 parts converter slag; the coke amounts to 6.5% of the weight of the ore. The air pressure is equivalent to 1500 mm. (59 in.) of water. An average of 55.5 tons of charge is smelted per furnace in 24 hr. The resulting matte contains 45% Cu; the slag, 0.5% to 0.6% Cu. The slag has almost the same composition as the slag of the ore furnaces. Flue dust from the concentration furnaces and converters is briquetted, with addition of lime, and fed back into the concentration furnaces.

The 45% matte is tapped directly into small converters of the barrel type, mounted on cars. The shell dimensions are 1.8 m. diameter and 2 m. long. The converters are acid lined; however, with each charge additional quartz flux is added. The air pressure is 8.8 lb. and the amount of air available is 8000 cu.m. per hr. The blister copper is poured into molds and charged cold into an oil-fired refining furnace.

There are two refining furnaces with a capacity of about five tons each, only one being in operation at a time. They are built of quartz rock and have a quartz hearth. The roof is built of magnesite bricks. The oil is atomized with converter air and additional low-pressure air is blown into one of the side doors to get a better combustion. Three charges can be made in 24 hr. and the oil consumption is then 10% of the charge.

About one-third of the copper produced is refined electrolytically at a plant in Manhès. The copper is precipitated with a current density of 210 amp. per sq.m. and the current efficiency is 1.07 grams of copper per ampere-hour, the copper having an electrical conductivity of 102.5 per cent.

Experience has taught that concentrating the ore in two stages is the best practice under the given conditions of furnace dimensions and limited available quantity of converter blast. The daily capacity of the plant is about 800 poods (29,000 lb.) of copper. However, the production at the middle of 1914 was only about 500 poods.

There is said to be only three years' ore supply in sight. However, after having renewed the lease with the owners, prospecting is going on and the modernizing of the smelting plant will depend upon the results thereof.

Operations at Zangerour

At Zangerour, Katar, on the Turkish frontier, the French company also has mines and a smelting works. The ore is rich, containing 12 to 14% Cu, and is brought up to about 18% by hand picking. The plant is situated about 250 versts from the railroad, and coke is said to cost at least 1.2 rubles per pood at the works. The ore is smelted semi-pyritically at present, but the company intends trying the Knudsen process to reduce the coke expense. At present it only pays to smelt high grade ores; however, in the near future a railroad will be built from Dschulfa to Tabriz, which will change conditions.

Nearby in the same district are several small mines and primitive smelteries, operated by the owners, and it is said that the mines owned by the Société Industrielle et Metallurgique de Caucase are not the best with respect either to quantity or quality of ore.

SIEMENS' KEDABEG PROPERTIES NEARLY EXHAUSTED

The von Siemens'sche Berg- u Hüttenwerke in Kaukasus owns mines and a smeltery at Kedabeg, in the Government of Elisabethpol, and mines at Kwarzchana, near Artvin, where they have a smelting plant in course of construction. The plant at Kedabeg, the oldest in the Caucasus, has been in operation since 1864 and will be shut down completely in the near future, as the mines are worked out. A description of the plant at Kedabeg, its early and the more recent practice can be found in the literature[1]. The six old Siemens circular reverberatory furnaces (19 ft. 6 in. diameter) coupled to hand roasters had to be put out of service about two years ago as they used too much oil for the present oil prices (40 to 55 kopeks per pood, f.o.b., Baku), and were replaced by sintering pots and a small circular water-jacketed furnace. There was not enough ore in sight to justify the building of a modern oil-fired reverberatory furnace.

All kinds of fine material, such as ore under ½ in., screenings from matte (both partly roasted in kilns and heaps), etc., together with siliceous ores and slag from a black-copper furnace, are sintered in small pots. Some charges need an addition of charcoal or anthracite screenings and dust. The sinter, together with coarse ore, raw ore roasted in heaps, slag from the black-copper furnace, lime and quartz fluxes are smelted with coke and anthracite in the small water-jacketed furnace, which measures 1000 mm. (39.4 in.) at the tuyeres. This furnace has a capacity of 60 to 65 tons of total charge in 24 hr. and uses about 8% coke (including one-third anthracite) in making a matte of about 40% Cu. The slag averages 0.5% Cu and the blast pressure 500 to 600 mm. (19.7 to 23.6 in.) of water.

The matte is broken up and roasted in kilns. The dead-roasted matte is smelted to black copper in a so called Siberian blast furnace, which consists of a rectangular shaft entirely of brick. Besides black copper, some white metal (about 5% of the roasted matte) is made. The black copper is refined in a small three-ton refining furnace which uses 140 to 160 poods of oil in 24 hr.; the white metal is sintered and reduced in the refining furnace together with some raw white metal and rich slag (last skimmings from the refining furnace).

In connection with the smelting works, there is a leaching plant with a large stock of low-grade ore. These low-grade ores can still be worked profitably for another five years by allowing them to oxidize in the air, leaching with water and precipitating with scrap iron. The present total production of the works is about 5000 poods (18,000 lb.) of copper per month.

NEW WORKS AT KWARZCHANA

At Kwarzchana the Siemens firm possesses a lens-shaped orebody of massive cupriferous pyrites with, locally, some covellite. The average copper content of the ore is 5.5%, and there are now about thirty million poods (542,000 tons) of this ore in sight. The average analysis of the ore is: Cu, 5.87%; Fe, 35.9; S, 13.1; SiO_2, 3.3; CaO, 0.24; As, 1.35; Pb, 0.63; Zn, 3.3; Bi, 0.01%. As mentioned before, a smelting works was in course of construction near the mines. The power plant is equipped with three Diesel engines of 285 hp. each, using crude oil from Baku. Each motor is direct coupled with a direct-current, 500-volt generator. Two Enke positive blowers (Roots type) will furnish the air for the blast furnace; they are direct connected to a motor. The converter air will be produced by a turbo-blower, which is also direct connected to a motor.

The ore as it comes from the mines will pass over a grizzly and both coarse and fine ore will be transported by aërial ropeway to the smelting plant, situated a few versts from the mines at a lower elevation. The coarse ore is dumped into the bins, and the fine goes to the sintering plant to be sintered with flue dust, etc. The sintering plant consists of six pots and will have a capacity of about 60 tons in 24 hr. Coarse ore and sintered material, together with flux and coke, will be smelted pyritically in a small rectangular, water-jacketed Humboldt furnace. This furnace has an area of 3.3 sq.m. at the tuyeres and a depth of 5.5 m. from the charging floor to the tuyeres. It is entirely water-jacketed, has three tiers of jackets and possesses several new features.

The matte will be tapped from the settler into a cast-steel ladle and transferred by means of a crane to a five- to seven-ton Humboldt converter of the barrel type. The slag will be granulated, and when the water supply is limited slag will be hauled to the dump by horses in pots of about two tons' capacity.

There is but one converting stand and the converter shells will be basic lined; a hydraulic car will serve to lift and move them to and from the blowing stand. The converter slag will be transferred in a cast-steel ladle and poured into the blast-furnace settler. The blister copper will also be tapped into cast-steel ladles and poured directly into an oil-fired refining furnace of about five tons' capacity. A car with molds has been provided for occasions when the refining furnace cannot take the copper.

There will also be built a small arsenic plant to treat that part of the flue dust which is rich in arsenic and to refine the As_2O_3. Furthermore, it is intended to build a small roasting-and-leaching plant to treat the poor ores.

The furnace, the sintering pots and converter will send their gases into a large dust chamber, with inside measurements of 50 m. long, 12 m. wide and 7 m. high. The dust chamber is connected to the flue by two balloon-shaped sheet iron flues 37 m. long with a cross-section of 4 sq.m. In this part of the flue it is expected to catch the arsenic. The flue is built of stone on a hillside, and is 600 m. long, 300 m. high and has a small stack at the end. In building the large dust chamber and high flue, the company expects to reduce smoke damage to a minimum.

CHOT ULJA MINES

The firm of DeBoer & Gukossow bought a few months ago the old mines of Chot for 125,000 rubles and intended to build a smelting plant near the mines, having a capacity of about 100,000 poods (3,600,000 lb.) of copper annually.

Chot is situated near the Turkish frontier, about 110 versts from Batum or 50 versts from Artvin, both distances including 40 versts of private road (under construction from Zehalo Kro near Zria in the Schoroch valley to Chot Ulja).

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[1] "Mineral Industry," 189[illegible], p. [illegible]; "Eng. and Min. Journ.," Aug. [illegible], 1913, p. 1[illegible]

The main orebody is a vein of cupriferous pyrites, containing 5 to 6% copper and 38% S. A large part of this vein is said to have been taken out by the former owner. There are said to be several small veins, with many ramifications, which are poor in copper (2%) and several pockets which are rich in copper (15% and over). The company calculates on run-of mine ore of the following average analysis: Cu, 10.4%; Fe, 29.7; S, 37.7; Zn, 0.9; Pb, 0.05; Al_2O_3, 3.5; CaO, 3.3; SiO_2, 18.3%. There is a great deal of doubt as to the correctness of the assumption that the ore will average 10% copper, and the opinion of outsiders is that the quantity of ore, which is in sight and can be expected does not justify the building of a reduction plant.

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Pittsburg-Dolores Mining Co.'s Mill at Rockland, Nev.

By E. J. Schrader*

The Rockland mine is in the camp of that name about 27 miles south of Yerington, Nev., in Mineral County. Yerington is the nearest post office and Wilson, on the Nevada Copper Belt R.R., is the nearest shipping point.

Rockland Mill of the Pittsburg-Dolores Mining Co.

The Rockland mine was discovered in 1868 by a prospector named Keene who had been working in the Wilson mine at Pinegrove, which at that time was producing high-grade gold ore and supporting a large number of leases. The point of discovery was at the peak of Rockland Mt. at an elevation of about 8500 ft., and Keene traced the ledge down the south side of the mountain and started a short adit on an oreshoot exposed about 100 ft. below the summit of the mountain. The ore was first hauled to Pinegrove and was said to have plated about $40. About 1870 Keene erected a 10-stamp mill in Keene cañon about one mile north of Rockland, but after a few months the mill was destroyed by fire.

Some years later the mine came into the possession of Gov. Blasdell, and after doing considerable development work he erected a 10-stamp mill near the mine and also used pan amalgamation, or the Washoe process, which had been developed on the Comstock. Most of the ore taken out was mined by Blasdell, but the recovery was not high, as the tailings from his mill assay about $7. After Blasdell's death the mine was operated by leasing for a number of years; but finally carelessness resulted in serious damage by fire and work stopped for a long term of years.

First Cyanide Installation

In 1902 the mine was acquired by the Nevada Chief Mining Co., which erected a five-stamp mill near the Blasdell plant and also put in concentrators. Finally it added a 15-ton cyanide plant for leaching tailings from plates. The total recovery was about 70%. The best ore contains but little free gold and fine grinding is necessary to recover the values by cyanidation.

A few years later a further reorganization took place and in 1907 a 60-ton dry-crushing and leaching plant was erected. The five-stamp mill was wrecked and much of the machinery and lumber used in the new mill. Two sets of 14x27-in. Humphry rolls were used for grinding, but the product was too coarse (80% through 10 mesh), and the assay books show that less than 50% was recovered. The tailings from the plant ran a little less than $5 per ton. No slimes treatment was attempted and leaching was done in 5x30 ft. steel tanks. Since the old five-stamp mill was no longer in shape, the mine was shut down and was idle until 1912, when it had been acquired by the Pittsburg-Dolores Mining Co. It is difficult to get an accurate estimate of the gross production up to this time but locally this is placed at about $500,000.

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*Manager, Pittsburg-Dolores Mining Co., Rockland, via Yerington, Nev.

The new owners had several difficulties to overcome. Wood for fuel is not plentiful and what timber there is should be used for stulls. The extension of the power line of the Truckee River General Electric Co. from Pinegrove to Rockland solved this problem and will result in the saving of thousands of dollars annually, in addition to which it will leave mine timber enough to last for many years.

In former times the water from three springs was used and as no great amount of work was done at the springs, a large percentage of the water was lost. In the winter time the springs froze up at the pipe entrance or the pipe lines gave trouble for the same reason and a shutdown of several months resulted. By building several miles of new and larger pipe lines, and driving tunnels to drain the springs at depth, the water shortage was overcome. Tests on the ore were made by the California Ore Testing Co., by Henry Wood & Co. and by the Dorr Cyanide Machinery Co., and all of them indicated that the ore was ideal for cyanidation if sliming was used. Consumption of cyanide is low and the ore settles readily. An extraction of 95% should be obtained without great difficulty.

During the winter of 1913-14 a storm wrecked the old leaching plant, although the tanks were not injured, and an entirely new cyanide addition to the old mill was constructed during 1914. The management plans to use the rolls that were in the old mill and the coarse-crushing end will remain practically the same, but crushing in solution will be followed instead of dry as formerly. For fine grinding a 5x18-ft. Allis-Chalmers tube mill will be used. This will be driven direct from motor by silent chain drive.

CONSTRUCTION OF PRESENT PLANT

The coarse ore from the mine is delivered to a grizzly. By automatic feed the fine ore is fed to a trommel and at this point solution from the storage tank will be added. The oversize from the trommel goes to the coarse-crushing rolls and thence to the bucket elevator. The undersize from the trommel goes directly to the elevator. By this it is expected that a large part of the clay will by-pass the rolls and avoid clogging them. The discharge from the elevator goes to a Bunker Hill screen (8 mesh), the oversize from which goes to the fine rolls and then back into the elevator. The undersize from the Bunker Hill screen goes to a Dorr classifier. The sands are fed to the tube mill by a scoop feed and the slimes go to the first 5x30-ft. Dorr thickener. The Dorr system of continuous counter-current decantation will be used in the cyanide end of the mill. Five 5x30-ft. tanks are used as thickeners.

The tanks are shallow, but on account of the large settling area and the rapid rate of settlement of the ore they have been considered safe. The thickeners have been provided with long shafts so that they can be raised to 8 or 10 ft. height at any time. Agitation will be in three Dorr type agitators, 22 ft. in diameter and 19 ft. deep.

The ores at Rockland are found in a fissure vein that was formed by the intrusion of a large rhyolite dyke in rano-diorite. Rising hot solutions deposited a quartz-rrying auriferous pyrite and at the same time so altered the foot wall and deposited quartz in fractures and seams in it that the pay ore is much wider in places than the width of the original fissure. The ore is easy to mine, and on account of the strong and hard hanging wall little timbering is necessary. The average dip of the vein is 40°, and on the lowest level a depth on the vein, below the highest outcrop, of 1300 ft. has been attained. All the development work consists of tunneling and raising. About 75,000 tons of ore averaging close to $10 have been developed and large areas of virgin or partly developed ground are available. About 12,000 ft. of development work has been done.

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Present Prospects for Mohawk

SPECIAL CORRESPONDENCE

At the present time the Mohawk output is limited only to the capacity of the stamp mill. The possibilities of rock production are far beyond the tonnage which the four-head mill at Gay can handle. Whether the Mohawk will build an addition to its mill or arrange for rented mill capacity from an outside company—the Michigan, for instance—is one of the questions which the more enthusiastic Lake Superior friends of the company now are asking.

Mohawk has really five mines on her 800 mineralized acres on the Kearsage lode. Any one of these is capable of producing copper rock at the rate of 1000 tons daily if driven to the limit of capacity. All are "young" shafts, the deepest being 2200 ft.; all are in average Kearsarge lode mineralized rock; all are well opened in advance, excepting only the newest shaft, No. 6; all are practically and efficiently equipped, except for some details which can be rectified at no extraordinary outlay. At the present time the rock tonnage from the Mohawk is running 2650 daily. No. 6, farthest south, is sending about 350 tons of this amount. This rock is coming mostly from openings in drifts, as no stoping is being done there as yet.

The richest rock that is coming from any part of the Mohawk territory at this time is from No. 5 shaft, which is maintaining a daily production of 700 tons of copper tenor equal to that of any mine on the Kearsarge lode at any time. A new rockhouse will be built. This shaft is down to the fifteenth level. Its lateral openings are extended to the Ahmeek border in the upper levels, as are the upper laterals of No. 6. The sixth and eighth levels of No. 5 are also connected with No. 6, so that there is underground connection from the extreme southerly laterals of No. 6 to the extreme northerly levels of No. 1. The No. 3 shaft has been abandoned. It has served its purpose and the mineralized territory contiguous to it can be handled best from No. 4 shaft.

At the Mohawk No. 6 they are experimenting with 24-in. wheels on the large skips. The first skips used in the Cliff mine in the early days of copper mining in the Lake Superior district had 6-in. wheels, and it was only a few years ago that it was thought safe to increase their size. This 24-in. wheel is the largest in use in this district and has not yet proved its practicability.

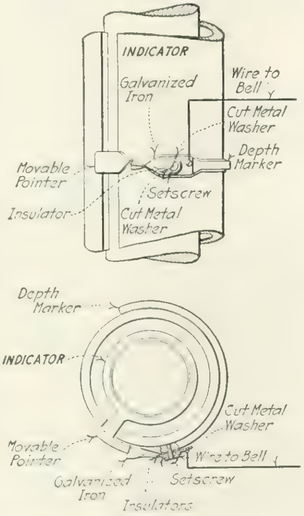
The Mohawk has a peculiar distinction in that it has the only known deposit of arsenide of copper, called mohawkite, and it derives a considerable annual income from the sale of specimens of this unique mineral.

Details of Practical Mining

Warning Bell for Topman

By Harold A. Linke*

At many small shafts the "topman," besides acting as skip tender and car "rustler," is engaged in making ladders or striking for the blacksmith, etc. These odd jobs take him away from the shaft, and even though he be exceedingly careful and conscientious, he is likely to miss a bucket occasionally. As the rule is not to delay shaft work, any contrivance which tends to obviate such delay makes for efficiency.



Device for Completing Electric Circuit of Warning Bell

The sketch shows a simple device for completing an electric-bell circuit for use on the indicator of the hoist. A depth- or station-marker, furnished with the indicator, can be fastened at the position desired by means of a setscrew. A piece of galvanized iron is bent as shown and punched with a hole large enough to pass the setscrew without contact. Two mica insulators, such as are furnished with igniters of gas engines, or thin rubber gaskets are used to set the galvanized iron off from the setscrew and the marker. A cut metal washer is applied as shown. A copper wire to the bell is soldered to the galvanized iron; the other wire may be grounded or fastened to some part of the engine, such as a screw of the name plate.

The marker is set at some point on the indicator so that, in hoisting, the contact between the movable pointer and the piece of galvanized iron may be made, and the warning bell rung sufficiently early for the topman to be at the shaft collar to meet the ascending basket.

* * *

A Circular Chart has been patented by the S. C. Carpenter Drafting & Engineering Co., of 26 Baltimore St., Hartford, Conn., on which there are a number of concentric scales. By means of a rotating celluloid arm the following data can be read for any setting in inches. Equivalent decimal fraction of a foot, circumference of a circle having the given setting as diameter area of the circle; the square; the cube; the square root and the cubic root of the given dimension. A payroll chart on a similar plan is in preparation which will cover all rates from 10c. to $1.54 per hr. by 2 and 2½c intervals for various periods reckoned by quarter hours.

Reversing Rope on Single-Drum Hoist

C. M. Rasmussen*

I note in the Journal of Oct. 24, 1914, an article by Joseph Hocking on reversing winding ropes in shafts. He says if there is a space of say 50 sq.ft. near the headgear, coil the rope up in such a way that the engine can pull the other end in when the entire rope is uncoiled from the engine. This is a natural way, but why do all this hard and dirty work by hand when the engine can do it?

If the rope has to be rewound on account of slackness on drum, or the wearing parts in the rope have to be shifted, or the rope has to be turned end for end, then the following is the best, cleanest and quickest way a rope can be reversed, requiring less than two hours for one from 4000 to 5000 ft. long:

(1) Block the skip or cage at the surface; unfasten the end of the rope and coil up enough rope to go over the headgear and to be fastened to the engine drum later. (2) Then for a 1¼-in. diam. rope get a 20-in. single-sheave wheel, unturnable, and put the bight of the slack rope coiled up around the wheel. (3) Fasten the block, unturnable, to the bridle of the skip. (4) Fasten the free end of the rope above the skip with strong chains or clamps. (5) Then let the engine pull the rope tight, take the blocking away from under the skip and let the skip run down the shaft with double rope. When all the rope is off the engine drum fasten this end of the rope in the headgear also with chain or clamps. Then unfasten the former end and pull the one end down and the other up over the headgear and fasten to the engine; then when ready pull the rope tight, take the chain off the end of the rope first made fast, signal to the skipman below to fill the skip at any handy ore box with rock; let any slack rope already on the drum off again by lowering the skip and then pull loaded skip to the surface. Block the skip and take the 20-in. sheave wheel off the skip, and unchain the new end of the rope and fasten it to the skip. Take the blocking from under the skip, and the job is finished. All this work seems complicated on paper, but when once tried will be found easy and can be done in much less time than coiling a mile of rope on the ground.

If the rope requires lubricating, that can also be done at the same time. Put the grease box across the shaft, and pack the one rope going down through the hot grease.

Here, on the Rand, we have very little time to waste over winding ropes, as all tramming, crushing, etc., depends on winding. Ropes must be maintained to the best advantage of the mine corporation, cheaply, and yet safely. All ropes are under government supervision by a man appointed by the chief engineer and manager of the mines.

Here are figures from one winding plant for May, 1914: 132,240 tons of rock hoisted, working 15 hr. per day for 26 working days, in 16,530 skips, each skip containing eight tons of rock, from a depth of 2400 ft. in a vertical shaft with a 2 in. diameter, 6x31 triple compound wire rope which has a breaking strength of about 200 tons.

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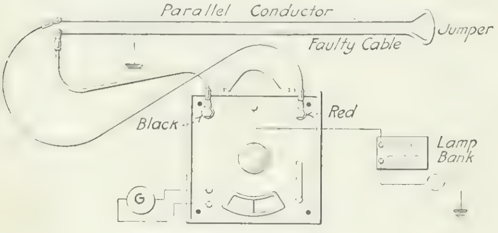
*Mining engineer, 401 Sixth St., Calumet, Mich.

*P. O. Box 101, Crown Mines, Johannesburg, South Africa.

Care should be taken to avoid a quick crystallization of a fast-winding rope in a wet shaft and that the lubrication on the rope is watched; at some places it requires more care than at others. If the rope wears more in one place than in others, shift the rope away from that place by pulling the end fastened to the engine further in. Grease your rope hot through a grease box over the shaft once a month or oftener if required; pack the rope well by a grommet of cotten rope fastened around the wire rope in the grease box. During 20 years' experience with wire ropes at the Rand mines I find that petroleum jelly mixed with black engine oil, half and half, is about the best and cheapest for this purpose as well as cleanest for the engine. Lubrication to any winding rope, fast or slow speed, when applied hot will save a lot of internal friction, wear and corrosion. A good rope thus properly cared for should last from 3½ to 4 years in a dry shaft before crystallization reduces the breaking strength of the rope from 200 to 140 tons. Neglect any rope and it will not last one quarter of the time. Lubrication to a rope is like oil to the bearing on an engine.

Portable Fault Localizer

A portable fault localizer for quickly locating a ground on an electric cable has been developed by the Westinghouse Electric & Manufacturing Co. The position of a ground is read directly from the dial in per cent. of length of the defective cable. It is an application of the Wheatstone bridge, with all the necessary apparatus contained in one portable case wired for connection to the circuit to be tested. Its use assumes that the cable is grounded at only one point and that a parallel conductor of the same length and resistance is available.



Outfit for Locating Faults

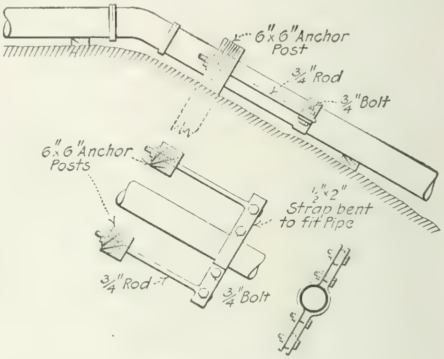
After proper connections are made, a dial on the instrument is revolved by means of a knob in the middle of the localizer until the galvanometer shows no deflection when the key is closed. The reading of the meter then gives the percentage of length of the feeder from the point where the test is being made to the location of the ground, assuming the total length of the feeder to be 100 per cent. the red scale indicating that the ground is on the conductor connected to the binding post marked red and the black scale indicating to the binding post marked black. Direct current only is used in these tests.

The variable-resistance arms consist of two loops of low-resistance wire attached to the side of a revolving disk, upon which the dial is attached, so that contact is easily made from two brushes attached to the case and connected to the galvanometer terminals. As the disk is revolved the point of contact between the brushes and the resistance loops is thus varied, as in the slide-wire bridge. The dial is calibrated in percentage of the length of the conductor tested, so that the reading is direct.

Hillside Pipe-Line Anchor

By W. R. Hodge[*]

To take up some of the weight of a pipe line laid on the surface of the ground and pitching steeply, the arrangement shown here is used. Two 6x6-in. posts, sunk well in the ground, hold each a ¾-in. rod. These rods have at the end an eye through which they are bolted to a yoke. This yoke encircles the pipe to be supported. The yoke is made in two parts and is drawn up snugly about the pipe by means of two ¾-in. bolts set close to the pipe.



Pipe-Line Anchor

Don'ts for First-Aid-to-the-Injured Corps[†]

(1) Don't fail to attend your first-aid practice. It is for your benefit and that of your fellow workmen.

(2) Don't touch a clean wound with dirty hands. You are sure to infect it and cause blood poison.

(3) Don't forget that in the absence of a tourniquet pressure will stop hemorrhages.

(4) Don't fail to handle a sprain the same as a fracture.

(5) Don't expose a punctured wound.

(6) Don't tie "granny" knots; they slip.

(7) Don't forget arterial blood is bright red and spurts. Venous blood is dark.

(8) Don't use tobacco or cobwebs on a wound of any kind for fear of infection.

(9) Don't fail slightly to loosen tourniquets at end of one hour; if hemorrhage returns, retighten.

(10) Don't retain the dangerous rubber and chain tourniquet longer than 20 min., endeavor to apply a safer tourniquet as quickly as possible.

(11) Don't fail to stimulate and apply heat in a condition of shock.

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[*] Mining engineer, Ducktown, Tenn.

[†] From Susquehanna Coal Co.'s Book of Instructions to Employees.

(12) Don't attempt to reduce a dislocation. Put parts at rest and send the patient to a doctor.

(13) Don't apply a tourniquet too tightly; you may cause death to the part.

(14) Don't forget to handle a patient with a fractured spine with the utmost care and gentleness for fear of injuring the cord.

(15) Don't handle a simple fracture except with great care; you may make it a compound fracture.

(16) Don't delay efforts to restore life.

(17) Don't hurry in performing artificial respiration.

(18) Don't give up hope of saving the patient's life—work.

(19) Don't attempt to place a person suffering from shock in a standing or sitting position.

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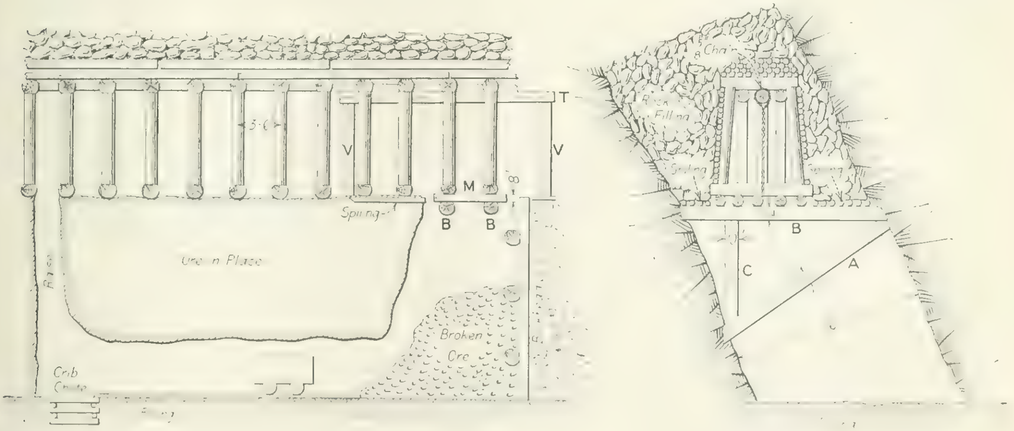
Removing Ore under Timbered Drift

By H. H. Hodgkinson*

Sometimes it is necessary to remove ore from under drift sets which have been loaded with rock-filling on both top and sides, and to do this without disturbing the set timbers, so that the drift is still maintained. The following method has been used successfully and economically, not only keeping the set timbers and filling intact, but permitting a complete recovery of the ore.



Section Showing Method of Removing Ore under Timbered Drift

On the level below, set timbers with chutes were installed and two raises driven to the level above at each end of the orebody, so as to afford an entrance and exit to the working place after the chutes in the sets were full of broken ore.

The ore was then stoped to within 12 ft. of the level above. The stope was drawn and filled with waste up to within 5 ft. of the back, a crib chute being built as the filling progressed for handling the ore which would be obtained by mining the 12-ft. floor pillar.

The fill was placed in the empty stope by means of the two raises until it reached its angle of repose, when it was leveled off to an elevation of 5 ft. below the floor pillar. The remainder of the fill was placed in the stope by means of a small mine car which was lowered down one of the raises and supplied with fill by a chute placed at a raise bottom.

Before mining the floor pillar the three 12-in. oak timbers *T*, 15 ft. long, were placed under the caps, being supported by 10-in. posts, *V*, as shown. Each of the set sills was then chained to the caps by means of $\frac{5}{8}$-in. iron chains made tight so as to hold the legs and sills of the sets in place while the ore was being removed below.

The fill on the sides of the set timbers fortunately was coarse rock; it was spiled off with lagging each time a sill was exposed and was thus prevented from running.

The ore was mined from beneath two sets, these being immediately supported by the timber trusses *A, B, C*; then the ore was mined from beneath the third set, which was supported in the same manner. These timber trusses *A, B, C* were erected as soon as possible after the sills were exposed, the timbers *A* and *B* being placed in hitches in the foot wall. The timbers *B* were about 8 or 10 in. below the sills, to facilitate placing them in position, the space between them and the sills being blocked up tight by means of the timbers *M*. As a precaution two props were placed under the timbers *M* to relieve the timbers *T* of some of their weight while the trusses were being framed.

The timbers *M* were placed far enough apart to permit similar timbers used under the next sill to interlock with them. The broken ore was not removed until the exposed sills had been supported, and these made a handy stage from which to work.

After three timber sets had been supported firmly by means of the trusses, the timbers *T* and *V* and the chains were moved along and used to support three more sets, the ore from beneath these being removed as before. When the ore had been removed from below five to six sets a bulkhead was built as shown and the space back of it filled with waste.

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The Amalgamation of Rusty Gold and Platinum Metals is said by Robert E. Lyon, of Bloomington, Ind. (U. S. pat. 1,118,-940), to be greatly facilitated by a treatment with amalgamated zinc and dilute sulphuric acid.

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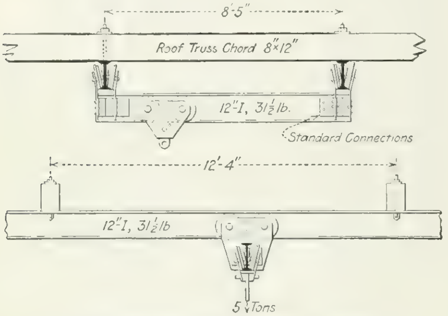
*Mining engineer, Franklin Furnace, N. J.

Details of Milling and Smelting

A Home-Made Traveling Crane

By Percy E. Barbour

The accompanying sketch shows a hand trolley which can be readily improvised at any plant having a machine-shop equipment. This trolley, with a 5-ton chain-block, makes a workable traveling crane. It consists, besides its 12 trolley wheels, of plates, I-beams, bolts and pins, all easily fabricated in the average shop.



A Home-Made Traveling Crane

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Safety First*

Ever since the electric overhead traveling ladle crane has been used in smelting operations, employees have appreciated the danger of being injured by being caught in the machinery, which may accidentally be set in motion by another employee in the crane cage. After a crane has completed its 24-hr. run and has been sent back for its daily inspection, machinists, electricians, oilers and other employees may be seen engaged in their respective duties, standing in or around the machinery and paying no attention to what their co-workers are doing. During the period of inspection a motor may be started for brake adjustment, or by accident the main switch may be closed during controller inspection, which would start a motor and be the cause of injuring some employee, either by being caught in the gearing or by electric shock.

To prevent such accidents, a safe means should be provided to lock open the main circuit which supplies current to all electrical apparatus on the crane. There are a number of appliances in use to accomplish the locking open of a circuit. Such a device should be fitted with a key of a suitable size for carrying in the pocket.

An efficient arrangement for accomplishing the above result is used on the cranes in the Boston & Montana reduction works at Great Falls; it is a magnetic blow-out circuit-breaker having a removable handle. This circuit-breaker is so designed that it is necessary to open it before the handle can be removed, and in the act of removing the handle the circuit-breaker is locked open. The handle is small and can be conveniently put in the overalls pocket. While engaged in doing any work on the cranes, it has become the practice of the men to open the circuit-breaker, remove the handle and place it in their pocket. They are thus assured that while working it is impossible for other employees to start any of the machinery which might be the cause of injuring them.

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Reverberatory Furnace Temperatures

An accompanying chart (Fig. 1) shows the temperatures observed in the No. 8 reverberatory furnace at Anaconda, Mont., on Feb. 9, 1915. Two curves show the average temperature with the secondary-air ports open and closed. The gas analysis and the draft at the throat are also presented for each set of conditions. The Anaconda No. 8 furnace is 124 ft. long by 21 ft. wide, and varies in height from 8 ft. 6 in. at the firing end to 5 ft. 7 in. at the skimming end. Pulverized coal is used as fuel and the charge is fed from openings in the roof along the side walls. It is interesting to compare the lower temperatures of this coal-dust-fired "side-fed" furnace with those of the Steptoe oil-fired "end-fed" furnace, the latter being fed in charges of 20 to 25 tons dropped from four hoppers, the last two of which are about 36 ft. from the firing end.

	Av. Temp. in First 75 Ft. (over the Charge)	Av. Temp. in Last 40 Ft. (over Settling Space)	CO_2 in Exit Gases	Excess Air	Draft at Flue En
Secondary Air Ports Closed	2405°F	2295°F.	16%	15%	0.23"
Secondary Air Ports Open	2385°F	2275°F.	12%	52%	0.17"

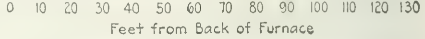

Fig. 1. Temperature and Gas Analyses of No. 8 Reverberatory at Anaconda

Fig. 2 shows the flame temperature noted in reverberatory furnace No. 2 at the works of the Steptoe Valley Smelting & Mining Co., McGill, Nev. The temperatures at the side doors were taken with a Scimatco optical pyrometer, at the verb with a Féry radiation pyrometer and in front of the boilers with a Brown base-metal thermocouple. The furnace is 132 ft. ½ in. long and 18 ft. 10

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*Abstract of an article by C. D. Woodward, of the electrical department of the Boston & Montana reduction works, in the "Anode," March, 1915.

in. wide. The roof is 7 ft. above the skimming line at the firing end. The oil used is California crude petroleum, having a specific gravity of 16.5° Bé., flashing in open test at 199° F. The oil is heated to about 200° F. before going to the burners, where it is atomized by air at 40-oz. pressure supplied by a motor-driven Connersville blower having a capacity of 42 cu.ft. per revolution.

In discussing[1] the practice at Steptoe, R. E. H. Pomeroy says that the maximum temperature is found near the second side door, about 21 ft. from the burners. The only exception is during the first 10-min. interval after charging, when the combustion is delayed by the cold charge and the inert gases evolved. The maximum temperature is thus advanced about 10 ft. farther down the furnace. The effect of this delayed combustion immediately after charging is also noticeable at the verb and in the flue to the boiler, where the temperature is higher during this 10-min. interval.

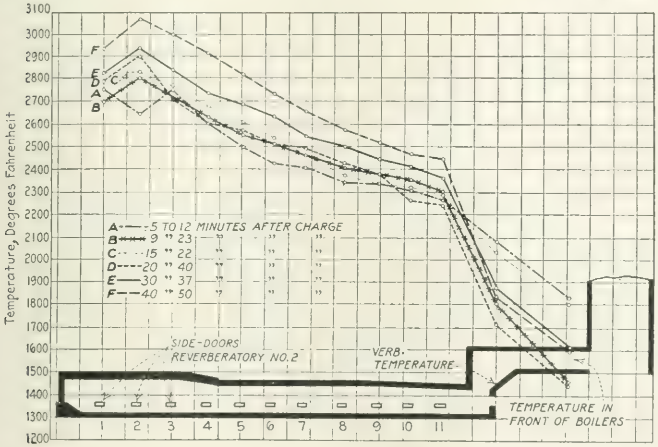

FIG. 2. SIDE-DOOR TEMPERATURES IN STEPTOE REVERBERATORY

The gradient of flame temperatures is nearly uniform. The average temperature range in the furnace is not more than 300° F. between charges. The sharp drop in temperature between the last furnace door and the boiler is due to the fact that the flame is burned out at the throat of the furnace and only the gaseous products of complete combustion pass on to the boiler. To minimize radiation from the flue leading to the boiler, this has been covered by a 2-in. coating of asbestos and the surface painted with heavy asphaltum.

The heat recovery in the Steptoe boilers is based upon the water evaporated, and is recorded as a percentage of an empirical factor of 14 lb. of water per pound of oil. The average heat recovery during this period was 34.35%, equivalent to an evaporation of 4.81 lb. of water per pound of oil burned.

The combustion of fuel, as shown by gas analysis at the front of the furnace, is practically complete, the carbon monoxide in the gases being less than 0.5%. The draft at the firing end of the furnace is 0.18 in. of water. At the throat the draft is about 1 in., and in the stack, 1.1 inches.

Removal of Cadmium from Zinc Ores

A recent patent of Gilbert Rigg (U. S. pat. 1,129,904), assigned to the New Jersey Zinc Co., provides for the easy removal of cadmium from zinc ores. The invention is based on the discovery that when a zinc ore containing cadmium oxide is leached with water containing enough sulphuric acid to convert the cadmium oxide present into cadmium sulphate that the cadmium oxide will be attacked in preference to the zinc oxide. Moreover, even if the sulphuric-acid radical is already combined with the zinc, the zinc sulphate will be decomposed and cadmium sulphate formed. In practice it will be found that if a zinc ore has been roasted to a degree beyond the sulphatizing roast, when the roasted zinc ore is leached with water, preferably near the boiling point, it will usually be found that the small amount of zinc sulphate still present in the roasted ore will be sufficient to convert the cadmium oxide present into cadmium sulphate, which, being highly soluble, will be removed from the ore.

In carrying out the operation it is preferable to have the hot leaching fluid in the leaching tank and then to admit the ore gradually, so that the anhydrous zinc sulphate will go more readily into solution. If the ore were first placed in the leaching tank and the hot water poured upon it there would be a tendency for the anhydrous zinc sulphate to combine with the water and to crystallize in the mass of ore, acting as a binding agent, and thus interfering with further progress of the operation. Hot water is recommended owing to the greater solubility of zinc sulphate in hot water than in cold.

If the amount of zinc sulphate present is insufficient to convert all of the cadmium oxide into cadmium sulphate, the necessary amount of sulphuric acid or of zinc sulphate may be added to the leaching water to make up the deficiency. In operating upon natural oxidized ores—either carbonates or oxides—enough sulphuric acid may be added to bring about the desired reaction.

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A Novel Mixer for Assay Work

By W. S. Black[*]

A simple and rapid manner in which thoroughly to mix pulp samples and assay charges is to use the familar beverage shaker. It is quick and efficient in producing a thorough mixing and if secured in the smooth, nickeled finish there is no question as to its cleanliness and accuracy.

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The Disposal of Flotation Concentrates at the Herculaneum smelting works of the St. Joseph Lead Co. is interesting. The company has installed pug mills for breaking up the flotation product and delivering the same in a continuous and uniform stream on the main mixer belt, thereby enabling this material to be incorporated in the feed of the Dwight & Lloyd sintering machines.

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[1] "Bull. of A. I. M. E.," February, 1915.

[*] Aurora, Nev.

Apex Litigation at Tonopah

Special Correspondence

SYNOPSIS—Whether the top of an anticline is an apex and gives extra-lateral rights in two directions is an interesting and novel point raised by this litigation. Whether there is an anticline or two veins apexing together is also a question involved. Unusual array of legal and professional talent and model exhibits.

In February, 1914, the Jim Butler Tonopah Mining Co., in the ordinary progress of development work, while running a crosscut to the north on the seventh level from its Wandering Boy shaft, broke through into stopes, under its surface, which had been made by the West End Consolidated Mining Co., its neighbor on the north. The investigation which followed disclosed the fact that 55,769 tons of ore had been removed by the West End, which claimed that it was entitled to the ore in this vein by virtue of ownership of the apex, which it said was situated within the West End claim. This was disputed by the Jim Butler, and, after several unsuccessful attempts to compromise, the Jim Butler filed suit involving the sum of $3,197,154, the Nevada law allowing the recovery of three times the gross value of ore removed in cases of illegal trespass.

The West End employed Judge W. H. Dickson, of Salt Lake City, as chief counsel and W. H. Wiley, Horace V. Winchell, John Chandler and E. C. Juessen as expert witnesses. The Jim Butler employed Judge Curtis H. Lindley, of San Francisco, as chief counsel, with John Wellington Finch, Prof. Andrew C. Lawson, Fred Searles, Jr., and Fred J. Siebert as expert witnesses.

The case was tried in the district court at Tonopah last December before Judge Mark Averill, but was not argued until March of this year. No decision has yet been rendered and the outcome is being awaited with great interest, as it means much to the district, involving as it does many points which are now in dispute between other companies or threaten to lead to further disagreements or litigation.

Each company acknowledged the title of the other to the ownership of its respective claims, admitting their validity in every way, so that the case immediately resolved itself into one of proof of apex.

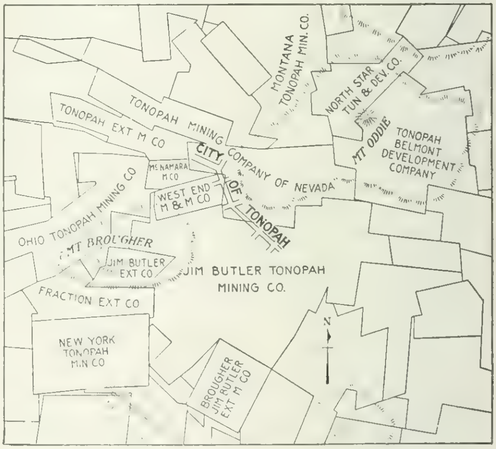
Contentions of the West End

As the West End company had mined the ore and claimed the ownership of the apex, the burden of proof was upon it. Fig. 1 represents in a general way the situation as viewed by the West End company, which contended that there were two separate veins, the one dipping southerly being older than the one dipping northerly and having its apex against the foot wall of the northerly dipping vein, which continued upward and beyond the southerly dipping vein and had its own independent apex against the overlying cap rocks. Midway andesite or Fraction dacite-breccia, as the case might be. The company claimed that what is shown in Fig. 1 as the Siebert fault was the hanging wall of the north dipping vein.

In the summary of its contentions the West End company gave as its six principal reasons for believing that there were two veins: (1) The difference in dip; (2) the difference in strike; (3) the difference in size or thickness of the veins, claiming that the south dipping vein was much the larger; (4) the difference in the hanging walls, claiming the hanging wall of the south dipping vein was Mizpah trachyte, was without selvage and with the ore frozen to the wall rock, while the north vein hanging wall (Siebert fault) had a heavy gouge, showed distinct separation of the vein from the wall and showed a plane of considerable movement; (5) the difference in the rake of values, claiming that the oreshoots terminated at point *A*; and (6) the upper portion of the north dipping vein extended upward and beyond the apex of the south dipping vein.

Contentions of the Jim Butler

The Jim Butler company contended that there was but one vein, which was anticlinal in form, the crest or axis of the anticline being at point *A* and that the north dipping limb of the anticline did not extend upward and beyond the southerly dipping limb, but that the quartz disclosed in that portion of the ground over the axis of the anticline was a stringer section which existed generally above the hanging wall of both limbs of the anticline and was given somewhat the appearance of a vein due to the slicing through of these stringers by the Siebert fault. The company also claimed that the only apex existing within the limits of the West End claim was the upper terminal edge of this anticlinal roll toward the west, which crossed both side lines of the West End claim and gave the West End extra-lateral rights, if any, toward the east into the ground of the Tonopah Mining Co. and not toward the north or south.



Map of Tonopah Showing Properties in Apex Litigation

In reply to the contentions of the West End, the Jim Butler argued (1) that the difference in dip amounted to nothing as an argument because the vein was one of rolling type or habit and might assume almost any dip without having its identity destroyed; (2) that when the axis of an anticline is inclined at any angle whatsoever from the horizontal the strike of its limbs on any one level must necessarily be divergent; (3) that there was no marked difference in the size of the two limbs, but that in any case difference in size could not be an argument, since the vein varied greatly in size in short distances on either limb; (4) that the hanging wall of both limbs of the anticline was the same except where the Siebert fault cut directly along the hanging wall and there was a resultant gouge; (5) that values were continuous over the roll of the anticline and that stopes were carried over the anticline uninterruptedly and under a continuous and unbroken hanging wall; (6) that quartz exposed above the anticlinal roll and under the Siebert fault was not a vein but a mass of reticulated stringers, which existed generally throughout the hanging-wall portion of the vein, forming a halo or aura over the vein and gradually diminishing in size and number as they left the hanging wall.

TESTIMONY AND DISCUSSION

Naturally the discussion centered around the situation as disclosed at point *A*. The West End in attempting to establish its two-vein theory admitted that at *A* there had been intense dynamic movement, causing great shattering of the rocks in that vicinity and allowing the vein-forming solutions to percolate from one vein into the other so that it was possible to pass from one to the other on continuous quartz, but that the change in dip was abrupt; and that fact taken in connection with the conformable quartz existing in vein form above *A*, on the north-dipping vein, was proof that two different veins existed. The company admitted also that the quartz and mineralization of both veins were practically identical, and while it felt sure the south-dipping vein was the older it believed that both veins were nearly of the same age. The West End also claimed that at one or two points the actual juxtaposition of the two veins could be seen, but that in general the two veins had been fused and the actual line of demarcation obliterated.

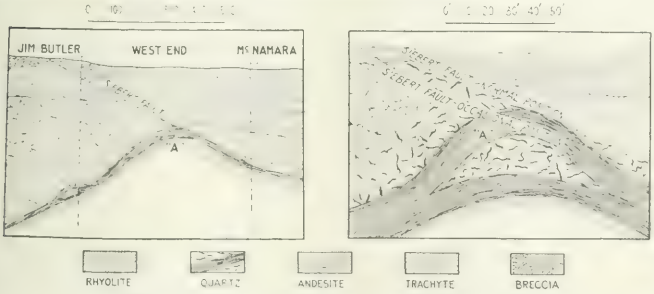


FIG. 1. FIG. 2.

SECTIONS SHOWING GEOLOGY OF APEX AS VIEWED BY THE LITIGANTS

RAISES DRIVEN TO DETERMINE STRUCTURE OF QUARTZ ZONE

A number of raises had been driven upward under the Siebert fault above point *A* to disclose the character of the country, and it was about conditions existing in these raises that there was the greatest divergence of opinion among the witnesses. On all other points, with the possible exception of the Siebert fault, the testimony was materially the same.

The West End witnesses testified that the quartz in the raises, with one or two exceptions, was solid and in place and in vein form, conformable to the hanging wall and in reality an upward extension of the north-dipping vein, but diminishing in size as it left the intersection of the two veins due to a lessening of the hydrostatic pressure of the solutions as they reached upward. Witnesses for the Jim Butler testified that the quartz disclosed in these raises was not continuous and not in vein form but was a mass of stringers, as stated before. The company offered in evidence detailed drawings showing the quartz occurrences as illustrated in Fig. 2.

The Siebert fault, so named by J. E. Spurr (U. S. Geol. Surv., "Geology of the Tonopah Mining District," 1905), was claimed by the West End to be the hanging wall of the north dipping vein, while the Jim Butler contended that it was a fault of major proportions, of trough-shaped character, with an extensive movement in a direction N 65° E; that it was tangential to the axis of the anticline, but departed from the vein in its northerly extension. The company pointed to its displacement of the younger overlying rocks to prove that it was much younger than the vein.

Another point hotly argued by opposing counsel was whether or not an anticlinal roll controlled extra-lateral rights in two directions or at all.

This article is intended to be merely descriptive of the points at issue and not a discussion of the merits of the case in any sense whatever. The case is unique in many ways and is a splendid argument for the establishment of vertical boundaries. Tonopah has been a peaceful camp ever since its discovery, but the opening gun has been fired, and unless the situation is handled by the operators with some considerable degree of tact and some respect for the ethical rights of their neighbors Tonopah is destined to be the veritable Elysian fields for the lawyer and the expert. On page 664 a panoramic view of the Tonopah camp is shown, which assists in giving an idea of the relative positions of the different properties.

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Damages for Wrongful Taking of Ore

BY A. L. H. STREET*

Where one innocently trespasses upon mining property, removing and milling ore, and applying the proceeds to his own use, the damages recoverable by the owner are measurable by the gross value of the ore in place before it was disturbed, according to the decision of the Supreme Court of Colorado handed down recently in the case of Liberty Bell Gold Mining Co. vs. Moorhead Mining & Milling Co., 145 *Pacific Reporter* 686. In other words, the owner's damages are compensatory only, and he is merely entitled to reimbursement for his actual loss.

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*Attorney, St. Paul, Minn.

"In case of willful trespass upon metalliferous veins, where the trespasser has mined, milled and sold a finished and enhanced product, the conversion takes place when he applies the proceeds to his own use, and the measure of damages is the enhanced value or gross proceeds realized from the ore without deductions on account of any value the trespasser may have bestowed upon the ore by his labor."

⁂

Mining in Bolivia

By H. L. Venables*

The mineral production of Bolivia for 1914 decreased as compared with the previous year. This is attributable (1) to the fall in the price of tin and (2) to the European war. As the price of rubber has fallen to a fraction of what it was quoted a few years ago, the chief industry of Bolivia is mining, especially tin. Most of the tin mines are being worked by individual mine owners; and although the production is not great, each supplies his quota toward the general total. The product —high-grade tin concentrates containing 55 to 65% metallic tin—is generally sold outright to ore buyers in Oruro or La Paz. At times the ore is sold on consignment and a sum equal approximately to 80% of the value of the ore is advanced to the miners, due deduction having been made for freight, smelting charges, export duty, etc. The balance is paid as soon as advice is received from Europe stating the price at which the ore was sold.

In general, a noticeable improvement has been made in the substitution of machinery for manual labor. Few of the mines are equipped with hydraulic-power plants, but a noteworthy exception is the hydro-electric plant of Llallagua. With coal costing £8 ($38.88) per ton in cars, and local fuels scarce, steam-driven machinery is out of reason as regards economical mining. In a few mines gas engines have given good results; but the most adaptable engine for mines at the altitude of the Bolivian plateau—10,000 to 16,000 ft. above sea level—is without doubt the oil engine. Compactness, ease of starting and comparatively low cost of running are factors in favor of this class of machine, even after taking into account that the efficiency is about 25% less than at sea level.

Although for some years the driving of main tunnels has been carried out by means of piston drills, the stoping was always performed by hand labor, and it is only recently that some of the big companies have invested in stopers, principally of the Ingersoll-Rand type. Every mine of importance is equipped with an aërial ropeway. Most of these have been installed by Ropeways, Ltd., of London. The question of mine drainage has generally not been troublesome, as the topography of the ground lends itself to the driving of tunnels. Nevertheless in the Huanchaca, Itos, Corocoro and Morocacala mines both electric and steam pumps are doing good service in unwatering the lower levels.

The present arrangements for the concentration of the ores in most of the mills are far from perfect. As a rule the plant consists of small rolls, a ball mill or a battery of light stamps, followed by jigs and tables. Little attention is paid to regrinding of the middlings, and even less to classification. It is rare that assays are made of the tailings; and the mine owner will use one table for the ores—rich or poor, coarse or fine—without altering the stroke or inclination. Much loss occurs in the fines because of the absence of proper machinery to collect them. The treatment of the oxidized tin ores is comparatively easy, such old-fashioned arrangements as stationary convex buddles and square buddles being sufficient to produce 55% concentrates. As soon as the sulphide zone is reached it is necessary to roast the ores, and this is generally carried out in reverberatory furnaces. Lately, however, both the Uncia and Llallagua mills have installed magnetic-separation plants, in which the pyrite is converted into magnetic oxide and separated, it being possible to produce concentrate containing 70% metallic tin.

The only tin smelters in Bolivia are in the district of Potosí. They use vertical water-jacket furnaces, with further refining of the tin in reverberatory furnaces. The high-grade ore is exported as concentrates, and as only the poor ore containing many impurities is smelted, the bars do not contain more than 95% tin. Due to the high cost of fuel and inefficient but costly labor it has been found as economical to ship 60% concentrates as 95% bars.

With the exception of the Olla de Oro and Yani mines in the La Paz district, no other gold properties are being worked. Dredging auriferous alluvial deposits has not proved successful because of the large proportion of boulders. It is expected that the Amayapampa mine will resume work shortly.

In spite of the innumerable old silver mines that are scattered over the country, little silver mining is carried on, the principal producers being Soux of Potosí, the San José and Huanchaca mines. Attempts to float the San Cristobal mine in London were unsuccessful. During the present year the old silver mines of Colquechaca will probably be restarted. From an examination of a large number of the old silver mines it is evident that the Spaniards extracted practically all the payable ore from the oxidized zone. In the majority of cases the bottom levels are not accessible, and it is probable that the Spaniards did not continue working for one or more of the following reasons: Difficulty with water and ventilation, pinching out of the orebodies and unsuccessful treatment of the sulphide ores.

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Bethlehem Steel Corporation

The financial report of the Bethlehem Steel Corporation for the year ended Dec. 31 last is unexpectedly favorable, showing a substantial increase over 1913. The statement is given below, the net earnings being the surplus over working expenses, ordinary and extraordinary repairs and maintenance of plants:

	1913	1914
Net earnings	$8,530,708	$9,378,385
Interest, etc., received	221,963	271,283
Total net income	$8,752,671	$9,649,668
Interest on funded and other debt	$2,101,184	$2,212,374
Depreciation of plants	1,272,270	1,500,000
Exhaustion of mines, etc.	256,516	347,273
Total charges	$3,629,970	$4,059,647
Surplus	$5,122,701	$5,590,021

Dividends paid on preferred stock in 1914 were $745,400, leaving a net balance of $4,844,621, equal to 30.6% on the common stock. The sum of $5,000,000 was appropriated for additions to plant.

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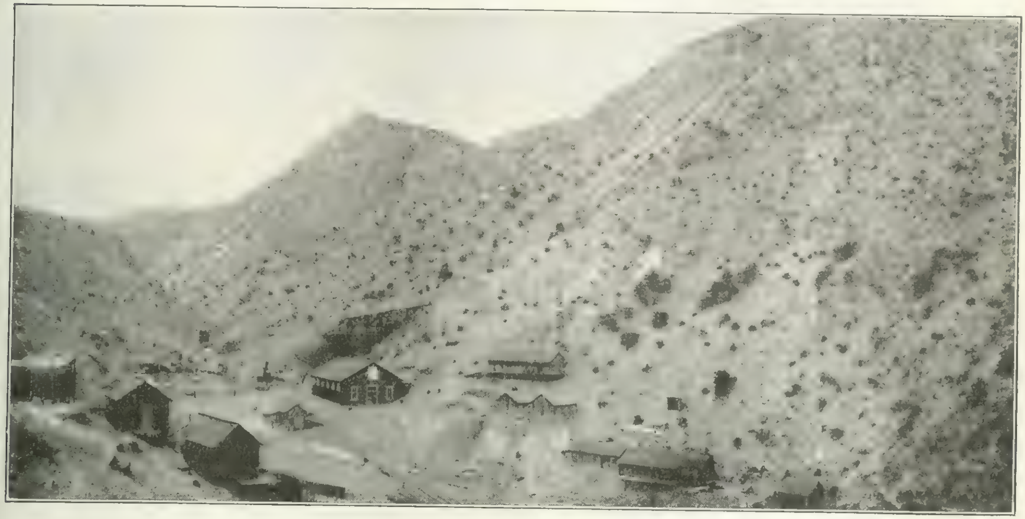
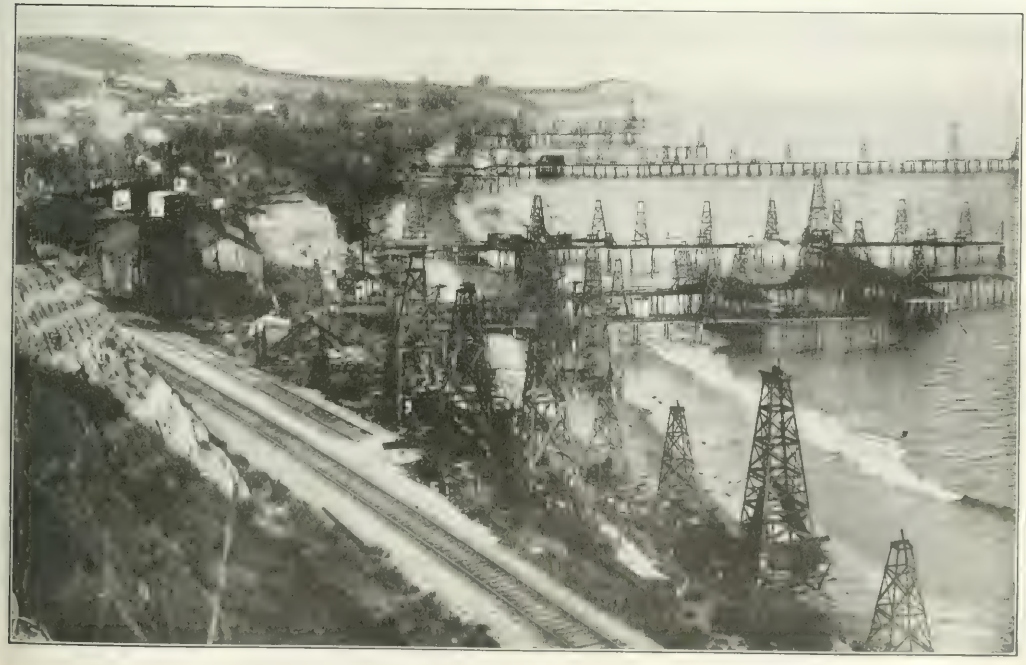
*Mining engineer, Casilla 105, Oruro, Bolivia.

Photographs from the Field



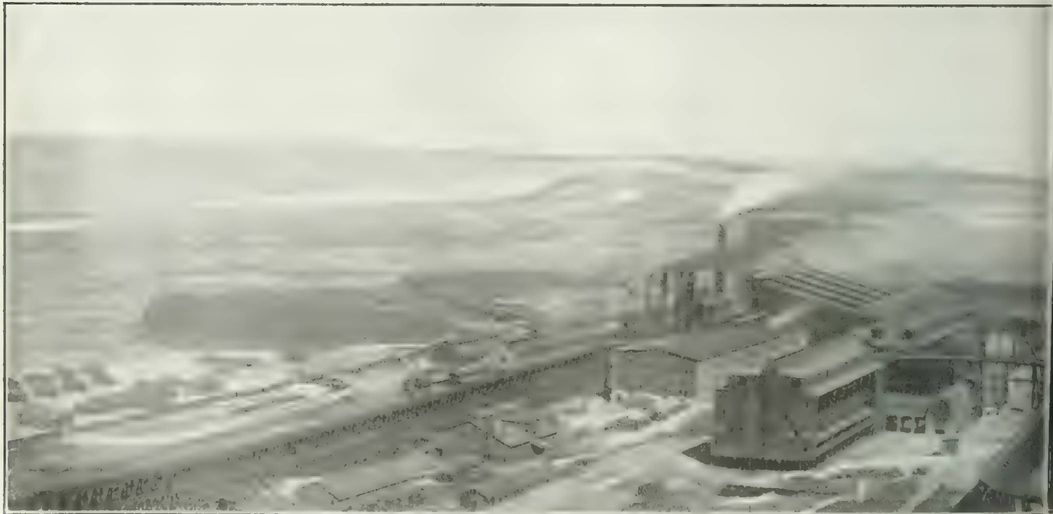
The Arizona Copper Co.'s Old Incline, 1500 Ft. Long, at Metcalf, Ariz.



A Group of Oil Wells on the Beach at Summerland, Calif.

A Panoramic View of the Mogollon Mountain

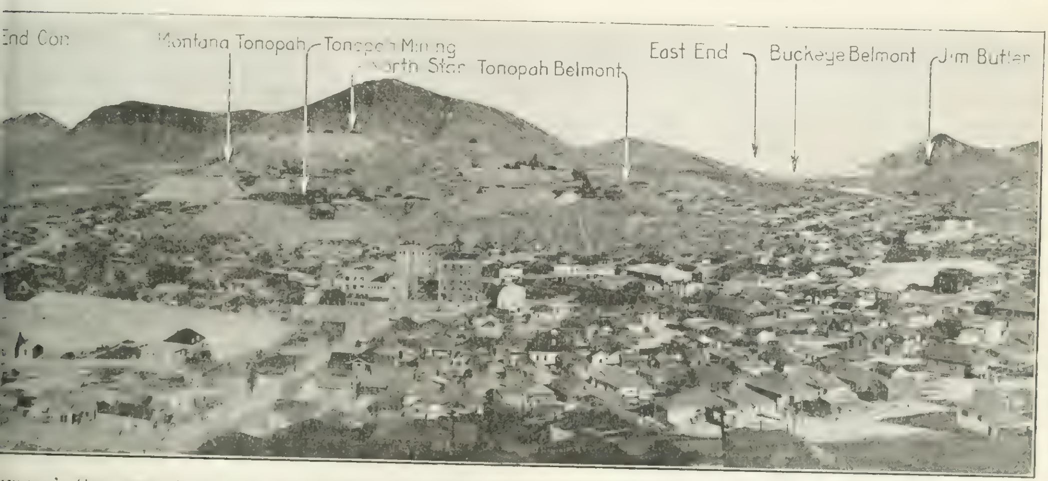
City and Camp of Tonopah, Nev., One o



Plant of the Garfield Smelting Co., Garfield, Utah, a Propel

Plant is 15 miles w

New Mexico, Looking Northeast from Mogollon



erica's Greatest Silver-Mining Districts

The American Smelters' Securities Co.: Salt Beds in Background
alt Lake City

The Layland Rescue Work

The following remarks by Earl A. Henry, the head of the Department of Mines of West Virginia, will be of interest to readers:

"I arrived at the Layland mine on the evening of Mar. 2, the day of the explosion, and was on the ground from that time until all the bodies, both dead and alive, were removed from the mine. The rescue work was in charge of H. M. Bertolet, the general superintendent, and the State Mine Department, ably assisted by Oscar Knerr and John Clapperton, superintendents under Mr. Bertolet, also several hundred volunteers from the different mines in the New River coal field.

"While Secretary Lane and George S. Rice, through the press, give great credit to the helmetmen connected with the Bureau of Mines, they would be unable to convince the mining people of any heroic work accomplished by them at the Layland disaster. The statement has been made in an interview that the helmetmen worked in advance of the state mine inspectors and others; that their work consisted of constructing brattices and arranging the ventilation in the dangerous sections of the mine, making it possible for the parties engaged in the rescue work to proceed without any danger whatever. If the helmetmen constructed any brattices or did anything to assist in arranging a system of ventilation, it is unknown to any person who was on the ground.

"There were no extremely dangerous conditions encountered in the rescue work, as the mine did not liberate explosive gas and there was no evidence of great force in any section of the mine, there being only a few light slate falls to travel over. The greatest difficulty was the afterdamp resulting from the explosion.

"I have no desire to do or say anything that might detract from or take away any honors due to the helmetmen. I believe that credit should be given to those to whom credit is due, and I desire to go on record by saying that no more heroic men could be found on God's earth than those who volunteered their services and assisted in the rescue work at the Layland mine. These men were mine foremen, firebosses, miners and mine laborers from the different mines in the New River field. They hurried to the scene and entered into this work of their own free will and did not expect to be rewarded with medals of honor for anything they might do in an effort to remove the dead, or to rescue the living, if any might be found entombed in the mine. Their only motive was one of humanity, and they were in no way seeking honors.

"As to the helmetmen rescuing a number of live persons—this is a misstatement of facts. At midnight on Friday, Mar. 5, all the rescue workers were called from the mine and the fan was stopped so that arrangements could be made on Saturday morning to reverse the air current. About 8 a.m. of the latter day five Italians walked out of the mine with open lights, making the statement that on the morning of the explosion they had inclosed themselves behind a brattice at the head of 9th left entry of No. 3 main haulage road, approximately a mile and a quarter from the entrance of the mine.

"These men had each day tried to make their way out, but could not do so by reason of the afterdamp; but after the fan had been stopped and the air current had ceased for about seven hours these men were able to travel to the outside, at which time they reported that 12 men were bratticed off in the 10th left heading off No. 3 main haulage road, a distance of 500 ft. farther in the mine than the 9th left heading. The 9th and 10th left headings were the regular working places of these men and were in no way affected by the explosion except by the cutting off of the ventilation.

"The question that is raised by the mining people in this state is: Why should the use of helmets be necessary to rescue the entombed men when they were able to use an open light all the time they were entrapped in the mine and when rescued were able to travel to the outside without the use of helmets?

"In conclusion I desire to say that the Department of Mines of West Virginia is willing to coöperate and assist the Bureau of Mines in all its efforts to determine the cause of these disastrous explosions and will cheerfully adopt any recommendations that will prevent any other disastrous catastrophe in this state, but I do not believe that mine explosions can be prevented by long-winded statements given out to the newspapers booming the work of any person along this line."

The report of the coroner's jury contains no matters of interest, the statement being that the five men whose deaths were investigated "came to their death by a dust explosion caused by a blownout shot in the third left of the main tunnel heading in No. 3 mine of the New River & Pocahontas Consolidated Coal Co., located at Layland, county of Lafayette, State of West Virginia, on Tuesday, Mar. 2, 1915."

The *Fayette Tribune and Free Press,* of Fayetteville, W. Va., Mar. 18, 1915, under the heading, "Pricking a Bubble," said:

"It is learned from newspaper reports emanating from Washington that the 'expert' rescuers sent by the Federal Government to Layland are to be decorated with gold medals in commemoration of their brave services in rescuing 47 men alive from the mines. And not only are they to have these mute testimonials of their rare courage, but the Secretary of the Interior, Mr. Lane, treats them to a tribute such as would make modesty shrink. Here is the item that is going the rounds:

"Tribute to the Bureau of Mines' rescuers for saving 47 men from death in the mine at Layland, W. Va., was paid by Secretary Lane, of the Interior Department, in a statement issued this week. 'Out of the gloom of such a catastrophe,' said Secretary Line, 'involving, as it appeared from the earlier dispatches, more than one hundred lives, the saving of 47 men comes almost as a benediction. I am proud of the brave fellows from the Bureau of Mines who have been working heroically for several days to bring about this consummation. I am equally proud of their associates who have been trained in the modern rescue methods by our men. For years it has been demonstrated that the old methods of rescue work not only did not save lives, but even cost the lives of many brave volunteers.

" 'The oxygen helmets worn by the trained rescuers, which permitted them to penetrate parts of the mine filled with poisonous gases where no other human being could go, are undoubtedly responsible for the saving of the miners. The bureau's men, always in advance of the volunteers, restored the ventilation in the mine, thus permitting the volunteers to advance. Presumably the entombed men had protected themselves from the deadly gases by the erection of temporary doors. Then the way out of the mine was comparatively easy, for it had been restored to normal conditions as the rescuers proceeded.

" 'I have wired to the rescuers,' said Secretary Lane, 'my heartfelt appreciation of their heroic efforts in saving these lives. I am also told that the American Mine Safety Association has already started a movement to award to each rescuer one of its gold medals.'

"From unbiased, unprejudiced sources the *Tribune* learns that not only are the federal rescuers not entitled to so lavish a testimonial, but are entitled to none at all. Instead of being of service in this time of great distress, they were an almost intolerable nuisance.

"Such credit as is due for heroism in the rescue work at Layland, and much *is* due, should go to the volunteers and not to the trained rescuers of whom Secretary Lane speaks. They were there with the real article of courage and almost foolhardy zeal in their efforts to clear up the mine and rescue survivors, if such there should be.

"The State Department, headed by Mr. Henry, assisted by Inspectors Holliday, Absalom, Murray, Blenkinsopp, Lambert and Cobb, working without safety appliances and unaccompanied by canary birds to give them warning of foul air, were the real heroes of the week of horror at Layland. There were dozens of others too that might be mentioned who went about the work with a seriousness born of courage.

"These were thinking of the distress and discomfort of the mourning ones about the mine mouth. The others were taking up their time telegraphing reports to headquarters and informing the newspapers of their heroic handiwork. Secretary Lane has been imposed upon."

The Case of Leonard Worcester, Jr.

A case which demonstrates how modern government works in Mexico is that of Leonard Worcester, Jr., who was arrested Feb. 13 last upon complaint of Francisco Rueda Quijano and confined to the Chihuahua penitentiary. He is charged with conspiring with the Granby Mining & Smelting Co., of St. Louis, to defraud Quijano of money due for ore purchased from him by the Granby company coming from a mine which originally belonged to the Cia. Minera Ignacio Rodriguez Ramos, but which was confiscated by the Villa government and leased by it to Quijano.

Mr. Worcester wrote to the Editor of the Journal, explaining that he was employed by the Granby company to attend to all matters incident to the forwarding of ore from Chihuahua, paying expenses incurred and transmitting to Quijano 75% of the value of the ore, the funds for which were to be furnished by the Granby company; but Worcester was not to be personally responsible. After a time the Granby company became alarmed for fear of action against it by the original owners of the mine and withheld the 75% due to Quijano on 15 cars of ore, withdrawing without notice, as explained by Mr. Worcester, the money deposited in the State National Bank of El Paso. Quijano then had Worcester arrested and confined in the penitentiary, a large part of the time *incommunicado* and without bail. Mr. Letcher, American Consul at Chihuahua, investigated and then advised Secretary Bryan of Worcester's innocence and freedom from responsiblity in the matter. Secretary Bryan instructed George B. Carothers, Special Agent of the State Department, to take up the matter. Carothers was in Chihuahua for two days after he received the instructions, but made no effort to investigate the case at first hand and did not attempt to see Worcester. Carothers wired the State Department that he did not believe the Villa government was interested in Worcester's prosecution and that he had been advised that Worcester had not applied for bail, which was not true, and that he would be admitted to bail if he applied. He applied and was again refused.

In order to clear the matter up definitely the Journal communicated with the Granby Mining & Smelting Co. and received the following letter, under date of Mar. 25:

> On Nov. 27, 1914, a representative of our company was sent to Chihuahua, Mexico, and while there entered into a contract with one F. Rueda Quijano for the purchase of a certain tonnage of zinc silicate and zinc-carbonate ore. The Chihuahua Ore Testing & Sampling Co., of which Mr Leonard Worcester, Jr., is president, was instrumental in interesting us in this matter, and under the contract the Chihuahua Ore Testing & Sampling Co was selected by both parties to make a preliminary assay, and we agreed to accept drafts for 75% of the purchase price as shown by these assays, the drafts to have the bills of lading and the assays attached. Our representative learned that this mine had been confiscated by the Villa authorities, and as part of the transaction Mr. Quijano was to secure releases from the original owners, and our representative was given to understand by Mr. Worcester that Quijano would be able to secure these releases.
>
> Five cars were shipped and we paid drafts for 75% of the price on Mr. Worcester's assays. About that time some difficulty arose on account of certain extortionate and improper demands of the local Mexican custom authorities with respect to the export duties, and 15 cars passed Chihuahua and went to the border without Mr. Worcester securing the necessary samples for assays. About the time these cars reached the border we were notified by the original owners not to accept this ore, as the title remained in them and they were under contract with the Empire Zinc Co. We immediately sent down our representative, who ascertained that Mr. Quijano would not be able to secure releases from the original owners, and in fact made no effort to do so. As the 15 cars were then within reach of attachment, we were advised by our counsel to notify Worcester and Quijano that no payment could be made on the 15 cars until they reached our smelter at Neodesha, and furthermore to notify Mr. Quijano that we would not accept any further ore under the contract. We so notified him. At the same time, under our attorney's advice, we withdrew a deposit which we had placed in a bank in El Paso, merely for convenience in paying any drafts drawn on us. We received a letter from Mr. Worcester stating that these notices had been received and served on Quijano and that Quijano had protested; but Mr. Worcester did not indicate that he thought our action was not entirely justified under the circumstances, and in fact he endeavored to interest us in the purchase of other ore in the Chihuahua district.
>
> On Feb. 9 we received a telegram from Worcester stating that he had been arrested. We at once got into communication with Mr. Marion Letcher, Consul at Chihuahua, who advised us that Mr. Worcester had been released under surveillance, with him as surety. On Feb. 15 we received the following telegram from the Consul:
>
> Worcester in prison here like common criminal. In solitary confinement since Saturday. Telegraph status of shipment of ore made by him to your smelter on behalf Quijano, since this has formed pretended basis criminal procedure in case.
>
> We immediately replied by wire to Mr. Letcher as follows:
>
> Your telegram. Cars have arrived at smelter awaiting release U. S. inspectors. Have Quijano draw on us for three-fourths value 15 cars with Worcester's analysis and statement attached as per contract and we will honor drafts.
>
> We asumed that this had cleared the situation, and heard nothing until Feb. 28, when we received the following telegram from Consul Letcher:
>
> Worcester still in prison here. Quijano refusing accept any settlement based on his assays and pretending criminal responsibility on Worcester's part involving valuation of 15 cars in excess of $10,000, calculating this on Government assays which are ridiculously high and on quotation on zinc for day on which cars crossed border. Worcester desires to know if you are ready to make final liquidation on 20 cars on your results. If so wire American Consul Juarez for transmission here by mail, with amount due Quijano according to your liquidation on 20 cars and also your assays by car numbers.
>
> We replied by wire as requested, as follows:
>
> Results show five thousand three hundred twenty dollars and eighty-one cents due on twenty cars. Quijano can draw on us at State National Bank, El Paso, for above amount, and on being so advised we will arrange for payment of draft. If preferred we will settle on U. S. Government samples, weights and assays which check ours within two-tenths of one per cent. Please mail this telegram to Letcher, Consul at Chihuahua.
>
> We followed this by a letter sending settlement sheets in detail on each car and confirming our offer to settle on either our assays or the assays of the United States Government or on Worcester's assays. We have never at any time received Worcester's assays on the last 15 cars, although samples were taken by him after the cars had reached the border. In our letter we explained that we would be entirely

justified in withholding any payment on this ore until the question of title had been determined and that we made the offer simply in order to expedite the release of Mr. Worcester, although we were in no way responsible therefor. We heard nothing more in reference to this matter until Mar. 17, when we received the following telegram from Consul Letcher:

> Referring to your letter of the sixth, to Consul Edwards, last paragraph, Worcester still confined. Am notifying Quijano this morning that I will recommend to you final and irrevocable withdrawal provisional offer at 10 o'clock tomorrow morning unless Worcester unconditionally released. Meanwhile this for your information.

In reply we immediately wired Consul Letcher as follows:

> Your wire received. If Worcester not unconditionally released before 10 o'clock Thursday morning, our offer is withdrawn. Please advise Quijano.

As we have received no notice that any draft has been drawn upon us on the bank at El Paso as directed, we doubt very much if Mr. Worcester's release has been secured.

The Mexican Government's assays for export average about 10 points higher than either the assays of the United States Government or our own assays, and would have resulted in adding about $5000 to the price of this ore. As the Consul states, this course would be ridiculous. Our counsel advises that under ordinary circumstances we should not pay anyone for this ore until title is settled, and our judgment would lead us to the same conclusion. In offering to settle in full, as provided in the contract for the ore, we did so merely to assist in securing Mr. Worcester's release. While we are in no sense responsible for what has happened to Mr. Worcester, we are naturally very much interested in securing his release, and have done everything we were requested to do by the Consulate officials.

The matter was then taken up by the Granby company with the State Department in Washington, and assurances were made that Mr. Worcester would be immediately admitted to bail, so that the supposition at the present time is that he is at liberty. Mr. Worcester expresses the belief that, as Quijano said to him, the refusal to accept the liquidation offered by the Granby company and the demand for a much larger sum of money was because Villa was personally interested in the matter and was to receive 80% of the profits of the deal.

The New Mining Edict in Mexico

In promulgating an addition to the mining law of Mexico, General Villa has taken a step which, if not promptly retracted, will inevitably prove to be the death of his cause.

In order to protest against the decree, a committee representing about 90% of the foreign holdings in the State of Chihuahua and including representations of such companies as San Toy, Potosi, Chihuahua Mining Co., Rio Tinto, Alvarado, American Smelting & Refining Co., Mines Co. of America, London Exploration Co., Empire Zinc Co. and the Guanajuato companies, has formulated a protest which has been sent to the State Department at Washington, explaining the effect of the new law and urging steps to secure its immediate repeal. Extracts from the vital parts of this report are noted herewith:

"In briefest terms, any of the following may cause forfeiture of mining property:

"(1) Nonpayment of taxes within the prescribed period.

"(2) Voluntary suspension of working of mine for 60 days or more, excepting because of fortuitous circumstances individually approved by the Secretary of Fomento as being of sufficient weight to justify the nonoperation of the property.

"(3) Abandonment of work.

"(4) Deficient exploitation (to be determined by the Secretary of Fomento).

"(5) Failure to maintain prescribed work in each 5-*hectara* section (regardless of the practicability of such work or the irregular occurrence of the mineral deposits).

"The enforcement of this drastic decree, which is about to be promulgated by the action of a dictator who has assumed the powers of legislation inherent only in a national legislature, will radically change an important fundamental property law, apparently without full knowledge of the serious consequences involved, and, so far as we know, without giving the mining interests of the republic a chance to be heard in this matter, which so vitally affects their welfare.

"We maintain that the restrictions imposed by the new law are absolutely unjust and will work great hardship to American investors who in good faith and at great sacrifice have acquired mining property in the Republic of Mexico, chiefly during the period when the relations between the United States and the Mexican republic were amicable and when there was reason to believe that their investments were welcomed by the Mexican nation, and that the security of the same was assured under international law and existing treaties between the two nations. The present decree is evidence that this confidence was misplaced.

"As a result of the conditions existing in Mexico during the last few years, both this and the preceding administration of our government have felt constrained to advise foreigners to leave the Republic of Mexico until such time as conditions in the country rendered it safe for them to return to their respective business occupations. As a result of this, we believe it is safe to assert that at least 85% of the foreign-owned mining properties in the Republic of Mexico have been closed down and their owners have returned either to the United States or to Europe, feeling that their investments were safe so long as they continued to pay the tax upon their properties as fixed by law, which properties in the great majority of cases have been purchased from Mexicans for large sums of money.

"American citizens who have withdrawn from Mexico at the urgent request of their own State Department and have been deterred from returning to Mexico by the published warnings of that Department find themselves in this position: After losing in many instances large amounts of personal property as a consequence of the internal disorder in the Mexican Republic, but nevertheless having paid at considerable cost and sacrifice the taxes imposed by one, and in some cases by two, of the Mexican factions claiming to be *de facto* governments, these property-owning American citizens are now threatened with the loss of their properties if they do not expend further sums—regardless of profit—in the development and operation of the properties which they hold. They are required to do this, not in the most economical and systematic manner for the development of their property according as the occurrence of the ore dictates, but under an arbitrary and unscientific restriction which requires that for every five continuous *pertenencias* of any group there must be an extraction working. From a technical standpoint this is absolutely absurd. The new decree requires such expenditures, whether or not an orebody is known to exist, and apparently regardless of whether the ore is of profitable grade under prevailing conditions and metal markets.

"The decree requires, also, that the scale of operations must be sufficient, and it is left to the discretion of the Secretary of Fomento in the last instance to rule whether or not the extent of operations is sufficient. If he decides that the scale is insufficient, he is authorized to declare the title forfeited and the property subject to denouncement by any individual residing within the republic.

"The mineral agents in the several districts are delegated to act as inspectors and to bring all cases of noncompliance with the new law to the attention of the Secretary of Fomento. This feature introduces opportunities for graft on the part of the mineral agents and opens up an unlimited field of annoyance to mining operators. In view of the fact that under present conditions even well-equipped properties, with complete operating staff organizations, are unable to operate on a really profitable scale because of the insufficiency of labor supply and of railroad facilities which render it extremely difficult to secure needed supplies and fuel or to ship the product mined to treatment plants; therefore, in the case of most properties, especially those which are isolated or in an early stage of development, it is clearly impossible for the owners to comply with the new decree; and consequently the enforcement of this decree is confiscatory in effect.

"In case any developed mines should even temporarily be forfeited to the Mexican Government and by it delivered to some other individual, it is highly probable that immense damage would result to the mine before the same could be recovered by the original owners after a really constitutional government shall have been established.

"This decree is unjust and harmful to the interests of American citizens who have in good faith invested in mining property in the Republic of Mexico. Unless the decree can be repealed or annulled great hardship, distress and financial loss will result to individuals and corporations who have already suffered immensely."

Following is a translation of the Villa decree:

Francisco Villa, General in Chief of Operations of the Constitutionalist army, unto the inhabitants of the Republic, makes known:

That by virtue of the extraordinary faculties contained in the decree of February last, issued in the city of Aguascalientes, of which I am invested, and

Considering, That the voluntary suspension of mining exploitation without justified cause, is detrimental to the nation, inasmuch as there is hereby withdrawn from the commercial activity means of necessary wealth in general and since it likewise depletes the public treasury by the non-payment of taxes thereto accruing by permanent exploitation;

That the payment of the mine taxation now in force on mining properties should not, according to the general constitution of the republic, be of so ample effects as regards the right of ownership of such mining claims as to imply a monopoly, as would happen if the guarantee of a mining claim were to base his donation solely on the payment of said tax, as without any other motive that the ministration of an exiguous law should withhold from the world's commerce an effective value in order to convert same to his own benefit;

That the foregoing reasonings are at present of so much greater importance, as the circumstances of the country require for one part that the exchequer should lose none of its incomes which are indispensable for the fulfillment of its obligations, today increased by the requirements of war, and for the other part, so that the revolution realizes everything possible of its aspirations, one of which is abolition of all monopoly, and

That not only for public utility recognized in the mining industry by its laws that exploitation of the properties promotes and that derived from the transactions therefrom resulting, the government must see that the same does not decline, but by reason of notorious injuries that would result from the diminishing of the mining activity, as the inactivity of the hands employed in mining might occasion in these difficult moments, besides the sufferings of the poorer classes, new confusions of public order, I have seen fit to decree the following:

Art. 1. Article 51 of the mining law is hereby reformed in the following terms:

"Art. 51. Mining property shall be forfeited by the non-payment of taxes, in accordance with the conditions established by said law; by the voluntary suspension of working of the mines; by the abandonment of such work and by insufficient exploitation."

Art. 2—Voluntary suspension or abandonment of the working, when suspended for 60 days or more, except in cases of accident or constraint, to be judged qualified by the secretary of "Fomento." The maintenance of a watchman or a corps of employees in charge as caretakers of a property shall not be considered as activity of working unless at the same time interior work is being done in the mine.

Art. 3—Every individual or company at present owning or to whom in the future a mining claim be adjudicated, must maintain in activity at least one working exploitation within each five pertenecias (10 acres), or fraction thereof, that may be contiguous, it being understood that a working is a shaft, pit, tier, tunnel or any other working, whatsoever be its name, which be subject to work of extraction and not those which serve for access to the mine.

Art. 4—The provisions set forth in the preceding articles are understood to be without detriment of maintaining in good order the timbering and other necessary work for the security and salubrity of the interior of the mines.

Art. 5—The mines at present not being explored or those which are suspended within the territory of the republic must begin their working in the manner set forth in the foregoing articles three and four, within 120 days counting from the date of the promulgation of this law.

Art. 6—Unto the individuals or companies possessing claims of more than five pertenencias without having worked same in the manner aforesaid, are likewise conceded a period of 120 days in which to begin exploitation in accordance with this decree, except in such cases that they have forfeited the property by non-payment of the taxes upon their mining claims.

Art. 7—If, however, they have failed to pay the said tax they shall enjoy a period of 90 days, beginning with the promulgation of this law, in which to pay same and start their exploitation.

Art. 8.—No individual can in the future denounce more than 15 continuous pertenencias, and no company or corporation may denounce more than 150 pertenencias, in the same mining district except in the event, determined by the secretary of "Fomento," after expert report, that by reason of the nature of the acres of ground to be explored, would necessitate the increase of the number of pertenencias which are by those articles designated as the limit.

Art. 9—For the effects of this decree relative to the forfeiture by reason of voluntary suspension or abandonment, of recent or long past date or efficiency of the working of the mines, the mining agent shall be under obligations to give notice unto the secretary of "Fomento," that the periods of 60, 90, 120 days herein conceded, having transpired without the working having been continued or increased, in their cases, and in order that the said secretary, with due knowledge of the circumstance, may determine the cause of suspension or abandonment or the insufficiency of said workings. It is understood under the terms of this decree, as suspension, abandonment, or insufficiency, of the workings, to be of cognizance of the secretary of "Fomento," to declare the forfeiture of mining property, in the same manner in which the secretary of hacienda decrees same by reason of non-payment of taxes.

Art. 10—The mining agents in order to comply with the obligations imposed in the preceding articles shall keep themselves informed of the working of the mines within the jurisdiction of the office under their charge.

The owners of mines, in their turn, as soon as an accident occurs, or be restrained from working their mines, shall make said cause known unto the mining agent, so that he may assure himself through experts appointed for the purpose, of the reasons for such suspension or abandonment.

Art. 11—The right is conceded unto every individual residing within the republic to make a denouncement unto the secretary of "Fomento," through the mining agencies, of all mines whose workings are suspended, abandoned or not being integrally exploited by the individuals or companies who have denounced same, though they pay or not the [illegible].

Transitory. 1. All legal dispositions which may conflict with this decree are hereby annulled. 2. This decree shall become effective on the 1st day of April [illegible].

Given in the City of Monterey, N. L., the [illegible] day of March, 1915.

Note—This translation is one furnished as official and has been printed without alteration.—EDITOR.

Editorials

The Case of Leonard Worcester, Jr.

Elsewhere in this issue we give considerable space to a statement of the case of Leonard Worcester, Jr., for not only may it help him out of a bad predicament, but also it illustrates to our readers one of the many perils of trying to do business in Mexico at present. Chihuahua is the capital of the district that is supposed to be in the best order of any in Mexico. It is in that state only that mines are being operated generally, and of all the smelting works of the American Smelting & Refining Co. its Chihuahua plant is the only one that is running. However, the kind of law and order that prevails does not excite our enthusiasm. In the matter of selling ore, as illustrated by the case of Mr. Worcester, the idea seems to be to obtain settlement on the seller's own assay and cast the broker into jail if the buyer does not agree. Incarceration in a Mexican jail is not an agreeable experience, although, no doubt, it is better than being killed.

In the present case Mr. Worcester was manifestly an innocent party, while his principal—the Granby Mining & Smelting Co.—clearly acted with perfect propriety and much generosity. Such doings as there were about this ore shipment would not be permitted if there were any real government in Chihuahua. In fact, there is no real government anywhere in Mexico. Everything there is wrong and nobody is safe there at the present time. In the matter of Mr. Worcester it is to be hoped that Washington will act effectively.

* * *

A New Mining Law in Mexico?

A new and calamitous era for mining men in Mexico is about to commence. Villa has issued a proclamation embodying a new set of laws governing mining—a set of laws which can by no means be carried out. He stipulates that work on mining properties must be continuous and in amount to satisfy the Secretary of Fomento, who is to be the sole judge of whether a property is to be confiscated or not. Each block of five pertenencias must be worked, which is a technical absurdity. The payment of taxes is not to be sufficient to maintain ownership, no matter what may have been the conditions of former development.

We suspect that Villa has been duped by a coterie of individuals who want to confiscate foreign-owned property for their own benefit. A reference to the case of Leonard Worcester, Jr., which is explained on another page, shows how this is done and what its results are. Villa should be more watchful. It was just such practices as these that led to the downfall of Diaz. Pandering to favorites and exploiting the country's resources for individuals will not do. In this case the conditions are much worse for Villa. His act will estrange all foreign sympathy, isolate his cause, and start him on his way to oblivion. There will be no lack of other Mexican factions which will gain capital and sympathy by opposing Villa's scheme for replenishing his treasury. It behooves him, then, to pay strict attention to business and to discourage those advisers who, with only self-interest in view, are likely to put his cause beyond the possibility of success.

The Layland Mine Disaster

The explosion in the colliery at Layland, W. Va., on Mar. 2 has led to an interesting difference of opinion between the Department of the Interior at Washington and the mining department of the State of West Virginia. A rescue force of the U. S. Bureau of Mines arrived at the mine before the entombed miners had been released and were with the rescue party that entered the mine. The Secretary of the Interior has said some very flattering things about the U. S. Bureau of Mines men, speaking of them as leading the rescue party, exhibiting extraordinary bravery at the risk of their lives and being worthy of medals of honor. The chief mine inspector of West Virginia, who was in the rescue party, takes a different view of this, and says emphatically that the U. S. Bureau of Mines men were not leaders, and rather implies that they were simply "also rans" and were more or less in the way. The local paper also has said some sarcastic things about this.

The question seems to be whether the Washington officials have been crowning themselves with laurels that belong to other people, who in fact did not regard themselves as heroes, but simply as miners doing the day's work. The Secretary of the Interior has had his say and the West Virginia inspector has had his. Now—we should like to have the version of the technical chiefs of the Bureau of Mines.

* * *

The Platinum Market

In former years it was the custom among platinum refiners, both British and American, to exchange new platinum for scrap at a differential of about \$1.25@1.50 per oz.; but at present buyers find themselves unable to get more than \$36@38 for the scrap they turn in, although refined ingot is quoted at \$38@40. This unusual differential reflects a condition analogous to that of an inactive stock in the stock market, which may be quoted at 3 bid, 40 asked. Transactions may occur at either extreme according as the buyer or seller is the more urgent.

Recent transactions in platinum have been at the price quoted, but they have been small in amount and reflec the price asked by refiners and which is paid by occasiona buyers. When somebody seeks a buyer the condition be comes quite different.

Ever since the war began the situation in the platinum market has been one of the perplexities among man topsy-turvy things. In 1914 the price was steady at \$4 @45 up to August; then it rose to \$55@60, but soo fell to \$50. The advance was attributable especially t fear of a suspension of supply from Russia. The expo from there did cease, yet that had no great effect upon the market here, which began to decline in October, and soon was back at $43@45. This was a surprising development, inasmuch as production in Russia had come practically to a standstill, and consequently much distress among the miners was reported.

So far as we know, the conditions in Russia have not changed materially. The surprising thing is that the diminution in the supply from Russia has not caused any inconvenience in the consuming countries. Even the recent announcement of a Russian embargo on platinum was without effect. The demand for platinum seemed simply to fade away when the war began. Things here were so gloomy that relatively few persons were disposed to buy expensive jewelry, and we imagine that in Europe the interest in jewelry became even less.

We hear from manufacturers of jewelry that their trade prospects are now improving and that the demand for platinum settings promises to be even more emphatic than formerly. In view of the diminished supply of platinum this ought to make for an improvement in price; but there may be obscure, offsetting conditions whereof we are ignorant. The employment of substitutes in the dental trade may be a factor. Anyway, the platinum market is still stagnant and uninteresting.

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More Apex Litigation

Apex litigation, which has torn Butte for so many years and which has been so prolific of trouble and expense in Utah, has now seized upon the heretofore peaceful camps of Nevada, with results which, we anticipate, will have a more far-reaching significance than to the present litigants alone.

Goldfield is the latest entry on the list. The camp was seemingly on the road to a new era of prosperity after the long period of decline and slump covering nearly eight years. New discoveries of rich ore and the study of attendant geological conditions had inspired new interest and confidence and stimulated much new work. The Booth-Jumbo Ex. apex suit was filed and the scene has changed from one of optimistic endeavor to one of watchful waiting while the litigants are preparing for the long fight.

Tonopah has a $3,000,000 apex decision pending, with other suits likely as soon as it is found out which way the cat hops. Pending litigation not only affects the mining costs and limits the production of the parties to the suit, but deters other operators in the camp from undertakings to which they would otherwise be inclined—in this case, for instance, the Lone Star development on the southwestern section of its property has been stopped—besides casting more or less gloom and discredit on the issues in the stock market and on the camp itself as a whole.

A distinguished engineer, who makes a specialty of apex geology, states that there is almost an epidemic of new apex litigation and that he has more cases on hand now than he has had at any time for several years. The psychology of an apex suit is very unfortunate and affects many people. Hair-splitting over some geologic point, which may be more or less of a moot question anyway, is not conducive to the best interests of the mining profession from any standpoint.

The notable case of Bisbee, where in the early days of the camp agreements were made between various companies whereby vertical boundaries should be recognized, thus insuring peace in the camp and a concentration of energy and talent along strictly productive lines, recalls itself at this time as an impressive argument for a change in our mining law repealing the apex stipulations. In the case of the Booth and the Goldfield Consolidated we have another similar argument. When a question of apex recently arose between these companies, as a result of a conference the incident was closed by the passing of valuable considerations, not announced, and the agreement that in the future vertical boundaries should obtain between these two properties, thereby preventing any chance of future litigation.

There is no weight to the argument that the apex law was framed to cover a specific need and, having fulfilled that purpose successfully for many years, should not be changed. Even granting the first argument and passing over the second, the fact remains that conditions today are much more different in the mining industry than those prevailing when the apex law was originally framed; and the fact that mining operators with broad and extensive interests agree, for themselves and the district, that the apex shall not apply there, but that vertical boundaries shall govern, seems to show that they feel the need of a relief which the law does not provide.

The apex law was originally intended to protect the prospector who located a vein which subsequent work might show dipped out of his original location. Experience of many years with prospectors has shown that they are never satisfied with locating one claim, but almost invariably stake as many claims around their discovery as they have any chance of holding by the annual labor they are able to do. This would afford them all of the protection which the apex law was intended to give; but, as a matter of fact, the prospector himself never needs this protection, because he is rarely in possession of the property when the underground development has proceeded far enough to demonstrate either the value of the vein or the fact that it dips into an adjoining property owned by someone else. If the apex law ever had a justification, it has certainly outlived its usefulness and now serves only to provide employment for lawyers and professional men, who could add much more of value to our store of economic geology by attacking the underground problems in harmonious concert than by applying their technical ingenuity to convincing the court that they see the geology as it will most profit their client to have it seen.

⁂

In an article on the kinds of spelter in the JOURNAL about two months ago we referred to the possibility of refining spelter by redistillation. Common, or Prime Western, spelter may thus be raised to the standard of "high grade." Ordinarily the cost of the process, including the loss of zinc, does not make it worth while to do this. However, the increased premium realized by "intermediate" and "high-grade" spelters produced new conditions, and we understand that such refining is now being practiced. Of course in recent months smelters have been making all the "brass special" they could. Selected brands of Prime Western even have realized premiums.

PERSONALS

Alexander Stanley Elmore, one of the inventors of the Elmore process of ore concentration, is visiting New York.

E. H. Hamilton has resigned from the Norfolk Smelting Co., owned by Beer, Sondheimer & Co., and is now retained by Messrs. Eustis of Boston.

John T. Glidden, for several years past with the Cerro de Pasco Mining Co., in Peru, is in the United States on a leave of absence. He was last week in Boston.

Charles Warnock has been appointed manager and treasurer of Robert W. Hunt & Co., Ltd., Montreal, succeeding Charles C. Whittier, transferred to the Chicago office.

Joseph Leiter, of Chicago, recently spent a couple of days investigating mining properties in Cobalt, Ont. It is understood that he will shortly pay a visit to the Porcupine camp.

John Campion, superintendent of the Yak Mining Co., Leadville, Colo., has gone to California, where he will spend two months in visiting the Panama-Pacific and San Diego expositions.

I. Cohade, chief metallurgical engineer of Schneider & Co., Creusot, France, is spending a short time in the United States looking after some orders for steel that are being placed by his company.

J. A. Reid, of Toronto, Ont., representing a Toronto-Cobalt syndicate, has gone West to investigate reported discoveries of silver and nickel ore near Fond du Lac, at the northeast end of Lake Athabaska, in Saskatchewan.

John Palmer Cosgro, formerly general manager for Mexico of the Mine & Smelter Supply Co., has accepted a position as chief engineer and general manager of sales, for the Wilfley Machinery Co., Ltd., with headquarters at Salisbury House, London, E. C., England.

Alexander Taylor of Toronto, Ont., formerly assistant secretary, has been appointed secretary of the Lake Superior Corporation, the Algoma Steel Corporation and subsidiary companies, succeeeding Thomas Gibson, who recently became president of the Lake Superior Corporation. Mr. Taylor was also appointed a director.

H. R. Wahl on Apr. 1 resigned his position as designer and construction engineer with the St. Joseph and Doe Run Lead companies. During his 10 years with that company he completed the designs of the Leadwood concentrator, the reconstruction of the Bonne Terre mill and the new mill at Rivermines, Mo. Mr. Wahl will for the present reside in Chicago, his address being in care of the Western Society of Engineers, Monadnock Block.

Dr. Henry M. Payne, who left New York for the Yukon Territory Apr. 5, as consulting engineer for the Canadian Klondyke Mining Co., after completing his work there, about July 1 will go to Japan, and thence into the Lena River gold field in Siberia, where his work will be to examine the Lemkoie mines as an expert in methods of mining frozen gravels. He expects to return by way of Petrograd, Archangel and London in November.

E. E. Thum, superintendent of construction of the Boston & Montana reduction department of the Anaconda Copper Mining Co., has resigned after eight years' service with the company, and has been appointed assistant professor of metallurgy in the University of Cincinnati. He succeeds there James Aston, who resigned to accept an appointment in the U. S. Bureau of Mines, where he will direct an investigation into efficiency and safety in the steel industries.

OBITUARY

Captain William J. [illegible], head mining captain at Mass mine, Ontonagon County, Mich., for 12 years, was found dead in skip at 11th level B shaft. It is supposed he fainted on his way underground to test new drill.

Leon Chester Thrasher, who had been employed as an engineer at the Broomassie Mines, West Africa, is reported lost on the steamer "Falaba," which was torpedoed and sunk by a German submarine. He was 31 years old and a citizen of the United States.

William O. Fletcher, for many years the assistant treasurer of the National Tube Works of Boston, which, in 1901, was merged with the United States Steel Corporation and later the private secretary of Capt. J. R. De Lamar, mine owner, died Mar. 31 at his residence in Brooklyn, N. Y., from heart disease. Mr. Fletcher was born in Hingham, Mass., 52 years ago, and is survived by a widow and a son.

Arthur R. Parsons died at Las Vegas, Nev., Mar. 3, aged 39 years. He was born at Salt Lake City and graduated from Lehigh University as a mining engineer. For a number of years he was at Delamar, Nev., where he rose to the position of superintendent of the mill at the Bamberger Delamar mine. His faithfulness and skill won for him the position of superintendent of the Desert mill of the Tonopah Mining Co. His success was instantaneous and remarkable up to the time when failing health compelled him to resign his position and go to California, not to return. The esteem in which he was held by the Tonopah company is evidenced by the fact that his name was never dropped from the payroll. Mr. Parsons was married in September, 1905, at Salt Lake City, to Laura Shier, daughter of John Shier, of Delamar; she survives him, with two sons.

Clarence Edgar Copeland, mining engineer, and his wife were killed with 53 others in a snow and rock slide which demolished part of the Britannia Mine camp, Britannia Beach, B. C., shortly after midnight on Mar. 22. Clarence Copeland graduated with honors from the Colorado School of Mines in 1913 and since then had been engaged in mining work on the Pacific Coast. He was 25 years of age and a member of the Beta Theta Pi, Tau Beta Pi and Hammer and Tongs fraternities. His connection with the Britannia Mining & Smelting Co. dates from November, 1913, and at the time of his death he was the mining engineer for that company. He was a most capable and willing engineer with a brilliant future before him. On Jan. 6, 1915, he married Katherine Nora Holland of Seattle, Wash., who died with him. He is survived by his father and mother, Mr. and Mrs. J. S. Copeland of Los Angeles.

SOCIETIES

Montana Society of Engineers—The annual convention was to be in Butte this year Apr. 8, 9 and 10. The committee on arrangements, consisting of Reno H. Sales, president, Samuel Barker, Jr., Bertram H. Dunshee, Harry C. Bacorn and Clinton H. Moore, have completed the following program: Thursday, Apr. 8—Gathering and registration at the Silver Bow Club. Friday, Apr. 9, forenoon—Trips to the Anaconda mines, Timber Butte reduction plant, School of Mines, North Butte electric hoist, Butte & Superior zinc mill. Afternoon: Trip to Anaconda, Washoe smeltery and improvements. Evening: Exhibit of pictures of the Montana Power company, showing development work and plants in operation. Saturday, Apr. 10—Forenoon: Business meeting at 9:30. Lunch at Silver Bow Club. Afternoon: President's address at 1:30. Paper by Frank R. Ingalsbe, of the forestry service; subject, "Notes on National Forestry in Montana." Paper by Girard B. Rosenblatt; subject, "The Electric Hoist," installed at Granite Mountain shaft, North Butte Mining Co. Evening: Banquet at the Silver Bow Club.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., APR. 1, 1915.

of The Engineering and Mining Journal, published weekly at New York, N. Y., required by the Act of August 24, 1912.

Editor, Walter Renton Ingalls, 10th Ave. at 36th St., New York, N. Y.

Managing Editor, Donald M. Liddell, 10th Ave. at 36th St., New York, N. Y.

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The balance of the stock issued (less than 1% each) is owned by 71 employees, 4 ex-employees, and 14 others who are wives, daughters or relatives of employees.

Known bondholders, mortgagees, and other security holders holding 1 per cent. or more of total amount of bonds, mortgages or other securities: Mortgage on building held by Dime Savings Bank, Brooklyn, N. Y.

C. W. Dibble, Vice President,
HILL PUBLISHING COMPANY.

Sworn to and subscribed before me this 31st day of March, 1915.

RICHARD L. MURPHY,
Notary Public
(My commission expires March 30, 1917.)

Editorial Correspondence

SAN FRANCISCO—Apr. 1

The Comstock Merger of three of the big mines has been authorized by a permit issued by the California corporation department under the title of Jacket-Crownpoint-Belcher Mines Co. Permission was granted to issue 360,000 shares common and 12,000 shares preferred stock to the Yellow Jacket Gold & Silver Mining Co.; 208,000 shares common and 10,400 preferred stock to the Belcher Mining Co.; 150,000 shares common and 10,000 preferred stock to the Crown Point Gold & Silver Mining Co. The stock is in payment or in exchange for all the properties belonging to the three companies, subject to assumption of indebtedness of $80,962. The permit also provides for the sale of 217,600 shares of preferred stock at par. It is stated that the entire procedure is of a character that will protect the public and provide that the money received from the sale of stock be used for the payment of debts assumed by the company and expenses to be incurred in development of the property.

State Control of Protection of Oil and Gas Wells from water as provided for in the Maddux Bill has had the attention of a joint committee of the Senate and Assembly on oil industries. The State Mining Bureau was represented by State Mineralogist Hamilton, Secretary Thayer, and Mr. McLaughlin, chief of the oil department. There was ample representation of the oil operators and the majority sentiment was in favor of passage of the bill. The argument of the opposition rested chiefly on the assumption that as the oil operators had been in the business for 15 years or more they could manage their affairs without state interference, and that not knowing who might be the next state mineralogist it might not be safe to entrust the appointment of a chief supervisor to that official, particularly as the state mineralogist is subject to appointment and dismissal by the governor. So these opponents of state control announced themselves in favor of the first bill proposed by the mining bureau providing for district control, and this in face of the fact that at the meeting held at the mining bureau in January the same men announced that they would oppose both bills proposed by the bureau. The gist of the opposition to the present bill is that financial assistance of the state is desirable, but any control by the state is deemed interference. At a recent meeting in Los Angeles a prominent geologist declared that water infiltration is not of sufficient importance to require legislation, which was a surprising statement from the representative of big interests. The claim that the oil men having been on the job sinec oil production became an important industry qualifies them to attend to their own business is another surprising statement in view of the fact that for several years there has been a constant effort to secure legislation. It is believed the bill will be reported for passage and that it will pass, as it should.

BUTTE—Apr. 1

Rumors of the Contemplated Dissolution of the Amalgamated Copper Company are being freely discussed. It is the general impression here that with such power hereafter centered in Butte as would result from transferring all Amalgamated functions to Anaconda, the camp and the state as a whole can only be benefited. With the resumption, Mar. 30, of operations at the High Ore and Diamond mines of the Anaconda company, the output will be about 85% of the total producing capacity of the company. The opening of these mines gave employment to 1200 additional men, increasing the total number of men now employed by the company to 7556 out of a total of 9326 that are employed when mines are operating normally. The total output of the Anaconda mines at present is approximately 13,000 tons a day. Within a few days one of the oldest mine shafts in Butte, the J. I. C., belonging to the Anaconda company, will be closed permanently and the work of dismantling the surface plant begun. The output of this mine has been about 80 tons per day. Orders were issued Mar. 30 for the resumption of operations at the Boston & Montana smeltery at Great Falls which will involve the employment of 525 men. It is the intention to start the blast furnaces and three reverberatories for the smelting of concentrates and first class ore. The resumption of operations at the smeltery will also cause the additional employment of from 500 to 600 men in the lime quarries, coal mines and the railroads handling the ore and coal.

Outcome of the Approaching City Elections is the principal topic of interest for the time being. As usual, considerable animosity between the rival parties has been stirred up. The socialistic regime which has been in control of the affairs of the city of Butte for the last four years is making heroic efforts to perpetuate itself. In order to attract the votes of the chronically discontented, the leaders of the party have circulated unfounded statements regarding the alleged activity of the Anaconda company in the coming elections. To quiet all such rumors, Vice-President C. F. Kelley, of the company, has sent to Manager John Gillie the following telegram, dated New York, Mar. 30, 1915:

> My attention has been called to certain malicious and wholly unfounded statements appearing in the "Butte Socialist" of Mar. 27, wherein the Anaconda Copper Mining Co. is accused of harboring designs on the existence of the labor unions of Butte, and the statement made that our company intends to cut wages in Butte. I cannot believe that such absurd campaign talk will find any credence whatever with the people of Butte in view of the record of the company for more than 30 years, and the known policy of its officers should be a sufficient answer to any such statement. I am willing to let that record stand in contrast with the record of the dominant factor of the Socialist party in Butte today who is the candidate of that party for mayor and who was one of the six original organizers and at least until recently a member of the Industrial Workers of the World, an organization pledged to the principle of the destruction of craft unions. The friendly relations between the Anaconda Copper Mining Co. and the labor unions of Butte, it is hoped, will continue in the future, as they have in the past. The schedule of wages will not be lowered. It is a matter of congratulation that after having passed through the dark days of curtailment and poor business the copper market justifies the expectation that next month wages will be increased on 15c. copper. The contract understanding in that respect will be faithfully carried out. You may give this message any publicity you see fit.

Under the agreement referred to in this telegram, when the average price of copper is 15c. or more for a month, the wages of the miners are to be $3.75 and when 17c. or more, $4 per day. At the present time copper is slightly above 15c., and should this continue during the month of April, the miners' wages will be $3.75 for that month. During the entire time of the curtailment, the company has paid the wage scale originally agreed to. Even when copper was down to 11c., wages were not cut under the $3.50 rate, although thousands of men were clamoring for a chance to work for less money.

JUNEAU, ALASKA—Mar. 19

Prince William Sound District, since the closing of Cliff Mine near Valdez a year ago, has but one important operating gold mine, the Granite Mine opened last year. Japhet Lindeberg and Ed Chilberg of Seattle, and Col. B. F. Millard, of Valdez, are the principal owners. The vein is 2½ to 11 ft. wide and lies in granite and in slate. Development work covers 300 ft. of depth and 2000 ft. of levels on the vein. The ore averages $20 per ton. Since March last year, the mine has recovered about $150,000, using a 7-ft. Lane mill driven by a gasoline engine; capacity, 20 tons per day. The company is now installing two 80-hp. oil burning boilers, a 150-hp. engine and 3-phase 60-cycle dynamo, near the shore at tidewater, to transmit power 4800 ft. to the mine. Also, a 600-ft. compressor with motor, and a new Joshua Hendy mill with 10 1250-lb. stamps. Capacity 60 tons per day. A 700-ft. tunnel is being driven which will attain a depth of 560 ft. on the vein and bring the ore out to the top of the mill. All the new equipment is to be ready by May 1. The company has a year's ore in sight. A 1300-ft. tunnel is being driven on the Ramsey Rutherford property near Valdez, and some small development by prospectors is going on, but otherwise claim owners are waiting for spring.

In the Juneau District the Treadwell Mines, i.e., Treadwell, 700, Mexican and Ready Bullion, on Douglas Island are maintaining their average output of about 1800 tons daily. The Alaska Juneau, a Treadwell mine on the Juneau side of the channel, is developing conservatively. The 40-stamp mill is only an experimental plant and treats only about 200 tons per day, but very satisfactory results are being obtained. An electric trolley locomotive has lately been substituted for the gasoline locomotive running between mine and mill. United States Smelting, Refining & Mining Co. is doing little at present with the Ebner, although a small crew is working in the mine. Negotiations being conducted in New York over finances and settlement with original company. The Alaska

Gastineau started running the first section of its new mill Feb. 20, treating at first from 500 to 1000 tons daily, but lately after adjustments and some minor changes, it has been handling the 2000 tons per day expected of it. A cold snap in February caused a shortage of fresh water and necessitated installing a plant to pump sea water, but recently the rainfall has been heavy and the temperature above freezing, so that probably salt water will not be needed. Work is going ahead fast on the remainder of the unit, which should be finished and handling 8000 to 10,000 tons before the end of the summer. The Perseverance mine also is developing rapidly. Of the two main oreways from the upper workings to the haulage level, No. 1 is completed and its four loading chutes are in operation. No. 2 should be ready before the first unit is complete. There are eight large stopes ready now, each 300 to 400 ft. long by 80 to 150 ft. wide.

SEATTLE—MAR. 30

Quartz Development in the Fairbanks District will take a spurt as the result of the completion of the Heilig custom mill at the head of Fairbanks Creek. The machinery is now in place and with the exception of a few minor arrangements is ready to receive ore. Six quartz properties have shipments ready for the mill and will start hauling it as soon as the plant starts work. The quartz situation on Fairbanks Creek never looked better and practically every outfit working there is now confident of making good as soon as conditions become a little more favorable for operation. Weather has held back considerable development work this winter but every outfit is now preparing for the spring rush.

A New Gold Strike At Nome has stirred that district as has no other discovery since the location of the last beach line. The newest strike was made on the divide between Anvil and Dexter creeks about six miles from Nome. The stratum of pay gravel runs east and west and has been traced for more than a mile. The paystreak is 12 ft. deep and about 60 ft. wide. Pans running as high as $3 have been taken out. The old channel appears to have crossed from the head of Grass Gulch, at the head of Dexter Creek, to Specimen Gulch, on Anvil Creek. Several thawing outfits have been moved to the ground and a number of self hoisters are being installed. The Jim O'Sullivan claims, which already have produced a large amount of gold from the gravel found near the surface, are under lease to W. H. Jordan, who is putting in a big plant. Billy Shott and Oscar Wick are working on the claim owned by Nick Butler, Jack Ohrem is on the Kathleen claim and Brandt & Co. is operating No. 13 Dexter Creek. Over $150,000 worth of gold-laden gravel has been blocked out and the paystreak uncovered for a considerable distance running as rich as the Discovery.

Activity in Tin in Alaska is promised by the starting of construction work in Seattle of a $100,000 dredge by the American Dredge Building & Construction Co. for the American Tin Dredging Co., a Portland organization, for operation on Buck Creek. The machines will be in operation this summer and will accelerate the work of two similar plants placed on Anacovik River last fall. With the three plants working it is estimated that at least $500,000 worth of ore will be brought out next October to the tin smeltery of the Jamme syndicate, which has been in operation in Seattle for several weeks. Several tons of concentrates have already been reduced in the local plant by the furnace, largely designed for laboratory use, with a capacity of 500 lb. of tin billets daily and arrangements are now being perfected for the establishment of a plant capable of handling all the ore produced by the plants on Buck Creek, Anacovik and Lost River. The operations of this tin smeltery have been a closed book to outsiders, but the work here has attracted the attention of the government. The work has been so successful that the American Tin Dredging Co. was induced to construct another dredge and George E. Jamme, a mining engineer who is at the head of the Jamme syndicate, states that there is every prospect that the Seattle plant will be able to render productive the known areas of placer and quartz tin in the Cape Prince of Wales district, Alaska. The dredge on Anacovik River has a capacity of 1000 cu.yd. per day and the tin concentrates have been handled in such a way as to save gold amounting from $6 to $7 per ton. The Anacovik and its tributaries carry considerable gold and on Buck Creek wulfenite, scheelite and molybdenum are found in the gravels associated with the tin ores. Prospects are brighter for Alaska tin ore than ever before and operators owning tin properties are preparing to make greater efforts toward production, particularly since the announcement of the entire success of the experiments conducted by the Jamme syndicate, which have established beyond question that the tin ore can be handled here successfully and profitably.

GALENA, KAN.—Mar. 28

Much Activity in this District calls attention to some interesting and promising operations. The Illinois Lead & Zinc Co. has made arrangement for the installation of two 10-in. American pumps to drain its land and that of the Windsor Mining Co., both of which were flooded during the recent rain which caused a cave-in on the Illinois ground under the bed of Short Creek where mining had been carried on too close to the surface. It will probably take three or four weeks to lower the water to the bottom level. The flooding of these two tracts of land has thrown several hundred miners out of employment. The Diplomat Mining Co. is sinking a new shaft on the Galena Lead & Zinc land, the old shaft having been lost by a cave-in. It will be some weeks before the new shaft will be ready for use; in the meantime their mill will run part time on dirt from the mill shaft. G. C. Monlux will soon have ready for operation his new mill which replaces the one that was destroyed by fire some time ago. He will then be in the market for rough ore and dirt for his mill which will do custom work altogether. The district has been handicapped in getting its ores crushed and cleaned since his mill burned. George Rains has taken a lease on the old Cooper-Hollow land and is at present installing pumps to unwater the ground, and expects to be ready for mining in a few weeks. Mr. Rains worked this tract of land several years ago and believes with the present prices of ore it will be a profitable venture.

HURLEY, N. M.—Mar. 22

A Bill Taxing the Output of Mines was passed during its last few hours by the recently adjourned Legislature of this state. Mr. Sully, manager of the Chino Copper Co., spent some time at Santa Fe in conference with other executive heads of interested companies. The result was a bill drafted by the corporation attorney for Phelps, Dodge & Co., which went through without a hitch. The provisions of this bill are, of course, satisfactory to the operators.

HOUGHTON—Apr. 4

Copper Production in the mines of the Houghton district for the month of March is estimated at more than 20,000,000 lb. This is an increase of 4,000,000 lb. over the figures for February and is close to the largest output of copper that this district has ever turned out. Practically all of this tonnage of copper goes into shipments for export direct to the governments of Europe which are at war, or to domestic concerns which are manufacturing war munitions. Although the product for March is large by comparison with previous records the output for April will probably break all records in the history of this district. The unusual efforts that are being made to get out as much copper rock as possible and to get the copper out of the rock and into the market with as great speed as possible are shown by the fact that some of the milling plants of the Houghton district operated every day in the month of March, not even suspending for Sunday cleanups and repairs. The Mass Consolidated mill has gone on three shifts. The five-head mill of the Centennial-Allouez combination at Points operated every head every day in the month; it is handling the Isle Royale rock. The Gay mills of the Stanton group are working full time, including Sundays. Milling capacity will be taxed to the limit now that the Tamarack has resumed operations. Two additional heads at the Ahmeek mill will go into commission within 30 days but they will be required to take care of additional rock shipments from the North Ahmeek mine which will be reopened in the near future. The Isle Royale mill, rebuilt, will be ready to go into commission in June.

TORONTO—Apr. 3

Additional Oil Strikes in the Calgary field are reported. On the 27th of March oil was struck at the well of the Western Pacific Oil Co. at a depth of 2160 ft. coming in at the rate of three barrels per hour. The drill had entered the oil-bearing sands only 18 in. The well is a mile and a half southeast of the Alberta Petroleum Consolidated and about the same distance southwest of the Dingman. The oil is heavy and dark, similar to that in the Alberta Petroleum well. A strike on the Herron Elder property adjoining the Dingman is also reported.

The Demand for Molybdenite for steel hardening purposes in armament manufacture has been called to the attention of the Ontario Department of Lands, Forests & Mines in a communication from the Imperial Institute of Great Britain, asking for the names of any firms engaged in the production of this mineral together with samples from localities where it occurs in quantities. So far there has been no commercial production of molybdenite in Ontario, though it is found in large quantities in the eastern and northern parts of the Province. Supplies of tungsten are also in demand for the hardening process to take the place of the German product, and the Ontario government is making investigations to ascertain whether it can be profitably produced in this province.

The Mining News

ALABAMA

Jefferson County

U. S. CAST IRON PIPE & FOUNDRY CO. (Bessemer)—Has awarded contract to Virginia Bridge Co. for addition to present plant involving about 1000 tons structural steel.

WOODWARD IRON CO. (Woodward)—Work will be begun soon by Edison Laboratory Co. of Orange, N. J., on benzol plant to use gas from byproduct plant at Woodward.

ALASKA

McKINLEY MINING (Cordova)—Will commence operations this summer.

ALASKA JUNEAU (Juneau)—President F. W. Bradley announces company has set aside $4,000,000 for developments and as soon as weather permits work of preparing for increased operations will be started.

MOTHER LODE COPPER (Kennecott)—Ore shipments from Mar. 4, 1914, to Feb. 12, this year, amounted to 1,901,277 lb. producing 934,170 lb. of copper and 14,018 oz. of silver. Shipments averaged 49.13% copper and 14.74 oz. silver.

ALASKA CONSOLIDATED COPPER (Cordova)—A. B. Iles, manager, states that closing down of property is only temporary and that plant will be in full operation in spring as soon as suitable trail to property can be constructed. Heavy machinery will be freighted in during early summer.

ARIZONA

Cochise County

IMPERIAL GUARD (Tombstone)—Is erecting a mill at its mine.

BUNKER HILL (Tombstone)—Subsidiary of Phelps Dodge company, is building 40-stamp mill.

COPPER QUEEN (Bisbee)—Preparing to resume churn-drill exploration on Sacramento Hill.

CALUMET & ARIZONA (Bisbee)—Reported to have secured option on Jaynes mining property in Pinos Altos district, New Mexico.

Gila County

INTERNATIONAL SMELTING (Miami)—New smeltery practically finished but no date yet fixed for blowing in.

Maricopa County

JUANITA (Phoenix)—D. A. Seaman and associates of Phoenix will build cyanide plant at Juanita mine.

PROMOTER—(Phoenix)—Warren & Peters will install small reduction mill at Promoter mine in Rock Cañon.

Mohave County

OATMAN (Oatman)—Company is installing new hoist and will resume sinking.

SUMMIT (Oatman)—George W. Long has taken option on group and has small force of men at work.

UNITED EASTERN (Oatman)—On 460-ft. level crosscut 40 ft. long has been driven through $30 ore.

WALNUT CREEK (Kingman)—Property lying nine miles south of Kingman to be reopened by R. P. Wheelock.

CARTER GOLD (Oatman)—Operations have been resumed on property. Company will continue shaft to 500-ft level.

GOLD REED (Oatman)—Additional equipment to be installed and shaft sunk another 200 ft. L. L. Moore of Bisbee in charge of property.

Santa Cruz County

LEE (Patagonia)—This mine will start shipping again shortly. C. A. Pierce is in charge.

ELEPHANT HEAD (Amado)—This mine will be sold by the receiver for purposes of reorganization.

INDIANA (Patagonia)—A. H. Glidewell is getting out some good ore in development on this property near the town.

LA BOBRIZA (Nogales)—Robert Mitchell announces that the smeltery at this mine in Sonora will be in operation during April.

GLOVE (Tubac)—Development is proceeding on this zinc property with encouraging results. Shipments will be made right along.

HAVALENA (Nogales)—Shipments being made from this mine in western foothills of Patagonia Range, J. W. Smith superintending work.

JOPLIN (Alto)—Shipment from this mine by lessees goes to smeltery this week. Ore is good grade copper-lead-silver and is handled by Patagonia Commercial Co.

FLUX (Patagonia)—A Lawson tram being built to carry ore from mine to mill site. Machinery for mill is en route. Sterling Borax people said to be back of this. Mill will be dry-process plant.

DUQUESNE (Washington Camp)—Shipments will be increased from this Westinghouse copper property. While Sonora is torn up by revolutionary activities, shipments will be made from Patagonia.

RUPERT (Patagonia)—This group in Santa Ritas purchased by Henry White, locator of Grandby mine, and F. H. O'Neill. Have already done some work and will shortly proceed with further development.

TITANIC (Oro Blanco)—James Kane of Patagonia has commenced to open up this prospect in western end of county. Vein shows 20 ft. of fair gold ore. Reports that Sonora syndicate will take over adjoining property known as Old Glory, and as soon as possible will install 100-ton mill.

Yavapai County

SILVER KING (Superior)—Dan B. Gemmill of Los Angeles has leased old dump of Silver King and will build 50-ton plant to treat dump ore.

SWASTIKA (Prescott)—This group in Bradshaw Mountain district has been leased and bonded to Frank W. Giroux. Mines produce high-grade copper ore.

Yuma County

SWANSEA (Bouse)—Judge W. J. Thomas of Los Angeles recently took over Swansea mine, situated 32 miles from Bouse, and is preparing to make regular shipments of high-grade copper ore to smeltery.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Company has joined citizens in application to incorporate as a city of sixth class. Reopening mines by Bewick Moreing & Co. and installation of large metallurgical plant caused growth of village into mining town of importance. Output for 26 days in February was $48,731; operating expenses $27,427.

KENNEDY MINING & MILLING CO. (Jackson)—Supreme Court handed down decision quieting title to parcel of land relocated by H. D. Emerson. Land was formerly within townsite of Jackson, but located as mining claims by Charles Steckler who neglected assessment work. Lower court held Emerson claim not good because of neglect to establish claim earlier.

Butte County

AMOSKY (Oroville)—Richard Phillips preparing to reopen this mine. Boiler and hoist will be installed.

HENRY T. JAMES VS P. B. STEIFER MINING CO. (Chico)—Suit filed in Superior Court charging that of 530,000 shares of stock issued 309,064 shares were issued without consideration and in violation of law. Further charged that whole affair was stock selling proposition. Issuance of notes to Mary C. Steifer aggregating $89,837 also charged as unnecessary as indebtedness amounted to not more than $7000.

Fresno County

FRESNO COPPER CO. (Fresno)—Smeltery which never operated and 160 acres of land remaining of former holding of 2500 acres have been sold and "business" of company closed up. Company financed by Englishmen who were led to believe they had copper mine instead of ranch. Another promotion of same character was Copper King also recently closed up and closed out.

Inyo County

SKIDOO (Skidoo)—Five 1250-lb. stamps being added to 10-stamp mill also two Deister concentrators. Present water power being added to by installation of 40-hp. gas engine. In 1914 treated 9436 tons ore; total operating costs $7015 and gross return $14.54 per ton. Dividends to date $385,000.

Nevada County

RAGON FLAT (Nevada City)—Headframe, hoist and pumping plant being installed. Electric power will be used. Inclined shafts being retimbered near collar, will be deepened.

Placer County

BELLEVUE AND BULLION (Auburn)—Mines situated in Ophir district will be reopened. G. H. Hyde is general manager.

DAIRY FARM (Vantrent)—Construction of railroad nine miles to Sheridan about completed. Shipment of 300 tons copper ore per day contemplated. Ore will be dumped into bunkers and reshipped by Southern Pacific. Newman and Beals are lessees.

BLACK OAK (Wenner)—Edward Bell, of Auburn has leased mine from the several owners and is preparing for extensive development. Mine was discovered and located by Bell's father, Pike Bell, well known to early day miners as a famous pocket miner who discovered a fortune in a pocket near Ophir.

San Bernardino County

NIGHTINGALE (Dale)—Property on northern extension of Supply vein taken on bond and lease by J. M McPhee. Price said to be $35,000. Extensive development contemplated.

Shasta County

BLACK CLOUD AND RED TOP (Quartz Hill)—Five-stamp mill of Old Spanish mine near Redding will be [illegible] and installed here for crushing ores from both these mines.

YOSEMITE INVESTMENT (San F[illegible])—Suction dredge at Middle Creek will remove to K[illegible] pipeline intake. Original cost of dredge said to be $40,000. Repairs, additional machinery and moving it is stated will cost an additional $8000. Three divers will be employed.

GAMBRINUS (Stella)—New 5-stamp mill on lower Whisky Creek completed to take the place of old [illegible]-stamp mill. In past year improvements costing an aggregate of $10,000 have been made, including compressor and concentrator. Reported 3-ft. ledge of $15 ore recently disclosed on level five.

Siskiyou County

MCKEEN (Callahan)—Installation of 20-stamp mill contemplated. Mine is an old producer situated at head of Scott Valley, recently taken over and reopened by Los Angeles and San Diego men. James Doyle is manager.

Trinity County

COFFEE CREEK HYDRAULIC (Coffee Creek)—Property of 400 acres situated on north fork of Coffee Creek seven miles from town will be worked with two giants.

Tuolumne County

SPRINGFIELD TUNNEL & DEVELOPMENT (Sonora)—The 2600-ft. point in proposed 6000-ft. tunnel has been reached; raise will be run to tap old Buchanan channel where it is expected to find rich gravel.

COLORADO

Boulder County

WITH RISING MARKET FOR TUNGSTEN and advent of spring, indications are that 1915 will see large production of this metal from this small but famous district in Boulder County. Old mines are being reopened while numerous prospects are being developed.

COLORADO SCHOOL OF MINES offers short course in coal mining to begin Apr. 5 and run seven weeks. Is open to residents of other Rocky Mountain coal-mining states on equal terms with residents of Colorado. Instruction will be given to underground bosses and company men in elements of their duties.

KEYSTONE CONSOLIDATED (Magnolia)—This company has started to reopen and develop property. New electrical hoist and mining equipment have been installed and sinking and drifting are in progress. Company composed of Philadelphia parties. Clifford Staley is manager.

Denver County

WESTERN CHEMICAL (Denver)—Is making further extensions to its already large plant. Large new nitric-acid and sulphuric-acid departments are in operation. New roaster for handling pyrite, galena and blende is being constructed to enable company to enter market for purchase of low-grade complex ores from which various marketable products will be manufactured.

Pueblo County

COLORADO FUEL & IRON (Pueblo)—Some months ago number of employees were convicted of padding payrolls. Sentence of five months was given each of five men, who have been serving time until Mar. 24 when Gov. Carlson, upon representations made to him relative to straightened circumstances of families of these men, pardoned entire group.

San Miguel County

MATTERHORN (San Bernardo)—Development work has been resumed on this property under contract and is being directed by Frank Ensign of Ames.

COLUMBIA (Savage Basin)—Two years' lease on this property, adjacent to Tomboy, granted to Anderson, Carlson and Hoaglund, who have commenced clearing out workings preparatory to resumption of active development.

SHERIDAN (Telluride)—Sheridan vein is being developed by lessees working through Sheridan Crosscut. Arrangements are being made to start small mill near portal of tunnel. Power will be supplied by Western Colorado Power Co.

Teller County

SOUTH BURNS (Cripple Creek)—Rich oreshoot opened on seventh level by lessees. Vein is 5 ft. wide and assays $60 to $80 gold per ton.

CRESSON (Cripple Creek)—Continues to occupy attention through its high-grade shipments to Golden Cycle mill, Colorado City, where they are treated by roasting and cyaniding. New shoot of bonanza has been opened on 1200-ft. level.

ROOSEVELT TUNNEL (Cripple Creek)—Plans have been developed for extension of this drainage tunnel as far as the Elkton. Bids will be received up to and including Apr. 12, and it is probable contract will be awarded within next thirty days. Roosevelt Tunnel is 17,300 ft. long and has drained [illegible] at considerable depth. News of extension received with enthusiasm by operators in neighborhood.

CONNECTICUT

PAN-AMERICAN REDUCTION CO. (Meriden)—This company recently incorporated in New York for $6,000,000, has bought large tract of land in the city and will erect plant to manufacture [illegible] steel to supply new demands made by European war.

IDAHO

Shoshone County

VIRGINIA (Prichard)—Mine in Beaver Creek section near Wallace has started erection of small concentrator, consisting of crusher, two jigs [illegible] table.

FEDERAL MINING & SMELTING (Mullan)—Announced that Morning mine, closed down for several months, is to resume operations. The ores are low-grade silver. Mine and mill at full capacity employ about [illegible] men.

FLORIDA

Gadsden County

FLORIDIN (Quincy)—Fuller's earth plant, which was destroyed by fire, is to be rebuilt.

MICHIGAN

Copper

HANCOCK (Hancock)—Resumed operations Mar. 30 and is [illegible] shipping 200 tons daily to Franklin stamp mill.

AHMEEK (Kearsarge)—Construction work at company's [illegible] has been resumed and is being pushed rapidly.

MOHAWK (Mohawk)—Annual report shows earnings of close to half million for 1914. First quarter of 1915 has shown same earnings as whole of 1914.

CALUMET & HECLA (Calumet)—Preparations being made for reopening No. 18 shaft on Osceola lode closed down at outbreak of European War.

ISLE ROYALE (Houghton)—Work at Isle Royale mill, destroyed by fire during December, is being pushed and it is expected to have new plant in operation by June.

TAMARACK (Calumet)—This high-cost producer, subsidiary of Calumet & Hecla, has resumed operations at two shafts, 3 and 5. Action indicative of faith in future of higher metal prices.

WHITE PINE (Ontonagon)—Extensive construction work carried on at this property nearing completion and expected to be in operation latter part of April. New 750-kw. steam turbine was given trial run this week.

LAKE MILLING, SMELTING & REFINING (Calumet)—Seven boilers are in commission in new boiler house at this plant. All other necessary changes have been made to relieve conjested condition of stamping facilities.

QUINCY (Hancock)—This property showed increase of about 15,000 tons of rock for March. Raise of 5% in wages went into effect Apr. 1, making second raise of 5% since Mar. 1. Operations have not yet commenced at No. 9 shaft.

MASS (Mass)—Is shipping about 1000 tons of rock daily to mill, which is working to capacity. Stamps are being supplemented with crushing rolls which will increase capacity of each about 100 tons. Mine on old Evergreen property being drained and exploring is contemplated.

COPPER RANGE CONSOLIDATED—(Painsdale)—Ten per cent. raise in wages announced, applicable to all employees. Champion and Baltic mines in better grade rock than ever before mined in their history. Product of copper steadily increasing without appreciable increase in tonnage rock hoisted.

WINONA (Winona)—Captain Broan and Winona miners who are working on tribute have not yet sold much of their copper but have it stacked up in the yard of the Quincy smeltery. Have produced an average of 150 tons of copper rock daily giving refined copper yield of not quite 25 lb. per ton. Production has therefore averaged about 100,000 lb. per month. Have made substantial profits by holding onto their copper. Winona copper does not command premium secured by some "Lake" copper as it is arsenical.

Iron

CLEVELAND-CLIFFS CO. has about 3,000,000 tons of iron ore in stock at its mines on Marquette range. Some of this ore will have to be disposed of before operations can be increased.

OGLEBAY, NORTH CO. (Michigamme)—Has announced that operation will be started at Portland mine. Hoose & Person, of Iron Mountain, has contract to mine the limonite ore. This is one of few openpits in Michigan and shipped about 60,000 tons last season.

OLIVER IRON MINING (Ishpeming)—Will put several hundred men to work at Section 16 and Prince of Wales mines this month. Mines will operate two shifts, now working only one. News well received as there are several hundred men in idleness due to curtailment of last fall. New pumping plant of crank- and flywheel-engine type with capacity of 1000 gal. per min. will be installed on the 1200-ft. level. Floor of station will be of concrete.

MINNESOTA

Cuyuna Range

GREAT NORTHERN EXPLORATION CO. (Ironton)—Drilling on 40-acre tract showing up large tonnage of manganiferous ore under shallow overburden. Property adjoins Cuyuna-Sultana and other manganiferous deposits. Company has no connection with Great Northern Iron Ore Properties.

Mesabi Range

FAYAL (Eveleth)—Oliver Iron Mining Co. now pumping out pit of Fayal No. 4 preparatory to resuming operations.

HAWKINS (Nashwauk)—A 60x60 addition, costing $50,000, will be made to concentrating plant. Work to start at once.

LA RUE (Nashwauk)—During last few weeks washing plant has been remodeled, no elaborate improvements made other than changing source of water supply.

QUINN-HARRISON (Nashwauk)—Men now at work on new location for miners' houses, construction of concentrator, etc. Butler Bros., stripping contractors, interested in this property, will hereafter have their machine shops at Nashwauk near mine.

VIVIAN (St. Louis County)—Steel Corporation is pulling pumps and abandoning this low-grade operation. Organization is being transferred to Wood and Graham properties in same district. Fee to property owned by Northwestern Improvement Co.

ROBERTSON-KINGSTON (Franklin)—Two shovels will be started here about middle of April. Machinery now being put in shape. This is an independent property and shipped 500,000 tons of ore last season. Franklin is a new village on the Mesabi close to Virginia.

Vermilion Range

ZENITH (Ely)—Mine has so much ore stockpiled that it is cramped for space. Ships over Two Harbors docks and is anxiously awaiting opening of navigation. Harbor is free of ice, the field of ice on lake is broken and drifting; indications are for early opening of navigation.

McCOMBER (Tower)—A night crew has been added preparatory to substantial production this season. Thus far 533 ft. of shaft and underground work has been done, mostly on 100-ft. level. Considerable ore is blocked out. Contract just let for erection of boarding house.

MONTANA

Hill County

FEDORA GAS (Havre)—This company of Fedora, Kan., has had agents in the Havre gas field securing oil and gas leases and has announced that it will begin work in this field during coming month

HAVRE NATURAL GAS CO. (Havre)—Making preparations for drilling its third well one mile east of first one on fair grounds. Is expected this well will tap main gas flow known to exist in this territory. On completion of this third well, company will have sufficient gas for commercial purposes. Work of piping gas to city of Havre under way.

Madison County

FLORIDA GIANT (Twin Bridges)—Accidental explosion of giant powder, Mar. 24, caused death of Superintendent C. B. Blake and serious injury of Doctor Wilson of Twin Bridges. Powder was being thawed in crosscut close to mouth of tunnel that led into mine. Blake carrying a fuse with a cap attached to it went to powder thawing can. When the explosion occurred he was alone, it is therefore not known just how it happened

Silver Bow County

BUTTE-ALEX SCOTT (Butte)—Mine which has been closed since last September, resumed operations Mar. 29 with 75 men. Intention to operate at practically full capacity, which is 125 to 150 tons of ore per day.

PILOT-BUTTE (Butte)—This company and its superintendent Paul A. Gow were fined $25 each, Mar. 29, by Judge Lynch, after being found guilty of contempt of court, in having mined in the Emily vein after restraining order issued. On application of defendants' attorney, a stay of execution was granted for 10 days for purpose of carrying matter to supreme court.

BUTTE DULUTH (Butte)—A. Green, one of heaviest creditors and bond holders of company, after investigating its financial difficulties, stated that he was satisfied that company would be in position to pay dollar for dollar if not forced into bankruptcy. He is quoted as saying: "If bankruptcy is forced upon us it will profit no one and everybody will be a loser." The total investment in property and plant is $802,000. Hoped that within short time acid can be obtained at greatly reduced cost and that operations may be resumed.

NEVADA

Churchill County

NEVADA HILLS (Fairview)—Experiments will be made with pebbles found on shores of Goose Lake to determine their suitability for use in tube mills.

Elko County

NEVADA COPPER MINING, MILLING & POWER CO. (Contact)—Drilling has proved large tonnage copper ore. Leaching plant will be built; lumber now being shipped. Company owns 51 claims. Flotation plant also planned for district.

Esmeralda County

JUMBO EXTENSION (Goldfield)—No shipping being done at present on account of pending apex suit. Development work continued. Old workings being cleared and such other work under way as will aid in establishing claim to apex.

Humboldt County

FIRE AT NATIONAL destroyed post office building and contents. Complete loss

REVIVAL OF ACTIVITY IN ARABIA DISTRICT, near Oreana, may result from recent sale of group of claims. Arabia district produced several million in lead and silver in the '50s and '60s. Ore was hauled by ox teams to California and shipped from there by water to Swansea, Wales. Later, first silver-lead smeltery in United States built here.

ELDA FINA (Rochester) Company organized and work will start at once. Property on east slope of Nenzel Hill east of Nenzel Hill Mines.

ROCHESTER ST. VALENTINE (Rochester)—Property in Lower Rochester, adjoining Buck & Charley, sold. Final payment of $4900 made.

Lander County

GLASGOW & WESTERN (Battle Mountain)—Stated lease and bond of Glasgow & Western and Copperopolis property, in Copper Basin, secured by operators of Copper Queen group.

Mineral County

PITTSBURG-DOLORES (Rockland)—Milling plant, capacity 100 tons daily, ready for operation. Mine said to have 70,000 tons milling ore blocked out. Power supplied by Truckee River General Electric Co.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 27 was 10,723 tons, estimated value $218,974, compared with 10,940 tons last week. Producers were: Tonopah Belmont, 3794; Tonopah Mining, 2750; Tonopah Extension, 1620; West End, 1105, Jim Butler, 1100; Tonopah Merger, 150; North Star, 100; and Halifax, 104 tons.

TONOPAH VICTOR (Tonopah)- Water lowered in shaft below 1400-ft. level

JIM BUTLER (Tonopah) Net profit for February, $22,411 from 1255 tons ore milled

TONOPAH EXTENSION (Tonopah)—Oreshoot 6 ft wide, assaying $15 per ton, opened in raise from 600-ft level

TONOPAH MERGER (Tonopah)—Good-grade oreshoot opened in raise from 980 ft level, 250 ft. west of shaft

TONOPAH BONANZA (Tonopah) New electric station pump with capacity of 75,000 gal per day will be installed

TONOPAH BELMONT (Tonopah)—Favorite vein opened by crosscut 200 ft. east of any previous workings; 10-ft shoot of milling ore cut.

TONOPAH DEVELOPMENT (Tonopah)—For quarter ended Feb. 28 receipts for ore and bullion were [illegible], expenses $360,000; net earnings from operating $307,000 total net income, $325,000.

Storey County

OPHIR (Virginia City)—Concentrate shipment [illegible] made to Selby Smelting & Lead Co. Repair and development work continued in Central tunnel; ore extracted treated at K[illegible] mill.

CONSOLIDATED VIRGINIA (Virginia City)—Sinking from northeast drift on 2500-ft. level, where oreshoot cut recently, will be done. Vein well mineralized throughout 2500-ft. level

NEW MEXICO

Dona Ana County

EXCELSIOR (Organ)—George E. Wood heirs of Chicago, and Ben L. Farrar and associates of El Paso, lessees, have been placed in control of Excelsior mines in Organ district by verdict of district court at Las Cruces in case wherein Paul Davis of Organ laid claim to property. Steam hoisting machinery will be installed at mines and development work resumed.

Grant County

PINOS ALTOS MINING (Pinos Altos)—Will build concentrator, 50 tons daily capacity

EMPIRE ZINC (Pinos Altos)—Is preparing to build concentrating plant at its mine.

Lincoln County

WILLIAM A. FRANKLIN AND ASSOCIATES plan to build mill at their mine in Jicarrilla district, near Carrizozo.

UTAH

Carbon County

KETCHUM COAL CO. (Castle Gate)—This company's mines at Castle Gate have been sold to L. R. Eccles and associates of Ogden. Property has never been a shipper but much coal of good grade has been developed. L. L. Legg of Salt Lake was president of the company.

Juab County

TINTIC ORE SHIPMENTS for week ended Mar. 27 show more shippers and heavier tonnage than for any week since last summer, total 108 cars estimated 5400 tons at $130,000, compared with 96 cars last week and 74 cars the week previous. Centennial-Eureka, 21; Iron Blossom, 15; Chief Consolidated, 14; Eagle & Blue Bell, 9; Grant Central, 7; Gemini, 6; May Day, 6; Dragon Consolidated, 4, Lower Mammoth, 4, Uncle Sam, 3; Victoria, 3; Colorado, 3; Sioux mill dump, 3, Carisa Lease, 2; Gold Chain, 2; Godiva, 2; Opohongo, 1; Yankee Consolidated, 1; Beck Tunnel, 1; Ridge & Valley, 1 car.

MICHIGAN UTAH (Alta)—The mine terminal of the aërial tramway recently destroyed by mysterious fire will be rebuilt.

Salt Lake County

COLUMBUS EXTENSION (Alta)—Is making plans to replace horse tramming by electric haulage.

SILVER SHIELD (Bingham)—A second car of silver-lead ore carrying some zinc, from a stope above the tunnel level, has been marketed by lessees.

UTAH-APEX (Bingham)—During February produced 3954 tons of shipping ore and 3139 tons of concentrates from 9873 tons of milling ore. Operating profit was $18,055. Development costs were $7911

MICHIGAN-UTAH (Alta)—Suit instituted originally to collect bill amounting to about $1000 for groceries and supplies, has caused judgments amounting to $765,401 to be rendered against company now in hands of receiver

EMMA COPPER (Alta)—Drifting, under contract, has been started from the Flagstaff tunnel toward Emma Copper; about 200 ft. of work will be done in search of orebody thought to be indicated by 6 in. of high-grade ore opened in Buffalo tunnel nearby.

REED'S PEAK (Salt Lake) -Property in Big Cottonwood Cañon northwest of Cardiff consists of 21 unpatented claims, developed by 1100 ft. of tunnels Stock was listed on Salt Lake Stock & Mining Exchange Mar 29. Capitalization 300,000 shares, par value 10c., of which 100,000 shares are issued

Summit County

PARK CITY ORE SHIPMENTS for the week ended Mar. 27 were 1675 tons, estimated at $67,000, compared to 1811 tons the week previous Shippers were Silver King Coalition, 1,557,640 lb.; Daly West, 1,080,996; Daly-Judge, 666,100, Silver King Consolidated, 15,220 lb

DALY WEST (Park City)—In February there were produced 1100 tons of concentrates, the mill having treated a daily average of 200 tons

SILVER KING CONSOLIDATED (Park City) During first 11 days of March, 525 tons of first class ore shipped. Soft condition of roads made hauling at night necessary Shipment at present impossible owing to melting snow.

CANADA

BRITISH COLUMBIA

ROCHER DEBOULE COPPER (Hazleton) Plans in [illegible] to resume operations under control of Salt Lake [illegible] Property has large holdings and is well equipped

CANADIAN COPPER CO (Sudbury) [illegible] now being drawn mainly from Creighton mine which [illegible] richer ore and less fines than No 3 from which [illegible] was formerly mined Four blast furnaces [illegible] on regular roasted charge and two on green-ore [illegible] there are not enough fines produced to warrant [illegible] reverberatory Furnaces handling green ore [illegible] about 150 tons per day of fines and slightly smaller [illegible] of converter slag

The Market Report

METAL MARKETS

NEW YORK—Apr. 7

Copper, lead and spelter all have been distinctly firmer. Tin continued to be erratic, the actual transactions being insignificant.

Copper, Tin, Lead and Zinc

Copper—This metal improved materially and at the end of the week was firmly on the basis of 16c., delivered, regular terms, equivalent to about 15.82½c., cash, New York. The total volume of business was only moderate, but it included numerous round lots. Domestic consumers were considerable buyers. There appears to be some improvement in domestic consumption, especially among the sheet-rollers and wire-drawers, although reports from them indicate a rather spotty condition, some telling of material improvement, while others say they do not yet observe it. The brass-makers are, of course, busy with war orders. Their demand has resulted in fancy prices being paid for Lake copper when certain brands, no other accepted, are specified.

Copper sheets, base price remains at 20¾c. per lb. for hot rolled and 21¾c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is quoted at 16⅞@17⅛c. per lb. carload lots at mill.

Exports of copper from the United States for the week ended March 20 are reported by the Department of Commerce at 15,628,636 lb. The principal items were 7,327,544 lb. to France, 2,327,011 lb. to Great Britain, 2,689,496 lb. to Sweden and 1,568,809 lb. to Italy. Imports were 1,174,073 lb. in ore and matte, chiefly from Canada.

Visible stocks of copper in Europe on April 1 are reported as follows: Great Britain, 15,618; France, 2240; afloat from Chile, 1575; afloat from Australia, 4500; total, 23,933 long tons, an increase of 207 tons over the March 1 report.

Brass Prices, base, to date from Mar. 24, are as follows, showing advances of about ¼c. from previous schedule: Sheets, high brass, 18⅛c. net per lb.; low brass, 19¼c. Wire, high brass, 17⅞c.; low brass, 19¼c. Rods, high brass, 17⅞; low brass, 20c. Tubes, 21¾c. for both brazed and open seam. Angles and channels, 21¾c. Scrap allowances are 12⅝c. net per lb. for high brass; 13¼c. for low brass.

Tin—The business in this metal was insignificant. We could learn of nothing done on several days when the market is reported as merely nominal. In general the same conditions existing during several weeks back continued.

Tin output of the Federated Malay States for the full year is officially reported at 111,283,867 lb. in 1913, and 109,854,533 lb. in 1914; a decrease of 1,429,334 lb., which is less than was anticipated.

Visible stocks of tin as reported April 1: London, 8452; Holland, none; United States, excluding Pacific ports, 6016; total, 14,468 long tons, a decrease of 80 tons during March.

Lead—The strength of this market reported at the end of our last week of record foreshadowed the advance to 4.20c., New York, which was made by the A. S. & R. Co. on Apr. 1. Independent sellers who had already been getting that price on sales for shipment abroad found that they could still obtain a premium on such business, while they freely supplied domestic consumers at the price of the leading interest. Some considerable sales for export were made. These appear to have been neither so large in the aggregate nor participated in no generally as a little while ago. At the end of our week of record there were again some inquiries for tonnages in the market from domestic consumers.

Spelter—Right at the beginning of the week galvanizers began to exhibit more interest and a considerable aggregate of sales was made, divided among numerous buyers. Sales of several hundred tons per day were reported in subsequent days. However, the aggregate business of the week was relatively small. There was wide variation in prices realized, as high as 9½c. being paid for prompt metal at the end of the week, while metal for June delivery was sold as low as 8⅞c. At the close of the week, May spelter was on a basis of about [illegible]c., and April spelter on a basis of about 9c., while prompt was available at 9@9½c. The decline in the London market to a level of about 9.05c. for spot over there, which is below our parity, may lead to interesting developments. Sales of brass special and intermediate spelters during the last week were on a fairly liberal scale.

Zinc sheets, base price remains $13.50 per 100 lb., f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The demand is reported good and sales large.

Other Metals

NEW YORK—Apr. 7

Aluminum remains steady, but only a moderate business outside of contract requirement. Quotations are 18¾@19c. per lb. for No. 1 ingots, New York—**Antimony** has been quiet, almost dull. Most consumers have apparently satisfied their

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Apr.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
1	4.7950	50	15.60 @15.70	48	4.20 @4.25	4.15 @4.20	8.42½ @9.17½	8.25 @9.00
2	4.7938	49⅞	15.60 @15.70	*48	4.20 @4.25	4.15 @4.20	8.67½ @9.17½	8.50 @9.00
3	4.7950	49⅞	15.60 @15.80	*48	4.20 @4.25	4.15 @4.20	8.67½ @9.17½	8.50 @9.00
5	4.7950	50	15.60 @15.80	45	4.20 @4.25	4.15 @4.20	8.67½ @9.17½	8.50 @9.00
6	4.7950	50¼	15.75 @15.85	47	4.20 @4.25	4.15 @4.20	8.92½ @9.42½	8.75 @9.25
7	4.7938	50¼	15.80 @15.85	*48	4.20 @4.25	4.15 @4.20	8.92½ @9.42½	8.75 @9.25

* Nominal.

The quotations herein are our **appraisal** of the average markets for copper, lead, spelter and tin based on wholesale **contracts** for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Apr.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
1	23 9/16	69⅜	15.07	70	..	168	166	22⅛	4.86	43	9.34
2		.		...	.	...			..	....	....
3		..	..	..	.	....			....	.. .	....
5		...	...	..	...	..			...	. .	....
6	23 11/16	69⅞	15.18	70½	....	166½	165	22	4.78	42½	9 18
7	23¾	70¼	15.26	70⅞	....	168	166½	22	4.78	42¾	9 28

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

requirements for the present. Prices are firm; ordinary brands bring 22@23c. per lb.; while 31@32c. per lb. is asked for Cookson's—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher—**Quicksilver** is steadier, with a little better supply. For large lots in New York $65@67 is the nominal price, with no sales reported. Small lots are a little easier at $70@75 per flask of 75 lb.—San Francisco reports by telegraph that large lots are held at $62.50@67.50 per flask., with barely any demand. Some dealers hold for $80, but with no sales. London price unchanged at £12 10s., second hand asking £12 5s. per flask.

Gold, Silver and Platinum

NEW YORK—Apr. 7

Gold and Silver Movement in the United States two months ended Feb. 28, as reported by the Department of Commerce:

	Gold		Silver	
	1914	1915	1914	1915
Exports........	$15,992,834	$1,745,388	$7,602,054	$8,612,321
Imports........	13,651,226	19,622,890	4,232,637	4,686,878
Excess.......	E.$2,341,608	I. $17,877,502	E. $3,369,417	E. $3,925,443

Exports of merchandise for the two months in 1915 were valued at $566,607,070; imports, $247,271,708; excess of exports, $319,335,362. Adding the gold and silver gives $305,383,303 as the total export balance.

Silver—The market has opened up after the holidays with limited orders from India and China but of sufficient volume to advance the price to 23¾d. No marked movement is in sight.

Platinum—The market continues stagnant, with little business reported. Dealers continue to hold refined platinum at $38@40 per oz., but sales are reported at $35@37. Hard metal is held at $43@47 per oz. according to grade.

Zinc and Lead Ore Markets

JOPLIN, MO.—Apr. 3

Blende, high price $63; assay base, 60% zinc, low in lead $60@56 down to $50 for greater lead content; metal base, $52@45; Calamine base, 40% zinc, $33.50@30; average, all grades of zinc, $56.49 per ton. Lead, high price $53; base $50@51 per ton 80% metal content; average, all grades of lead, $50.90 per ton.

Buying was notably stronger on medium grades and a little stronger on best grades, except with one company, which offered only $58 base price.

SHIPMENTS WEEK ENDED APR. 3

	Blende	Calamine	Lead	Values
Totals this week....	10,106,780	846,100	2,097,590	$362,740
Totals this year.....	137,422,350	12,303,110	21,125,790	4,907,710

Blende value, the week $295,620, 14 weeks, $4,179,030.

Calamine value, the week, $13,750; 14 weeks, $22,400.

Lead value, the week, $53,370; 14 weeks, $506,280.

PLATTEVILLE, WIS.—Apr. 3

The base price paid this week for 60% zinc ore was $55@57 per ton. There was no competitive buying; all sales made were under contract. The base price paid for 80% lead was $50@51 per ton.

SHIPMENTS, WEEK ENDED Apr. 3

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	3,399,970	84,600	884,020
Year	50,972,940	763,990	5,243,350

Shipped during week to separating plants, 3,769,860 lb. zinc ore.

Iron Trade Review

NEW YORK—Apr. 7

While new domestic business has been rather quiet, heavy foreign orders are being placed, and it is altogether probable that the mills in April will keep fully up to their March average. Specifications on contracts are coming in freely, in view of the higher prices now asked for bars, plates and other material. A large quantity of bars is being taken by the agricultural implement makers, mainly on current contracts. Structural steel is still rather quiet, though more contracts are coming forward or are under negotiation.

The pig-iron market has quieted down, present demand having been apparently satisfied by the heavy sales made by the Buffalo furnaces recently. It appears also that over 100,000 tons of Southern foundry iron were sold at a basis of about $9 Birmingham for No. 2. Some Southern iron is also being taken for export.

It is generally thought that the heavy export orders now coming in will go far toward making up for the light railroad business.

PITTSBURGH—Apr. 6

The Youngstown steel mills are making a remarkable showing, operating at from 80 to 90% of capacity. They are doing better than mills in other districts chiefly [illegible] their output does not run largely to railroad material or structural shapes, such products being in particularly light demand. The steel mills of the country as a whole are operating at [illegible]what more than 65% of capacity, and the remarkable [illegible] that they are able to operate at this rate when there [illegible] spectacular demand in any direction. It seems quite clear that if business generally were good the steel mills would be unable to supply the demand that would result, even if they could secure labor sufficient to operate at capacity, and it is improbable that they could when alien immigration in the past 12 months has been less than the emigration.

March was a good month for steel bookings, but as there were some special bookings on account of the expiration of low priced contracts at the end of the month April may not make as good a showing, this being particularly true in bars, plates, and shapes. On Apr. 1, according to program, the large mills began quoting $1.20 as minimum for these products. The eastern mills have not fully concurred in this action.

March shipments of the American Sheet & Tin Plate Co. were the largest since March a year earlier, while the company's bookings were the largest since February, 1913, excepting last August. The company is operating 95% of its tin mills and 60 to 65% of its sheet mills, and is shipping about equal tonnages of the two products.

Pig Iron—The market continues very quiet, with no inquiry to speak of for bessemer or basic, and foundry iron moving only in small lots. Quotations are unchanged: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25; forge, $12.50@12.75; malleable, $12.75, at Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report that the average prices, as computed from all market sales reported, in lots of 1000 tons or over, were $13.60 for bessemer and $12.50 for basic in March, the same as in February.

Ferromanganese—Nothing further has been heard relative to reports that 5000 tons of English ferromanganese would be released for shipment to this country in April. The contract market remains at $78, Baltimore, subject to the possibility of shipment, while small lots for spot shipment command about $100 per ton.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 285,237 short tons; shipments at 284,713 tons. Production of Greensburg and Upper Connellsville region was 35,480 tons.

Connellsville Coke—The inquiry of the Pittsburgh Steel Co., for 20,000 tons a month of furnace coke for the twelvemonth beginning July 1, may be modified to a six-month inquiry. Prompt furnace coke is about 5c. higher, commanding $1.55@1.60, contract furnace being nominally $1.60@1.65 to July 1 and $1.75 to Dec. 31. Foundry coke is moving somewhat more freely and is a trifle firmer, being quotable at $2@2.35 for prompt and $2.25@2.35 for contract.

Chemicals

NEW YORK—Apr. 7

The general markets are uneasy but a little more settled, and business seems to be improving.

Arsenic—There is little change. The business doing is on a moderate scale and prices remain about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business continues about as usual. Prices current are $6 per 100 lb. for carload lots and $6.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is rather variable but fair on the whole. Prices are firm and 2.30c. per lb. is quoted for all positions this year.

Potash Salts—It is stated that the negotiations pending for a suspension of the German embargo on the exportation of potash salts have failed.

PETROLEUM

New oil wells completed in March are reported in the monthly summary of the "Oil City Derrick" as follows: Pennsylvania grade, 299; Lima-Indiana, 30; Central Ohio, 91; Kentucky, 5; Illinois, 53; Kansas-Oklahoma, 308; Texas-Louisiana, 83. The wells completed in the divisions named numbered [illegible] or 62 less than in February. The new production was [illegible] bbl., a decrease of 26,898 bbl. Among the completions were 187 dry holes and 139 gas wells. At the close of March [illegible] rigs and 1442 drilling wells were reported.

California oil production in February is reported at 6,912,332 bbl., shipments, 5,661,326 bbl. Stocks on Feb. 28 were 60,527,306 bbl. Deliveries in February were very light.

Assessments

Company	Delinq.	Sale	Amt
Big Elk, Ida.	Apr. 15	May 15	$0.001
Bobby Anderson, Ida	Apr. 12	May 3	0.0025
Challenge, Nev	Mar. 31	Apr. 21	0.05
Consolidated Imperial, Nev..	Apr. 27	May 18	0.01
Copper King, Ida	Mar. 1	Apr. 1	0.005
East Hercules, Ida.		Apr 7	0.001
Eastern Star, Ida.....	Mar. 25	Apr. 25	0.002
Emerald, Utah		June 9	0.01
Enterprise, Ida	Mar. 20	Apr. 20	0.002
Florence, Ida	Apr. 15	May 4	0.001
Galena King, Utah	Mar 25	Apr 25	0.0075
Gethin Le Roy, Utah	Apr 21	May 6	0.01
Giant, Ida...............	Apr. 9	May 14	0.002
Great Falls, Utah	Mar 18	Apr. 22	0.01
Idaho-Los Angeles, Ida	Apr. 24	May 15	0.005
Idaho-Nevada, Ida	Mar 10	Apr 2	0.002
Index, Ida. (post.)	..	Apr. 24	0.005
Indiana, Mich	Feb. 4		1.00
Ivanhoe, Ida.	Apr. 10	May 10	0.002
[illegible], Nev.	Mar. 18	Apr 7	0.02
[illegible], Ida	Mar. 20	Apr 6	0.003
Lake Superior & West., Ariz	..	..	0.10
Lucky Boy, Nev...........	Apr. 9	Apr. 28	0.01
Majestic-Idol, Nev...	Dec. 15	Jul 20	0.005
Nabob, Ida	Mar. 18	Apr. 12	0.005
Neva, Utah.	Mar. 18	Apr 12	0.002
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
Old Veteran, Ida...........	....	....	0.002
Oreano, Ida	Mar. 25	Apr. 26	0.0015
Pandora, Ida.............	Apr. 15	May 7	0.003
Pioche Metals	Mar. 20	Apr. 20	0.0025
Rio Grande, Utah.......	Mar. 25	Apr. 17	0.003
Saltese, Ida.............	Mar. 1	Apr 1	0.002
Samson, Ida..............	Apr. 3	May 3	0.002
Selma, Utah.	Mar 20	Apr 6	0.0025
Silver Cliff, Ida...........	Apr. 3	Apr. 24	0.0025
Smuggler	Apr. 17	May 17	0.0025
Sonora, Ida..	Mar. 15	Apr 15	0.002
Sunset, M. & D., Nev	Mar. 27	May 3	0.015
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tonopah Midway, Nev	Mar. 12	Apr. 12	0.01
Utah, Nev	Mar. 25	Apr. 15	0.02
Wolf Mountain, Utah	Mar 15	Apr. 14	0.0015

Stock Quotations

The outstanding feature of the week in the stock market was the removal of "minimum prices." So far, at least, have normal conditions been restored.

COLO. SPRINGS Apr. 6		SALT LAKE Apr 6	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	.04½	Beck Tunnel	.06¼
Banner	.01½	Black Jack	.09½
Cripple Cr'k Con	.008	Colorado Mining.	.13½
C. K. & N	.05	Crown Point	.01¼
Doctor Jack Pot	.08¾	Daly-Judge........	4.87½
Elkton Con.	.44	Gold Chain	.09¼
El Paso	1.05	Grand Central	.57
Findlay	.03	Iron Blossom	.96
Gold Dollar	‡.02	Little Bell	.27
Gold Sovereign.	.05½	Lower Mammoth.	.04½
Isabella	.16⅛	Mason Valley.	‡1.10
Jack Pot	.06	May Day	.12¼
Jennie Sample....	‡.02	Opohongo	‡.00½
Jerry Johnson..	.03½	Prince Con	.39
Lexington	.005	Seven Troughs	.02¼
Mary McKinney.	.32	Silver King Coal'n	2.92½
Pharmacist......	‡.01	Silver King Con....	1.70
Portland	1.16¼	Sioux Con.	.03
Raven B. H....	.03	Uncle Sam	.04
Vindicator.....	1.00	Yankee	.05

TORONTO		Apr. 6	
Bailey	.02½	Dome Exten	.10
Coniagas	4.80	Foley O'Brien..	.25
Peterson Lake	.20	Hollinger...	23.50
Right of Way	.03	Imperial......	.04½
Seneca Superior.	1.20	Jupiter	.11
Silver Queen	.01½	McIntyre	.40
T. & Hudson Bay	40.00	Pearl Lake....	.02
Timiskaming	.34	Porcu. Gold	‡.25
Wettlaufer-Lor.	.04	Preston E. D.	.02
Big Dome	‡12.50	Rea	‡.20

SAN FRANCISCO		Apr 6	
Comstock Stocks		Nev. & Cal	
Alta	.70	Belmont	4.65
Belcher	‡.40	Jim Butler	.80
Best & Belcher	.15	Lone Star	.07
Caledonia	.22	MacNamara	.03
Challenge Con	.05	Midway	.14
Confidence	.15	Mont.-Tonopah.	.35
Con. Virginia	.17	North Star	.11
Crown Point	.07	Rescue Eula	.10
Gould & Curry	.03	West End Con	.63
Hale & Norcross	.04	Atlanta	.39
Julia.......	‡.02	Booth	.30
Mexican	.33	C. O. D. Con	.05
Occidental.....	.79	Comb. Frac.	.08
Ophir	.06	Jumbo Extension	1.05
Overman	‡.19	Pitts. Silver Peak	.12
Potosi	‡.01	Round Mountain	.37
Savage	.05	Sandstorm Kendall	.08
Sierra Nevada...	.05	Silver Pick	.10
Union Con	.19	Cerro Gordo	‡.25
Yellow Jacket	‡.17	So. Eureka	‡2.25

N. Y. EXCH. Apr. 6	
Name of Comp.	Clg
Amalgamated	64¼
Am Sm & Ref, com.	67
Am. Sm. & Ref., pf	104
Am. Sm. Sec., pf. B.	76½
Anaconda.........	31¼
Batopilas Min	⅝
Bethlehem Steel...	88¼
Bethlehem Steel, pf.	105½
Chino	39¾
Colo. Fuel & Iron	29¼
Federal M. & S., pf	30
Great Nor., ore., ctf.	35⅜
Guggen. Exp..	54¼
Homestake.........	116
Inspiration Con....	28¼
Mex. Petroleum...	69
Miami Copper.....	24¼
Nat'l Lead, com....	62
National Lead, pf...	109
Nev. Consol...	13¼
Ontario Min ...	2
Phelps Dodge ...	‡177
Quicksilver, pf...	1
Ray Con...	21
Republic I&S, com.	23¾
Republic I&S, pf...	80¼
SlossSheffi'd, com.	33
Tennessee Copper..	30¼
Utah Copper	57¼
U. S. Steel, com...	49⅜
U. S. Steel, pf.	106⅜

N. Y. CURB Apr. 6	
Name of Comp.	Clg
Beaver Con......	35
Big Four.	07
Blue Bell	03¼
Braden Copper.	7⅞
Buffalo Mines....	.50
Can. Cop. Corpn..	1
Can. G. & S.....	03
Caribou	.55
Cashboy.........	08
Chambers Ferland.	19
Con. Ariz. Sm.	⅝
Con. Coppermines.	‡1 1/16
Davis-Daly.	1 1/16
Diam'field-Daisy...	07
Dia. Black B......	03
Florence	58
Goldfield Con...	1⅝
Goldfield Merger...	24
Greene Cananea..	29
Kerr Lake........	4¼
La Rose	⅝
McKinley-Dar-Sa..	35
Mines of Am..	2⅛
Mutual Min., pf...	‡2½
Nevada Hills.	24
New Utah Bingham	.68
Nipissing Mines....	6⅜
Ohio Copper.......	15
Oro..............	12
Pacific Smelt.....	‡.09⅞
South Utah......	‡.25
Stand'd Oil of N.J.	396
Standard S. L.....	1 5/16
Stewart	1 13/16
Tonopah	7⅜
Tonopah Ex......	2 15/16
Tonopah Merger...	.40
Tularosa	7/32
West End Ex.....	06
Yukon Gold.......	2⅜

LONDON Mar 25	
Alaska Tre'dwell	£7 2s 6d
Camp Bird ..	0 6 0
El Oro.........	0 8 0
Esperanza....	0 9 3
Mexico Mines.	‡3 15 0
Oroville.	0 11 9
Philippine Dr..	1 0 0
Santa Gert'dis..	0 8 6
Tomboy	1 3 5
Tough Oakes	0 14 0

BOSTON EXCH Apr. 6	
Name of Comp.	Clg.
Adventure.......	2
Ahmeek.	320
Alaska Gold M...	35¼
Algomah........	2½
Allouez	45½
Am. Zinc	29⅛
Ariz. Com., ctfs.	4⅜
Bonanza	.35
Butte-Ballaklava...	2⅝
Butte & Superior.	46½
Calumet & Ariz...	61¼
Calumet & Hecla	465
Centennial	19
Cliff	1
Copper Range..	47¼
Daly West	2¾
East Butte........	11
Franklin.	7½
Granby.........	73½
Hancock.........	14½
Hedley	26½
Helvetia........	.75
Indiana	6¼
Island Cr'k, com.	43
Island Cr'k, pfd....	87
Isle Royale........	24
Keweenaw........	3
Lake..	10¼
La Salle..........	5½
Mass	8½
Mayflower........	5
Michigan.........	1⅜
Mohawk	66½
New Arcadian.....	6¼
North Butte......	28¾
North Lake.......	2¼
Ojibway.	1¼
Old Colony........	5¼
Old Dominion.....	46
Osceola	73⅝
Quincy.	69
Santa Fe	1⅝
Shannon ...	7¼
Shattuck-Ariz......	26½
Superior..........	32
Superior & Bost....	1½
Tamarack.........	37½
Trinity.	4½
Tuolumne.	‡.27
U. S. Smelting.....	24½
U. S. Smelt'g, pf....	42⅛
Utah Apex........	2 7/16
Utah Con.........	10½
Victoria.	1¼
Winona.	2¼
Wolverine........	47½
Wyandot.........	.95

BOSTON CURB Apr. 6	
Name of Comp.	Bid.
Alvarado	.60
Bingham Mines....	4¾
Boston Ely. ...	.20
Butte & Lon'n Dev.	.20
Calaveras ...	1½
Calumet-Corbin....	.10
Chief Con	1 1/16
Corbin..	.40
Cortez	.15
Crown Reserve.....	.84
Eagle & Blue Bell..	.95
First Nat. Cop	1¼
Houghton Copper..	2¾
Iron Cap Cop., pf...	3
Majestic..	.20
Mexican Metals.	.17
Nevada-Douglas...	.40
New Baltic	2½
Oneco............	.96
Raven Copper..	.07
Smokey Dev.....	.45
So. Lake	6¼
Tonopah Victor....	‡.17
Trethewey	‡.12
United Verde Ext	2⅜

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519		27.416	26.958	
May	60.361	58.175	.	27.825	26.704	
June	58.990	56.471	...	27.199	25.948	
July	58.721	54.678	....	27.074	25.219	
August	59.293	54.344	...	27.335	25.979	
September	60.640	53.290	..	27.986	24.260	.
October	60.793	50.654	..	28.083	23.199	
November	58.995	49.082	...	27.263	22.703	..
December	57.760	49.375	.	26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York, quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January...	14.223	13.641	64.304	60.756	69.488	65.719
February..	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	14.787	64.276	66.152	69.170	*
April. ..	14.211	....	64.747	....	69.313	.
May .	13.996	.....	63.182	......	67.786	..
June .	13.603	.....	61.336	......	66.274	....
July.......	13.223	......	60.540	......	64.955	.....
August	*	.....	‡	....	‡	...
September	*	...	‡	....	‡	....
October..	*	....	‡	....	‡	....
November	11.739	....	53.227	......	*	.....
December .	12.801	. .	56.841	.....	*	....
Year			..		....	...

TIN

Month	New York		London	
	1914	1915	1914	1915
January.......	37.779	34.260	171.905	156.550
February...........	39.830	37.415	181.556	176.925
March.............	38.038	48.426	173.619	180.141
April...............	36.154	.....	163.963	. .
May...............	33.360	.....	150.702	....
June	30.577	......	138.321	.....
July.	31.707	.....	142.517	.....
August.............	*	.....	‡	.....
September..........	32.675	.....	‡	....
October.	30.284	.....	‡	. .
November	33.304	. ...	139.391	.
December	33.601		147.102	
Av. year.. .	34.301		.. ..	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January..	4.111	3.729	4.011	3.548	19.665	18.606
February..	4.048	3.827	3.937	3.718	19.606	19.122
March.....	3.970	4.053	3.850	3.997	19.651	21.883
April......	3.810	. .	3.688	......	18.225	
May.	3.900	...	3.808	......	18.503	. .
June.	3.900	....	3.810	......	19.411	.
July	3.891	....	3.738	......	19.051	.
August....	3.875	.....	3.715	......	‡	. .
September	3.828	......	3.658	......	‡	. .
October ...	3.528	....	3.384	.....	‡	. .
November	3.683	....	3.585	.....	18.500	.
December .	3.800		3.662	. ..	19.097	.
Year	3.862		3.737		..	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January...	5.262	6.386	5.112	6.211	21.533	30.844
February..	5.377	8.436	5.228	8.255	21.413	39.819
March.....	5.250	8.541	5.100	8.366	21.460	44.141
April.	5.113	.....	4.963	.	21.569	
May......	5.074	.....	4.924	....	21.393	...
June	5.000	.....	4.850	.....	21.345	....
July.......	4.920	.....	4.770	....	21.568	. .
August....	5.568	.....	5.418	....	‡	. .
September	5.380	.....	5.230	....	‡	....
October....	4.909	....	4.750	..	‡	....
November.	5.112	....	4.962	...	25.016	. .
December .	5.592		5.430	.	27.369	.
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February.	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	...	13.90		14.13	
May	4.90	....	13.90	....	14.27	.
June	14.90	.....	13.90	....	13.96	.
July.	14.90	.....	13.90	...	13.90	
August	14.90	....	13.90	....	14.08	..
September	14.90	....	13.90	...	14.03	
October	14.84	...	13.75		13.97	
November	14.59	....	13.43	.	13.83	
December	14.70	...	13.45		13.83	
Year	$14.88		$13.78		$14.01	

The Engineering and Mining Journal

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Mining in the Caucasus Mountains

By L. C. David[*]

SYNOPSIS—The property of the Caucasus Copper Co. makes use of a variety of labor, including Mohammedans, Persians, Georgians, Armenians and Greeks. The Mohammedans, from Turkey, form about 75% of the force and are good and steady workers, a strong reason being found in their religion, which prohibits the use of alcohol. Mining is by opencut and underground methods. Much of the overburden is removed by hydraulicking. Machine methods are used as much as possible, due to the labor scarcity.

The mines of the Caucasus Copper Co. are situated 6000 ft. above the sea level in the Caucasus Mountains of southern Russia, are 40 miles from Batum and a day distant from the Turkish frontier. The smelting and concentrating plants are in the Mourgul Valley, 2000 ft. below the mines. The mines are situated in the midst of Turkish farming settlements, and the whole country is beautiful by reason of its picturesqueness and the luxuriance of the vegetation. This disappears above the mines, and there are practically no farms at higher altitudes, most of the mountains above being covered with snow throughout the year.

Mine and Surroundings of the Caucasus Copper Co.

Varied Labor Obtainable

The labor at the mines was about 75% Mohammedan, from Turkey. These people are fair laborers, handy with a hammer, and efficiency can be attained by task work. The rest of the labor was Persian, Georgian, Armenian and Greek. The native Turks, Russian subjects, did little manual work, but acted as foremen, tallymen, etc. The more intelligent undertook contracts, such as drilling by the foot, moving overburden by the cubic meter, tramming by the ton, etc. They provided their own labor, kept their own timebooks, and personally looked after their own work. There is another excellent, though primitive, method in vogue called the *artel* system. In this plan a group of relatives or a group of covillagers undertake a contract to break or deliver ore to the crushing plant at a certain price per ton. The office keeps their time, and at the end of each month their payroll is made up; proper deductions are made and the net receipts divided pro rata. This method has proved acceptable to both the men and the company. Work is carried on seven days per week, and the labor is steady and regular in attendance. This is due partly to the fact that the Mohammedan religion prohibits the use of intoxicants.

Occurrence of the Ore

Ore has been found in so many places that we may almost say that the whole district is ore-bearing, except for intrusions of porphyry here and there. The ore occurs as a chalcopyrite finely disseminated through a matrix of quartzite. The grade of the ore varies in different places. We were doing most of our mining on a claim called Djangara, located in the foothills of Mount Kara Tepe. Generally speaking, the best ore is near the surface, and in opening up new ore it is not uncommon suddenly to find evidences of the old Genoese miners who did considerable work in this region about five hundred years ago. They mined a soft ore of very good grade. Most of their tools were of wood, and whoever happened to find one of these relics of antiquity prized it highly. The only remnants of their smelters that can be found are heaps of slag here and there in the mountains.

Removing the Overburden

Much experimenting has been done in the treatment of the ore, and only recently the proper metallurgical process has been decided upon. The ore was mined in a most economical manner by a combination of open-quarry and milling methods. The surface covering the ore varied considerably in depth, and in some places the ore was capped with silica. In the early days overburden was removed by hand. This was possible with shallow overburden and low production. Later, hydraulic equipment was added, and when the production reached 1000 tons per day steam-shovel equipment was installed. This mechanical equipment was necessary on account of heavy demands for the ore as well as increasing depth of surface as we approached Kara Tepe. The water for hydraulicking was obtained from the mountain streams, and was available from March until December. From December to March heavy snows prevented the successful carrying on of this work. A dam was built in the largest stream and the water led from this through a paved ditch to a reservoir near the mine. From here two 16-in. pipe lines carried it to the operating giants. Flumes had to be constructed for disposal of waste to protect land and adjacent farms from erosion. The flumes were built in standard style, but the bottom was lined with about 6 or 8 in. of sharp silica rock set in cement. This gave more satisfaction than any lining that was tried. On account of an excessive quantity of boulders, as well as shortage of water, the first results were unsatisfactory. Intercepting ditches were cut to lead more streams to the dam, and our work was confined to overburden containing fewer boulders. In order to get an outlet for the waste it was necessary to drive a tunnel through hard overburden to connect the hydraulic area with the flume. This tunnel was driven on a 1½% grade and a flume or launder built inside. The launder was lined with sheet steel so as to reduce leakages to a minimum. A wooden barrier was constructed between the hydraulic area and the uncovered ore in order to prevent the mine workings from being flooded. This barrier extended from the tunnel to the limits of the hydraulic area. It was built with 6-in. posts and 2-in. plank. On account of the nature of the surface we had to build a floor extending from the barrier for a width of 3 ft. This floor, as well as the barrier, was lined with old screen cloth from the crushing plant, all joints being calked with waste. The floor was necessary so we could play on it with a giant and wash the waste material to the tunnel, in this way avoiding undermining the barrier. After the banks had been washed away for some distance from the barrier, a ditch was cut with the giant, the barrier dismantled and further hydraulicking carried on. In one instance, where it was desired hurriedly to uncover a small piece of ore that could not be reached with water direct, overburden was trammed in dump cars, dumped off a trestle and washed away by a giant. In order to remove more efficiently such surface we hauled up piecemeal a Model 41 Marion steam-shovel and erected it in place ready for work. This shovel was set up just before the Russian-Turkish war broke out; but we did not have time to bring up the locomotives and cars. We had planned our dumps on the cliff side of the mountain, which would have given us an economical means of disposing of the waste.

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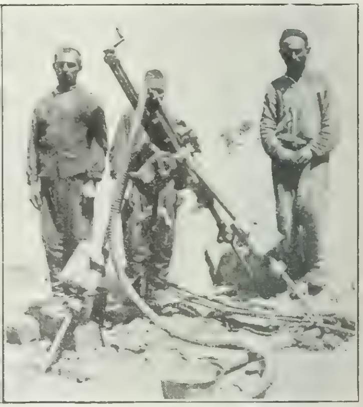
[*] Formerly mine superintendent, Caucasus Copper Co.

MINING SYSTEMS

The mine is opened by a tunnel and raises which are used as mill holes for the storage and handling of the ore. In the quarries the ore is blasted down on the floor below, broken to proper size, loaded into 3½-ton cars and trammed to the crushing plant. In the milling system the ore is blasted into the shafts, broken up and trammed out of the chutes to the mill. There is even practiced a combination of these two methods, in which the ore is broken down upon a flat, trammed to a storage shaft and loaded from chute into cars. A special type of chute was developed for this rough ore. It had a movable lip, raised or lowered by a 3-in.-pipe handle connected to the lip by a bail. By lowering, the ore would run into cars, and by raising the lip the flow stopped. This prevented spilling and allowed quick loading of the trains.

JACKHAMERS AT WORK IN OPENCUT


A TURKISH DRILL CREW

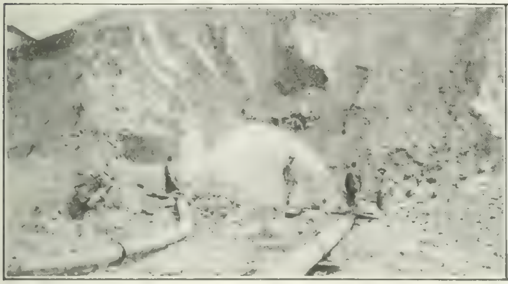
MACHINE AND HAND DRILLING

The ore is very hard. Drilling is done partly by hand and partly with machines. While we could do our drilling cheaper by hand than machine, on account of the cheap labor, nevertheless machines were an absolute necessity, as both the Balkan and the present war caused an acute scarcity of labor. According to Russian mining law it was necessary to maintain benches on the ore of specified dimensions in all open works. Our specifications called for benches not less than one *sagene* (7 ft.) wide and not more than two and a half *sagenes* high (17 ft.) The government district engineer made periodical visits to see that all governmental regulations were complied with.

Also, the law required that a responsible government *steiger* be employed by the company. The *steiger* is the personal representative of the district engineer and is charged with the duty of enforcing the regulations.

For bench work we employed 3¼-in. Ingersoll reciprocating drills, shooting as many as 60 holes by battery. The large masses were then block-holed with Jackhamers. In underground work, we used stopers to good advantage in raising. These seemed to be the best uses for the respective machines in this orebody. Drill runners, helpers and steel carriers worked on contract at a certain price per foot, and the best work was obtained in this way, all members of the crew being deeply interested. The breaking of all ore was done in the daytime; but in order to keep the crushing plant going steadily, ore was trammed both day and night. At night we were able to pull ore from the storage shafts. All tramming of ore was done by horses. The ore was delivered over a trestle to the crushing plant, which reduced the ore to 5 mm. in size. The crushing plant consisted of two sets of Blake crushers, three sets of rolls and necessary trommels. All crushing was done dry. Power for the crushing plant was generated by water power at the smelter and transmitted to the mines. This water power was not sufficient for all work and the extra energy needed was derived from oil-burning boilers. This oil, or *mazoot,* as it is called locally, is pumped through pipe lines from Baku, on the Caspian Sea, to Batum, and thence to the mines. Oil fuel was also used on our steam shovels.

From the crushing plant the ore was delivered by a 24-in. belt conveyor, 300 ft. long, to the ropeway loading station, from which it was taken to the concentrator below.



Surface-Hydraulicking Operation

Hand Drillers at Work in an Opencut

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Bolivian Mineral Exports

U. S. Commercial Attache A. L. Harrington reports the following exports of Bolivian mineral products in 1913, listed in the order of their value:

	Metric Tons		Metric Tons
Tin ore	44,591	Lead ore	1,765
Silver ore	81	Zinc ore	7,367
Copper ore	4,019	Gold bars	0.093
Bismuth ore	390	Bismuth ore (unconcentrated)	32
Copper ore (unconcentrated)	1,010	Iron ore	167
Wolfram ore	282		

The total value of all products exported from Bolivia in 1913 was 93,721,513 bolivianos, of which 67,784,377 were represented by tin concentrates. Rubber comes next with a value of 14,651,647 bolivianos. It is interesting to note the distribution of the exported mineral products. Of the tin ore Great Britain received 42,282 tons; Germany, 2007; France, 265 tons. Of the copper ore, Great Britain received 2466 tons; Germany, none; France, 1801. All the wolfram ore went to Great Britain; of bismuth, 50 tons went to Great Britain and 342 tons to Belgium. All of the zinc ore was shipped to Germany. The term ore in this report evidently refers to rich, sorted ores and to concentrates in various stages of enrichment.

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United States Rail Production

The production of rails in the United States in 1914, as reported by the Statistical Bureau of the American Iron & Steel Association, was the smallest since 1908. The total for the last three years, classified by processes of manufacture, was, in long tons:

	1912	1913	1914
Openhearth	2,105,144	2,527,710	1,525,851
Bessemer	1,099,926	817,591	323,897
Rerolled from old rail	119,390	155,043	95,169
Electric steel	3,455	2,436	178
Total	3,327,915	3,502,780	1,945,095

The decrease in 1914, as compared with 1913, was 1,557,685 tons, or 44.5%. The proportion of openhearth rails continued to increase, being 78.5% of the total in 1914, against 72.2% in 1913. No iron rails have been rolled for four years.

Girder and high T-rails for electric and street railroads are included in the above-cited figures. For recent years the tonnage thus included was as follows: 1912, 174,004; 1913, 195,659; 1914, 136,889 gross tons. The total production of rails as given in the foregoing includes, in addition to new rails rolled in the year, rails rerolled from defective rails and from old rails.

The number of rail mills active in 1914 was 24, of which 10 were rerolling mills. Fourteen plants produced openhearth rails, nine Bessemer rails and one (Illinois) electric rails.

The production of alloy-treated rails, which was 257,321 tons in 1910, fell to 59,519 tons in 1913 and 27,937 tons in 1914. Of the latter number 23,321 tons were titanium steel and 1616 tons manganese steel. Only 490 tons of alloy rails were made by the bessemer process.

The classification of rails according to weight has been as follows for three years:

	1912	1913	1914
Under 50 lb	248,672	[illegible]	[illegible]
From 50 to 85 lb	[illegible]	[illegible]	[illegible]
Over 85 lb	[illegible]	[illegible]	[illegible]
Total	3,327,915	3,502,780	1,945,095

The proportion of openhearth rails was greatest in the heavier sections.

Wolframite in Lower Burma

By E. Maxwell Lefroy*

Southern Burma is chiefly comprised in the Tennasserim Division, which itself is split up into districts, and is bounded on the south by the Malay Peninsula of tin-producing fame, with the independent kingdom of Siam to the east. Of the two districts Tavoy and Mergui, the former is becoming known for wolframite, with cassiterite as a byproduct, which is obtained chiefly from quartz lodes carrying both minerals. In one proposition cassiterite alone is worked for, a suction dredge being used on this property.

The town of Tavoy has 25,000 people, is 32 miles up the Tavoy River and is headquarters for the local government. It is served by steamers from Rangoon and Penang and is the only port in the district. All ores are exported thence after they have been assessed for duty, which is at the rate of 2½% ad valorem. In the case of all wolframite concentrate the value is taken at the flat rate of $480 per long ton, irrespective of unit value.

The grade of wolframite is a high one and varies from 60 units of tungstic acid, the commercial minimum, to as high as 76%. The price per unit was steady in the German markets before the war at 33 marks ($6.69), and with increasing use of tungsten for steel hardening, for filaments and with some newly invented aluminum-tungsten alloys there appears little fear of a serious drop when the war is over.

Ample Water Supply for Hydraulicking

Tavoy has a climate of great humidity—the rainfall for a year to Mar. 31, 1914, was 196.62 in.—and is a district of steep hills and mountains, so that successful sluicing is a feature which may be highly developed. Hydraulicking will follow as the extensive hillside deposits, detritus and alluvials are opened out. Mining is confined at present to exploiting by adits, and is mainly effected by Chinese labor under white supervision. Payment is by result: From 20c. to 32c. per *viss* (3½ lb.) when on the lode; for crosscutting the rate varies from 48c. to 96c. per ft., according to the ground. Laborers do their own timbering, but buy candles and explosive.

In practically all cases crushing is effected by the miners using hand hammers and concentrating in cradles. Concentrate sells at from $430 to $600 per ton.

The bulk of it has been going direct to the Hamburg market, the assay made by the German government for duty assessment being accepted by buyer and seller. On concentrate from a concession known to carry ore of good quality local agents advance 85% of the market value on assumed grade of 65 units. The balance is paid, less interest on the advance, on realization.

The geological conditions are granite overlaid by metamorphic schists, sandstones or quartzites. These are of varying thickness, from nothing up to, probably, many thousands of feet. Schists are argillaceous, arenaceous and graphitic, being the last remnants of former sedimentaries which have in many cases been eroded to the intrusive plutonics. The generality of lodes strike more or less north and south—from 50° west of north to 30° east. Dip is in all cases to the east. In a number of instances lodes have followed from a schist capping a well down into the granite without any marked variation being noticeable. The wolframite content has not diminished appreciably, though width of lode is not maintained, a width in schist of 2½-ft. average narrowing to a bare 2 ft. in granite.

Many Rare-Metal Minerals Found

The deposits are undoubted fissure veins, with WO_3 as secondary enrichment in the milky quartz gangue. Associated minerals are cassiterite, galena, pyrite, columbite, molybdenite, tungstite, muscovite, chlorite; but only the first named is of economic value as yet. That molybdenite deposits of commercial value will be found is the expectation of local mining engineers, as that mineral occurs disseminated in many veins. Monazite, samarskite and gold have also been reported.

Owing to the heavy rains from May to November prospecting is carried on with great difficulty. The rainfall is about 200 in. in those months, and the jungle growth proportionately rapid; so that it is certain, when taken in conjunction with the recent origin of prospecting, and yet more of mining—since 1908—that not a tithe of the wealth of the district has been disclosed. Even the continuity of the lodes for a reasonable vertical depth is unknown, though no one doubts that they do persist to at least 2500 ft. from hilltop outcrops downward. Thus the writer has traced one lode—out of 15 known to exist on a hillside 2000 ft. in horizontal length—for 7020 ft. on the slope. The vertical height was ascertained at 1912 ft. (the slope lay therefore at an angle of 16° with the horizon and the base length approximated 5000 ft.). This hill is entirely of granite, though rising as high as 3987 ft. above sea level. At just one mile distant and 2000 ft. lower the lodes exist in schist, and two series are comprised, the first striking due north and south and the other at magnetic bearing of 310°, with intersection and crossing of the other series. Each of these groups consists of many parallel lodes, which are typical of the deposits throughout the district. The widths vary from 3 in. to 4 ft. The dip varies from 50 to 80°. The mineral (WO_3) content for more than 1000 ft. of drifts on the lode has been proved at just 2½% of the veinstuff. The miners hand crushed and concentrated by cradle and only treated the obviously rich ore, throwing on the dump at the adit mouths fully 95% of the rock broken. Cradle losses have been proved as high as 28%. Two English companies are now installing or operating rolls and stamps for crushing.

A properly organized and equipped company taking over a concession worked on local lines will find many hundreds or thousands of tons of rock broken which, if the property is not a "duffer," will contain from 0.5 to 1% of wolframite.

Mining costs per ton of concentrate vary from $145 to $190, crushing, timbering, etc., included; supervision is $25 to $40; transport averages for the district $19 (bags included); office, insurance, freight, etc., $80 to $90; and duty, $12—making the total outlay vary from $281 to $351. On selling prices of $430 to $600 this leaves a handsome margin for profit.

For the year ended Mar. 31, 1914, returns are: Wolframite, 1622 tons 814 lb.; cassiterite, 68 tons 182 lb. The April output was 167 tons of wolframite and 4 tons of cassiterite. The wolframite return includes some tin ore, to extract which the concentrate is sent to Penang for separator treatment.

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*Consulting engineer and mine manager, Tavoy, Lower Burma.

Gold Dredging in the Philippines*

SYNOPSIS—A review of the dredging practice that has been evolved in digging difficult but rich ground in the tropical environment of the Island of Luzon. Most of this development has taken place in the Province of Ambos Camarines during the last five years; other areas are now being investigated.

Placer mining has become one of the most important of Philippine industries. The recognition of the value of the alluvial deposits of gold in the islands came only after a long period of experimentation and the usual tale of hardship and struggle. However, the growth of the industry during the last three years has been rapid. During that time two old dredges which before had failed to pay have been put into successful operation; three new dredges have been completed; two are nearing completion, and three others are soon to be constructed, with promise of even more in the future.

Dredging Most Active in Ambos Camarines

Gold-bearing alluvium has been found in Cagayan, Ilocos Sur, Mountain, Pangasinan, Nueva Ecija, Bulacan, Rizal, Tayabas, Ambos Camarines, Catanduanes, Mindoro, Masbate, Panay, Surigao, Butuan, Misamis, Bukidnon and Zamboanga. Of these districts, only Ambos Camarines is at present producing gold on a large scale, but three others, Tayabas, Rizal and Surigao, are now installing machinery and will be operating in the near future.

At present six dredges are being operated in Ambos Camarines: One by the Gumaos Placer Co., two by Philippine Dredges, Ltd.; one by the Maximelo Gold Dredging Co., one by the Malaguit Gold Dredging Co., and one by the Philippine Dredging Syndicate. Philippine Dredges, Ltd., is constructing three other dredges, one wooden-hull dredge with 8.5 cu.ft. close-connected buckets, one with 6-cu.ft. close-connected buckets and an all-steel dredge, with 9-cu.ft. close-connected buckets, which is being built in Australia. In 1913 four dredges operated during the entire year and one operated for about six months. The gold produced from these dredges in 1913 amounted to 643,776 pesos ($321,888, U. S. currency).

In the Philippines probably more different types of dredges are represented than in any other district in the world. There are in operation or in process of building, locally, one or more dredges of the following types:

1. Loose-connected or link-bucket type; revolving screen and one bank of tables on each side, controlled by head-lines and side-lines; no stacking ladder used.

2. Loose-connected or link-bucket type, without screens or side tables, but with two long sluices one above the other, fitted with several different types of riffles; controlled by head-lines and side-lines; no stacking ladder.

3. Close-connected buckets, with revolving screen, two banks of tables on each side, and stacking ladder; co[illegible] by spuds and side-lines.

4. Close-connected buckets, without screens, with [illegible] central sluice and undercurrents on each side, no stacking ladder; controlled by head-lines and side-lines.

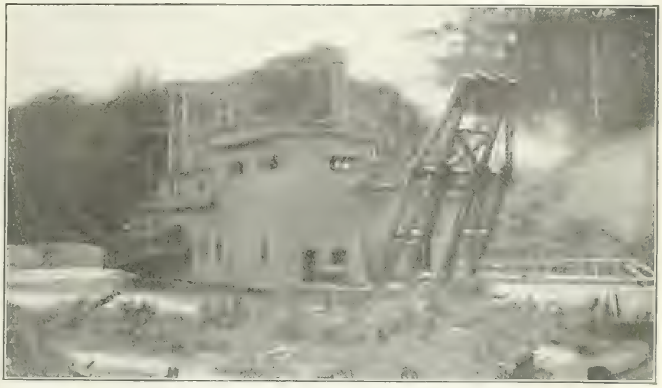
5. Close-connected buckets, with revolving screen, and single bank of tables on each side; no stacking ladder; controlled by spuds and side-lines.

6. Loose-connected buckets with screen and shaking tables, also after table and save-all; no stacking ladder; controlled by head-lines and side-lines; hull of steel.

Character of Ground

The placer areas in the Philippine Islands are small as compared with other famous fields, but are sufficiently large to offer profitable work. It is interesting to note that, except for a few feet of surface, all the ground dredged in the Philippines has been below sea level, and that the tide flows nearly to the head of the rivers on which the dredges are situated.

The gold in general is much more angular than gold found in placers in other countries. It is usually fine and occurs as small well-shaped crystals. Only a small quantity of rounded gold has been found. The only exceptions found so far are at Cansuran, Surigao, and at Umerai, Tayabas. An unusual feature is found in Paracale and Malaguit Rivers in the fragments of gold-bearing quartz picked up by the dredge. These vary from pieces the size of a pea to boulders weighing 100 kg. Gold is found in these boulders filling pockets or vugs; it is fine and crystalline, forming a spongelike mass.



Gumaos Placer Co.'s Dredge in Ambos Camarines, Island of Luzon

The gold in the Paracale district is usually found in the layer of gravel next to the bedrock and also filling the crevices and cracks of the bedrock. The gold-bearing gravel varies from 0.3 to 3 m. (1 to 10 ft.) in thickness. Little or no gold is found in the sands and clays which overlie.

At Gumaos little or no black sand or pyrite is found. At Paracale and Malaguit, however, large amounts of magnetite, ilmenite, pyrite, and some metallic copper, with other accompanying heavy minerals, are found in places. In Nueva Ecija the gold is even finer than at Paracale, and exceedingly large amounts of black sand are found, which make the saving of gold difficult.

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*An article in the "Philippine Journal of Science" by William Kane, superintendent of the Gumaos Placer Co., Manila, P. I.

On Paracale and Malaguit Rivers there are mangrove roots and soil for about 2.4 m. (8 ft.) in depth. Below this is a layer from 3 to 6 m. (10 to 20 ft.) of black sticky clay or "pug"; under this is a thin layer of sand and below that is the pay gravel, which is from 0.3 to 1.5 m. (1 to 5 ft.) thick. The bedrock is a decomposed granite or gneiss, and is well adapted for dredging.

Deepest Dredging at Gumaos

At Gumaos there is about 1 m. (3 ft.) of soil, then 3 m. (10 ft.) of yellow clay and from 6 to 9 m. (20 to 30 ft.) of black clay or pug, below which is the layer of pay gravel, which varies from 0.3 to 4.5 m. (1 to 15 ft.) in thickness. There is little quartz in this gravel, and none of the quartz is gold-bearing, such as is found in Paracale. The ground, so far worked, has yielded from 30 to 90 centavos (15 to 45c., U. S. c.) per cu.yd. Some patches have been dredged that yielded as high as 2 pesos ($1) per cu.yd. The greatest depth dredged is 15 m. (51 ft.), while the average depth is about 11 m. (35 ft.).

The gold is unevenly distributed throughout the Paracale district, and for this reason, unless drive pipes are put down every 100 ft., even an approximate value can not be obtained. Where the gold-bearing gravels are thick, the gold contents shown by drive pipe seem to check fairly well with the dredge output, but where the gravel bed is thin the results cannot be depended upon. Besides this, the gold is found in irregular streaks on the bedrock, and a drive pipe cannot be relied upon in such ground. Nevertheless, it is important that all placer properties be thoroughly tested in order to obtain even an approximate idea of the value of the ground. To do this it is essential that a good machine, making a bore no smaller than 9 cm. (3.5 in.), be used and that a man be in charge who thoroughly understands the proper use of the machine.

The difference between Philippine placer ground and that in other countries, as shown so far in working with dredges, is the extremely large percentage of fine material and clay in the former. In California only from 30 to 40% of the material dredged passes through the screens, and it is generally composed of clean sand with little clay. In this country the alluvium has undergone weathering and decomposition, due to the extreme oxidizing power of the elements in the tropics, and the result is the production of clay and soil so that from 70 to 80% of the material dredged passes through the screens. It also has the disadvantage of being made up largely of clay which is sticky and hard to disintegrate, resulting in loss of gold. Even the gravel bed in which the gold is found has undergone considerable decomposition and has produced clay.

Philippine Dredging Practice

The character of the Philippine placers presents an element in dredging that requires special attention and methods of treatment somewhat different from the usual practices. It appears from tests made on the tailings and on samples taken from the buckets that the present dredging practice recovers only from 60 to 85% of the gold in the ground. Because of the unreliability of drive-pipe tests in these deposits, samples taken in this manner are the only means of testing the efficiency of the dredge. Dredging men are beginning to realize this, and are gradually changing the design of the dredge to suit conditions. The principal changes which would seem to be advantageous are increased screen area and increased water pressure at the nozzles which play upon the screens. With suitable screens and water pressure, it is my belief that ground averaging 25 centavos (12.5c. U. S. c.) per cu.yd. can be profitably worked with dredges having buckets up to 7 cu.ft. capacity. With larger dredges and cheaper power, costs could probably be reduced still further. However, the adaptability of very large dredges to ground of this character is questionable.

The first principle in dredge building is to have a hull of sufficient strength to support rigidly the great weight of machinery and to withstand the excessive strain to which it is subjected when the dredge is digging, particularly the shock caused by the changing pitch of the bucket line. If any weakness develops, the machinery is apt to be thrown out of alignment, and excessive wear or breakage results.

Oregon-Pine Hulls

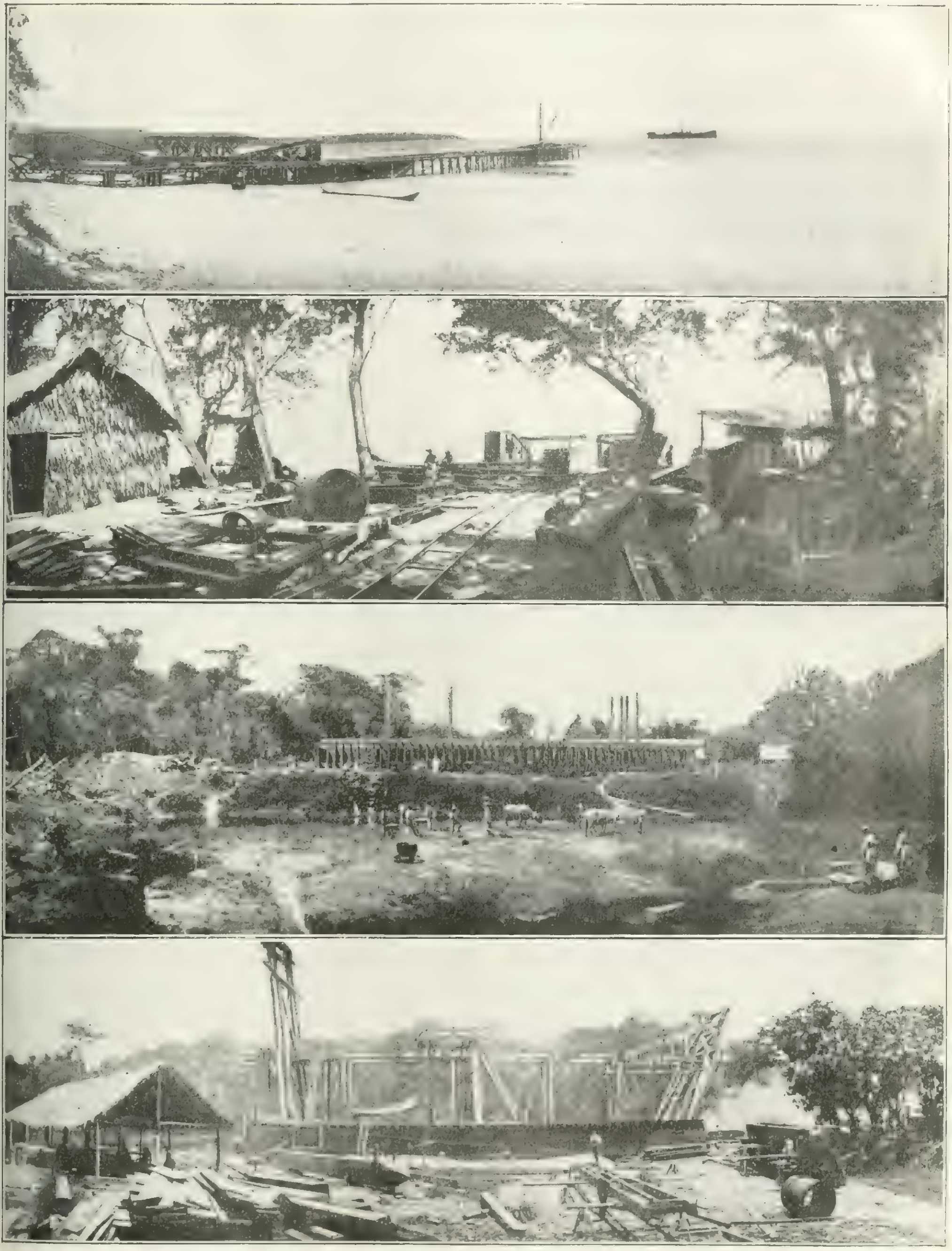
Steel hulls have not yet been tested in the Philippines. Steel has been proved superior to wooden hulls when working in fresh water, but when working in salt water, as is the case in the Paracale district, its superiority is questionable. Furthermore, the tendency toward rapid oxidation in the tropics may be a serious handicap to a steel hull. Philippine pontoons have been made of native wood and also of Oregon pine. It appears from evidence so far obtained that Oregon pine is on the whole more satisfactory. However, the Philippine wood used was not representative of the best Philippine wood, and therefore should not be taken as an example.

It is essential that all construction of Oregon pine should be well reinforced with steel plates, and in all cases the hull should be well ventilated. The pontoon should also be sheathed with tarred felt, covered by 1.5-in. boarding, to protect the hull from teredos and fresh-water borers. This is a precaution peculiar to the tropics where such water animals are found.

Ordinary Buckets Unsatisfactory in Clayey Ground

In order to handle the clay encountered in the deposit and to secure a proper capacity, it is necessary to have a specially designed bucket. Ordinary buckets designed for handling gravel are almost useless. The body of the bucket should be short and the lip cut well back to insure quick and clean dumping. In the Philippines, as elsewhere, the close-connected buckets have many advantages over open-connected buckets. It is an advantage to have the machinery so designed that the buckets can be driven fast while digging the overburden and more slowly while digging pay gravel and bedrock. A larger quantity of clay can be handled by moving laterally more rapidly and by decreasing the distance through which the digging ladder is lowered on each swing. The wear on buckets and on the digging end generally is light in the Paracale district because of the soft material handled.

Dredges are operating in the district with spuds and also with head-lines. There are advantages claimed for each system. If the operator desires to strip the overburden for about 3 m. (10 or 12 ft.) ahead of the work-



LANDING THE EQUIPMENT AND ERECTING A DREDGE IN THE PHILIPPINES

The accompanying engravings present scenes during the erection of the Gumaos dredge, in the Province of Ambos Camarines, by the New York Engineering Co. The top view show the dock and lighter built to land the Gumaos equipment from the steamer in the offing. The lower views show the dredge hull at various stages of construction, the completed dredge being shown in action on the first page of this article.

ing face and then drop back to clean up the gold-bearing gravel, the head-line is preferable, but the modern practice in the United States is to use spuds, holding the dredge right to the face and working to bedrock with each step. It is also claimed that the use of spuds saves time by eliminating the handling of heavy head-lines, which is especially difficult in a wooded country.

The modern screen is a revolving cylindrical screen, constructed with a framework of heavy channel irons, to which perforated plates are bolted. This makes it possible easily to replace the perforated plates, which have to be renewed about once every nine months. The plates are about ⅜ in. thick, and the perforations vary from ¼ in. at the upper end to ½ in. at the lower end.

Paracale River Dredges Operate without Screens

The dredges on Paracale River are operating without screens. The material is dumped into a large sluice, and water is supplied through nozzles at the head and also at several points along the sluice to assist in breaking up the material. For about 9 m. (30 ft.) from the head the material passes over stationary perforated plates. The undercurrent from the perforated plates passes out over wide tables which are fitted with riffles and placed on each side parallel to the box. After passing over the tables the material is returned to the main sluice. The overflow passes straight down the main box, which below the plates is fitted with heavy angle-iron riffles. There is also a clay sluice through which the valueless overburden can be passed, thereby relieving the tables and sluice from performing unprofitable work. This system is similar to that used in hydraulic mining in all parts of the world and is still used in dredging in New Zealand and Australia, but is not used in dredging in the United States; in Alaska it is called flume dredging. It appears that this practice would be good where there is not an excessive amount of clay and where there are not many large boulders, which have to be removed by hand from the sluice box.

The revolving screen with high-pressure nozzles would seem to be best adapted for material with a large percentage of clay and also wherever a stacking ladder is necessary.

Use of Mercury Increasing

On account of the fineness of the gold and the large percentage of fine material in the wash, the table area should be larger than usual. About 80% of the gold is caught in the first few feet of the first four tables where mercury is used in riffles. The advantage of using mercury is marked, and its use is now considered the best practice. The use of matting and expanded metal is decreasing, and is being replaced by riffles and mercury.

The general practice is to clean up the main tables at least once a week and the side sluices once a month. In cleaning up, the riffles are lifted and the entire material left on the tables is collected and washed in a streaming-down box. This practice is adopted on account of the unreliability of the laborers. The tables on dredges using screens and a distributing box can be cleaned up in sections while the dredge is in operation. The sluice-box type without screens necessitates a shut-down before the main sluice can be cleaned up.

It is advantageous to have the pumps driven by a separate engine and not from the bucket engine. There should be at least two pumps—one high-pressure and one low-pressure—rather than one low-pressure pump of large capacity, especially where much clay is encountered.

Power Problem Serious

Power is becoming a serious problem in the Paracale district. The available wood supply is being rapidly exhausted, coal is expensive, and oil fuel is now receiving serious consideration. It appears that Diesel engines would furnish by far the cheapest power. A central electric power plant run by Diesel engines would be an excellent solution of the problem.

A representative force of men required for a dredge in the Philippines is shown in the accompanying table. The cost of operation per cubic yard, representative of the best practice, is also shown.

DREDGE CREW IN THE PHILIPPINES

Dredge force per shift:	Pesos[1]
1 white winchman, per month	250.00
1 native winchman, per day	1.25
1 native fireman, per day	1.25
1 native greaser, per day	1.25
9 native laborers, per day	1.00
Additional day force:	
1 white mechanic, per month	300.00
1 Japanese blacksmith, per day	3.35
1 native blacksmith helper, per day	1.00
2 native assistant machinists, per day	1.50
1 native boss, per day	2.00
5 native laborers, per day	1.00

OPERATING COST OF PHILIPPINE DREDGE

	Pesos per Cu. Yd.
Labor, white	0.03
Labor, native	.027
Superintendence	.010
Fuel	.044
Supplies	.005
Repairs	.015
Total	0.131

About the best work that a dredge has done so far has been to operate throughout 75% of the working days. Most material made of iron and steel has a life about two-thirds as long as in the temperate zone. This is particularly noticeable in wire cables exposed to salt water. The distance from the base of supply makes it necessary to keep in stock a large supply of extra parts. Any unlooked for breakage is expensive for this reason, and may cause a delay of from one to three months.

* * *

German Steel Production

The German Iron & Steel Union reports that the production of the steel works in Germany, which fell to 663,223 metric tons in September, gradually increased to 941,399 tons in December. The total for the year 1914 was 14,973,106 tons, which was a decrease of 21% from 1913. At the close of 1914 there were 245 steel-making plants in operation.

The production of the German steel works for the full year was as follows, in metric tons:

	Basic		Acid		Total	
	Tons	%	Tons	%	Tons	%
Converter	8,169,183	54.6	100,617	0.7	8,269,800	55.3
Openhearth	5,946,215	39.6	274,321	1.8	6,220,536	41.4
Direct castings	211,095	1.4	87,243	0.6	298,338	2.0
Crucible	....	....	95,096	0.7	95,096	0.7
Electric	......		89,336	0.6	89,336	0.6
Total	14,326,493	95.6	646,613	4.4	14,973,106	100.0
Total, 1913	18,222,598	96.2	736,221	3.8	18,958,819	100.0

The total production for 1914 shows a decrease of 3,985,713 tons, or 21%, from that of 1913. Most of the loss was due to the war, but in the first half of 1914 there was some decrease in production owing to depressed business conditions. The output for 1913 is the largest on record. Owing to the unusual conditions of the year no special deductions can be drawn from the figures.

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[1] One peso equals 50c. U. S. currency.

Stated comparatively, the production for three years was, in metric tons:

	1912	1913	1914
Converter	9,981,479	10,784,835	8,269,800
Openhearth	6,845,489	7,610,140	6,220,536
Direct castings	321,663	362,916	298,338
Crucible, etc	153,367	200,928	184,432
Total	17,301,998	18,958,819	14,973,106

It is remarkable that, with dull business in the first half of the year and war conditions in the second half, the steel production of 1914 should have kept up to 79% of that reported in 1913, an exceedingly prosperous and active year.

Some Alta Activities

Special Correspondence

Alta is situated in Salt Lake County, Utah, at the head of Little Cottonwood Cañon in the Wasatch Mountains. This is a typical glacial cañon, with a large terminal moraine at its mouth and a lateral moraine on the south side. The sides of the cañon are precipitous and the formation is exposed all the way to the head. In succession, coming up the cañon, are quartzite, granite, quartzite, lime and overlying quartzite. The quartzite and lime dip NE 60° at an angle of 35°.

In Little Cottonwood Cañon

The upper contact of the lime and quartzite is attracting considerable attention at the present time. This contact strikes NW 30° and dips 35° easterly. It is cut by several fissures striking northeasterly and southwesterly; also by another series striking more easterly and westerly. All these fissures dip in a northerly direction.

Origin of Ore

The large orebody of the old Columbus, called No. 5 stope, was formed at the intersection of the Brain fissure and this contact. About $1,500,000 worth of ore was taken out of this stope. Recently the Cardiff developed a large orebody at the intersection of this contact and the South Fork fissure. It is estimated there are 140,000 tons of ore developed and partly developed that assays from $25 to $40 a ton. There is also some much higher grade ore, but no figures regarding it are available.

These orebodies are a replacement of the lime. The mineralization is due to the fissures, and the lime only affords a field where small fissures can make large orebodies. So much has been said of this contact lately that a great many people believe the mineralizing agent followed the contact. This is not true, as the contact is barren except in the vicinity of an ore-bearing fissure. It is true that the fissures have mineralized the contact some distance each way, but that is only on account of the solubility of the lime.

It is the recent development of this new orebody in the Cardiff that has given the present impetus to Alta mining. It has not the earmarks of a boom, but there is considerable activity, and more is expected.

Columbus Extension

The Columbus Extension drove approximately 5000 ft. of crosscut tunnel in a northerly and northwesterly direction, cutting five well-defined fissures. These were all cut in the overlying quartzite and no attention was given to the contact. These fissures are from 2 to 15 ft. wide. Some shipping ore has been mined and a large tonnage of mill ore defined. One of these bodies of mill ore is a replacement in a bed of soft quartzite and is about 30 ft. wide. It assays 6% Cu, 10 oz. Ag and a small percentage of lead.

The objective of the Columbus Extension tunnel was the big Toledo fissure. This strikes northeasterly and southwesterly, the filling cropping near the top of the ridge, and dips about 60° in a northerly direction. This is the strongest and most persistent fissure in the camp. In the early days a great deal of high-grade silver ore was mined from the Toledo fissure, from the surface to a depth of 400 or 500 ft. The Extension tunnel will cut this fissure at a vertical depth of 1400 ft.

The present management crosscut from the face of the tunnel 230 ft. to the contact with the intention of following the contact to the Toledo fissure, feeling assured of a large orebody at the fissure. After drifting only 85 ft. there was cut an unknown fissure 5 ft. wide, striking NE 20°, on which they are now drifting into the lime. Assays average 48% Zn, 7% Cu, 10% Pb and 18 oz. Ag. The face of the contact drift has advanced 100 ft. beyond this zinc fissure and shows 2 ft. of vein material on the contact, with some zinc and copper ore scattered through it. The Columbus Extension is working 10 men at present. Compressed air and electric power are furnished by the Wasatch Mines Co. The electric power is used for driving a 36-in. fan connected for suction through a 10-in. pipe line. The fan is driven by a 15-hp. motor at 1000 r.p.m. The tramming is done with horses, but electric haulage is contemplated.

Ore transportation is cheap, amounting to $2 per ton landed at Midvale or Murray. The ore is carried 3 miles by aërial tram and 2½ miles by wagon to the Wasatch terminal of the Salt Lake & Alta R.R., which connects with the Denver & Rio Grande at Midvale.

SOUTH HECLA

The South Hecla owns 550 acres of ground on the south side of Little Cottonwood Cañon, almost directly opposite the Columbus Extension. At present this company is drifting on the Wedge fissure in the lime. This is a northeast-southwest fissure. It has been opened 800 ft. on the 250-ft. level and 900 ft. on the 500-ft. level. The property is worked through a tunnel and the levels are referred to perpendicular distances from the surface. The ore averages 18 ft. wide and assays 0.03 oz. Au, 25 oz. Ag and 15% Pb. There are 5 miles of underground workings, and the property is splendidly equipped throughout. Ore is shipped only during the summer months. Last year 5000 tons were sent to the smelter, for which $104,000 was received. Fifteen men are working at present, but the force is greatly increased during the summer.

Cottonwood Cañon has a very heavy snowfall, which interferes seriously with mining during the winter, and heavy and disastrous snowslides are not infrequent. The rugged character of the country is shown in the illustration, as well as a typical snowfall, which has almost completely buried the miners' cabins to the right of the ore bin.

The Alta Consolidated claims are developed by 5000 ft. of tunnels and other underground workings and have produced about $100,000 gross since incorporation. The latest work in the west drift from the tunnel level on the Brain fissure has developed 1½ ft. of rich sulphide ore that will net about $60 per ton. At the present time a winze is being sunk on this ore to intersect a quartzite-lime contact, which is similar to the one which made the large orebodies in the Columbus Consolidated and the Cardiff. The east drift is being driven to get under the orebody of the old Matilda mine, which was a heavy producer in the early days and is now a part of the Alta Consolidated holdings. There is also a large bedded vein 40 ft. thick of sulphide ore, carrying copper, gold and silver, traversing the property northwesterly and southeasterly for approximately 1500 ft. It is intended to develop this by running a tunnel from the workings of the old Flagstaff, which are now in over 4000 ft. This proposed tunnel would intersect this bedded vein at a depth of over 700 ft. vertically below the present tunnel level and would give backs of over 1000 ft. of ore. This proposed tunnel would also serve as an outlet and working tunnel to develop the entire mine and furnish drainage facilities. Other companies will join with the Alta Consolidated in running this tunnel.

Mineral Output of Italy in 1913

According to the official reports in *Revista del Servizio Minerario nel 1913,* there were 645 producing mines in Italy in 1913, which were divided as follows: Sulphur, 359; lead and zinc, 99; coal and oil shale, 40; salt, 31; iron, 22; graphite, 22; asphalt, 17; pyrites, 10; petroleum, gas, etc., 9; mercury, 8; copper, 8; borax, 8; manganese, 4; all others, 8. The total number of laborers employed under and above ground was 45,407.

The output of principal minerals was as follows, the items being arranged in order of descending values: Sulphur, crude, 2,152,174 metric tons; zinc ore, 158,278; iron ore, 603,116; silver-lead ore, 11,651; lignite, 697,319; iron pyrites, 292,077; mercury ore, 109,379; asphalt and bitumen, 171,097; copper ore, 89,487; petroleum, 6572; borax, 2410; salt, 17,727; rock salt, 41,323; copper pyrites, 25,257; graphite, 11,145 metric tons; natural gas, 6,015,000 cu.m.; mineral waters, 25,700 metric tons; gold ore, 2047; antimony ore, 1822; alum, 5976; manganese ore, 1622; tin ore, 274; bituminous schist, 2640; lead and zinc ore, 504; bituminous coal, 1120.

The principal metals produced, exclusive of iron and steel, were: Lead, 21,674 metric tons; mercury, 1004; aluminum, 874 metric tons; silver, 13,094 kg.; antimony, regulus and sulphide, 76 metric tons.

Quarry products were: Bauxite, 6952 metric tons; pumice, 14,973; talc and steatite, 24,001; barytes, 12,970; quartz and feldspar, 32,268; marble, 509,342; kaolin, 11,920; refractory materials, 5560 metric tons.

The Galician Oil Fields in War Time

J. R. Falkowicz, a petroleum expert, who returned to London in March from a special visit to the oil fields of Galicia, has been interviewed by a representative of the London *Financial Times,* which presents an interesting account of conditions in this field. Mr. Falkowicz went via Norway and Sweden to the Finnish frontier, and as there is no connection between the Swedish and Finnish railways, a short sleigh journey had to be taken to the first station in Finland. Then came a long railway journey to Petrograd, and from Petrograd to Galicia, in the footsteps of the Russian army.

Once at Lemberg—which is the residence of the Russian military governor general—the journey to the oil fields, a hundred miles distant, had to be made by horse conveyance, for no trains were running and there was no such thing as a motor car to be had. Moreover, at the time of Mr. Falkowicz's visit the country had been entirely cleared of food, first by the retreating Austrian army and next by the advancing Russians. Further, there was no money available, as all the banks had been closed and the cash removed. The only people left were a few minor officials and a considerable number of workmen, who had not been paid their wages since the outbreak of war. Mr. Falkowicz said:

> On going over the oil fields I found that the oil properties generally had not suffered during the recent fighting. Finding the workpeople were in a state of semi-starvation, I obtained the immediate and full assistance of the Russian governor general in arranging for regular food convoys from Russia into the district. The food question having thus been solved, it became possible to reorganize the work, and in due course I was able to restart operations on some of the properties.
>
> The oil fields, generally speaking, have suffered no damage by the fighting. Whatever damage was done affected chiefly the private property and the houses of the inhabitants and of the various staffs of the companies. These suffered badly from loot and pillage. For this, however, the ordinary hungry mob which followed the army is more responsible than the Cossacks. Almost every private house and every office was entirely ransacked, even to the nails in the walls. People walking in the roads were, in spite of the cold, the frost and the snow, deprived in broad daylight of their fur coats and their boots. On such of the oil properties as were left without anybody to look after them, everything movable, chiefly beltings, metal fittings and even metal bearings from engines and boring rigs, began to disappear. In some instances whole derricks were dismantled by the thieves. We started to stop this by keeping a watchman, but more than once we found the watchman killed. We then began to keep gangs of three or four watchmen, but this was too expensive. We therefore decided to restart full work, as the best way of keeping off the thieves, and this is how we gradually came to organize working on the fields.

Tendency of American Milling Machinery Practice

By Julius I. Wile*

SYNOPSIS—Late tendency in milling machinery in America has been toward the removal of the expensive older types where they are not essential, and the application of machinery particularly adapted to each class of ore to be handled. Stamps are being shown to be not the best in many cases, but may be replaced to advantage by other machines. Disk grinders, rolls, ball mills and tube mills are discussed, and their application in various cases indicated.

The past few years have brought forth such a multiplicity of designs and processes for the reduction of costs and the increase of extraction from low-grade ores that milling engineers are somewhat confused as to just what is the best type of machinery to be used for any particular ore. Having been connected with one of the large milling-machinery manufacturers, I have had an opportunity to investigate the different machines and processes used in various camps throughout the United States and Canada, and the object of this article is to place on record the results of my observations according to my interpretation of them.

It is a well-known fact that crushing machinery best suited for the ores of one district may not be suitable for another where the ores are entirely different in composition and in resistance to crushing. For the simplification of machinery requirements, I would divide ores into two classes, placing ordinary ores in class A and the tough ores in class B. I would put ores in the various districts in the United States and Canada in general for the purposes of this article in the following list; and it will be particularly noted that most of the ores come under the class A division. It is difficult to draw an absolute line of division between these classes, but I doubt if engineers can find much objection to placing ores of below 25,000 lb. per sq.in. crushing resistance as ordinary, or class A ores, and those above that as tough, or class B ores

CLASS A, ORDINARY ORES

Porcupine gold ores, Ontario, Canada
Utah porphyry copper ores
Arizona copper-carbonate ores
Coeur d'Alene, Idaho, lead and zinc ores
New Mexico porphyry-copper ores
Missouri lead and zinc ores
British Columbia copper ores
Arizona porphyry copper ores
Nevada gold ores.
Montana copper ores.
Montana zinc ores
Wisconsin zinc and lead ores.
California gold ores.

CLASS B, TOUGH ORES

Cobalt, Ontario, Canada, silver ores
Pearce, Arizona, gold ores
Kingman, Arizona, gold ores
Tonopah, Nevada, silver ores
Michigan copper ores.

The division of stage crushing required to crush mine-run ore to pulp, whether for amalgamation, concentration, flotation or cyaniding, no matter what ultimate degree of fineness is required, I would separate into three stages—breaking, crushing and grinding. The principal machinery now being used I find to be as follows:

CLASS A, ORDINARY ORES

Breaking—Iron Blake-type crushers or gyratories, reducing mine-run to 1½ in., or to 3½ in., with Symons disk crushers to 1½ in.

Crushing	Feed	Product
Ball mill	1½ in.	10 mesh
or rolls	1½ in.	4 mesh
or disk	1½ in.	⅜ mesh
Grinding—		
Pebble tube mills	⅜ to 10 mesh	—30 to —200 mesh

CLASS B, TOUGH ORES

Breaking—Steel Blake-type crushers, reducing mine-run to 1½ in., or 5½ in. and using disk crushers to 1½ in.

Crushing	Feed	Product
Stamps heavy	1½ in.	3 mesh
Disk	1½ in.	⅜ mesh
Grinding		
Pebble tube mills	⅜ in. to 3 mesh	—30 to —200 mesh

Among the points to be considered in this article is the old question as to whether stamps, particularly for gold milling, are at last going to be discarded. I believe the tendency is that they will be, in most cases, in favor of ball mills, while still being retained in special cases, such as for very tough ores, where high iron consumption makes the use of ball mills prohibitive. I also believe in the pebble-tube mill for finishing, whether for 30, 60 or 200 mesh, its adaptation to coarse as well as fine feeds and its ability to produce a coarse as well as a fine product depending largely on the type of the discharge.

Preliminary Breaking

In smaller mills, up to 200 tons of daily capacity, the primary breaking is usually done in iron Blake machines reducing to 1½ in., while for tougher ores, as in class B, the minimization of breakage makes the steel Blake the most suitable. In such mills the size of the primary breaker is usually not larger than a 10x20-in. opening, the ore being broken in the mine to this size. In mills for 1000 tons and larger it is becoming more and more the practice to break to larger sizes in the mine, or use a steam shovel, and install large-size primary breakers. Blake breakers are now made with openings as large as 48x90 in. Gyratory machines are also used for primary breaking, but their complexity as compared to the simplicity of the Blakes for repairs and their high cost of repairs, except on soft ores, are causing them to be used less and less. Both large Blakes and gyratories take a steam-shovel feed and break to from 3 to 5 in., and it has been the general practice to follow these large breakers with secondary Blakes or gyratories or large rolls, such as 72-in. diameter, which are largely used at the porphyry-copper mills. For this work of secondary breaking to approximately 1½ in., the Symons disk crusher is now being largely used, and has been adopted by the larger mining companies such as Phelps, Dodge & Co., the Guggenheim companies, the Anaconda Copper Co., and the Inspiration Copper Co. Records of the Detroit Copper Co. of Phelps, Dodge & Co., at Morenci, Ariz., give a life of 170,000 tons for one set of manganese-steel disks, which are the main wearing parts, and cost about $300. The Federal Lead Co., at Flat River, Mo., obtained the low figure of 0.2c. per ton for wear over a period of a year.

An interesting test of capacity, power and size of the product of a 48-in. disk crusher was made by David Gilmour, chief engineer for the Guggenheim Exploration Co., with a view to determining the advisability of using it instead of 72x20-in. rolls, and as a result the disk crusher was adopted for the Chile Copper Co., at Chuquicamata, Chile. One of the tests was as shown herewith:

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TEST OF DISK CRUSHER

Feed, 20% 4 to 6 in., 50% 2 to 4 in., 25% 1 to 1½ in.
Crusher opening, 1¼ in.
Product, 78% ½ to 1½ in., 22% ½ in. and smaller.
Capacity, 100 tons per hr.
Power, 29 to 47.9 hp.

It will be noted that the rated capacity for this crusher with 1½-in. product is 60 to 80 tons; the power from 50 to 65 hp., so that the catalog ratings are conservative.

In a more practical way the advantages of the disk crusher can be shown by a comparison of costs, which are available for 1000-ton units for secondary breaking from 3½ into 1½ in. The accompanying estimate is based on the cost of power and repairs only, with 8 hr. crushing and power taken at the low figure of $50 per hp. per year, the average yearly tonnage being 350,000 tons. The estimate is given for both class A and class B ores, and comparison is made between gyratories, rolls and disk breakers.

CRUSHER ACTION ON VARIOUS ORES—CLASS A

	Two No. 5 Gyratories 50 Hp. (25 Hp. Each)	72x16-in. Rolls 60 Hp.	48-in. Disk 40 Hp.
Power	0.24c.	0.29c.	0.2c.
Repairs	0.65c.	0.50c.	0.2c.
Total	0.89c.	0.79c.	0.4c.

CLASS B

	Two No. 6 Gyratories 66 Hp. (33 Hp. Each)	72x20-in. Rolls 80 Hp.	48-in. Disk 50 Hp.
Power	0.32c.	0.39c.	0.25c.
Repairs	1.30c.	1.00c.	0.40c.
Total	1.62c.	1.39c.	0.65c.

The use of the disk crusher for secondary breaking enables an approximate saving in power and repairs alone of from ⅓ to 1c., depending on the resistance of the ore and the machinery used. It also offers other advantages such as low first cost, low transportation charges, less foundation and space occupied, also higher operating factor and less attention. As to first cost, the 48-in. disk crusher sells for $3500 f.o.b. works, and weighs 40,000 lb.; two No. 5 gyratories sell for approximately $3000 and weigh 62,000 lb.; and the 72x16-in. rolls sell for approximately $6000 and weigh 180,000 pounds.

Crushing from 1½ In. to Pebble-Mill Feed

By preparing ores for grinding is meant taking the average product of breaking, or 1½ in., and crushing it to a size suitable for pebble-mill feed, the size being determined by the process of recovery to be used. This crushing stage would be between 1½-in. feed and 10-mesh product for flotation or cyaniding, to 4-mesh product for table concentration, and to ⅜-in. where a jig feed is required.

The crushing machinery used for the cyaniding of gold and silver ores has been usually stamps, while for the flotation of sulphide ores, rolls are generally employed. The tendency, however, of machinery for this work is more and more toward ball mills, especially on class A ores, the reason being low cost of operation, less foundation space occupied, and erection charges, also less attention and no noise. Where tougher ores are encountered, as at Pearce and Kingman, Ariz., ball mills have been discarded, although at Pearce they have been again installed after stamps. No ball mill on such ores could economically take the place of stamps alone on account of the high iron consumption and the small output obtained for the power used. On gold ores such as at Porcupine, where they have been introduced, or on porphyry copper ores, such as at the Utah Copper or at the Inspiration Copper, where they have been tested, the ball mill should be preferred. In such cases the iron consumption should not be greater than ¾ lb. per ton of ore ground, including balls and linings. The balls used are of forged steel and cost approximately 5c. per lb. and the linings are of manganese or other steel.

The use of ball mills is not new, and various types have previously been used, the Krupp type being the best known. Richards' "Ore Dressing" reports ball consumption of 0.55 lb. on gold ores in Australia with a feed of from 6 to 2 in., and as high as 1.7 lb. on 4½% chalcopyrite ore in Chile. The Krupp type of mill has a limited screen area; hence the flow of ore through the mill is hindered and the capacity low. It is due to the more recent designs of ball mills of cylindrical shape, having free flow and a quick discharge that such strikingly improved results are being obtained.

The ball mill experimented with at the plant of the Utah Copper Co., and more recently at the test mill of the Inspiration Copper Co., is practically a dry tube mill such as has been used in cement practice, but used for wet crushing. It is a tube with less length than its diameter and is fitted with discharge lifters, and uses steel balls instead of flint pebbles. The feed is through a scoop feeder, which has a large enough opening so that balls may be fed through it. The discharge end of the mill is fitted with a grid or perforated diaphragm plate securely bolted together. The center of the plate is a center-discharge cone casting and the whole is held to the discharge head of the mill by means of fixed radial ribs extending from the cone to the periphery of the mill and serving as lifters, picking up the material which has passed the diaphragm plate and discharging it through the trunnion. The object of the perforated diaphragm plate is to allow all material to pass quickly through the end of the mill, while the lifters create a circulation and discharge, and eliminate the restricted flow through the mill, such as is the case with the center overflow discharge. Oversize is screened and returned to the mill. In this ball mill it is intended to keep a low pulp-load line, and dependence is put upon the lifters to do this. It is also claimed that this low pulp line increases the efficiency of the mill by avoiding the retarding effect of the balls acting upon a thick pulpy mass, which would be the case if the pulp load were carried on the center line. The ball mill will take a coarse feed: a 4-ft. mill will take a 3-in. feed, but for best results about 1½-in. average is considered good practice. The mill will also deliver a fine product, but at a sacrifice of capacity. In crushing to 10 mesh with a feed of 1½ in., approximately 50% will pass 60 mesh, the usual flotation product required, while about 25% will pass 200 mesh, so that its use eliminates a large number of pebble mills for finishing. At the Utah Copper Co. the ball tube mill, 4 ft. in diameter by 26 in. long inside the plate, crushes from a 3-in. to ¼-in. feed down to a 30-mesh product at the rate of 36 tons per 24 hr., using 13 hp. Of this product, 72% passed 60 mesh and 30% passed 200 mesh. This same mill ground 20 tons through 40 mesh for 11¼ hp. Of the product, 90% went through 60 mesh and 40% through 200 mesh. If it is assumed that equal amounts of energy are absorbed in crushing, this mill when crushing to 10 mesh should have a capacity of 75 tons with not to exceed 13 hp. At the Utah Copper Co. there was also a test on an 8x5-ft. ball mill crushing 1-in. feed through 10 mesh, with a capacity of

850 tons per day of 24 hr., for 130 hp. Of the product, 45% passed 60 mesh and 22% passed 200 mesh.

From this data I would rate the average duty of ball mills with 1½-in. feed and 10-mesh product as per the following table. With softer or tougher ores the capacities would be increased or decreased accordingly.

DUTY OF BALL MILLS

Size of Mill		Tonnage 24 Hr.	Horsepower
Diam.	Length		
4 ft.	2 ft. 2 in.	75	13
5 ft.	3 ft. 4 in.	200	30
6 ft.	4 ft. 6 in.	400	60
7 ft.	4 ft. 6 in.	600	90
8 ft.	5 ft.	850	130

Regarding operating costs, an estimated comparison between ball mills and stamps should be of interest.

In gold milling using stamps of 1050- to 1200-lb. weight on ordinary ores with a 3-mesh screen an average duty of 10 tons per stamp is obtained and for a 1000-ton unit a battery of 100 stamps would be necessary, to be followed by 10 tube mills approximately 5x20-ft. If a 10-mesh screen were used, there would be required a battery of approximately 150 stamps and five tube mills. The stamps would take an average 2.4 hp. per stamp or 360 hp. to crush 1000 tons to 10-mesh. Referring to the table above, it will be noticed that two 7x4-ft. 6-in. ball mills would conservatively do this work for 180 hp. With power at $50 per hp. per year, on a basis of 350,000 tons, a saving in power alone of 2½c. per ton is possible. At the Utah Copper Co. there was a ball consumption of about ⅝ lb. per ton milled and this with lining consumption would make a total of ¾ lb. Taken at an average of 6c. per lb. this would give a total of 4c. per ton for wear and tear. A figure of 4c. is the lowest possible which can be assumed for stamps, based on Alaska Mexican and Treadwell figures. The labor costs for ball mills would also be considerably lower, at least 3c. per ton. A fair comparison would be as follows:

COMPARISON OF STAMPS AND BALL MILLS

Type	Power	Repairs	Labor	Total
Stamps	5c.	4c.	4c.	13c.
Ball Mill	2½c.	4c.	1½c.	7c.

A saving of at least 6c. per ton in operating costs is possible on a 1000-ton basis. As for first cost, 150 stamps would cost about $35,000 at the factory, while the two ball mills would not exceed $6000. Not only is there the advantage in first cost and operation, but also in freight, foundation, erection and buildings. My opinion is that only where the iron consumption for ball mills is over 2 lb., or 12c. a ton, could stamps be considered.

As soon as the results of the tests at the Inspiration Copper Co.'s mill are available, a fair comparison can be made between their ball mill and the rolls at the neighboring Miami mill. It is doubtful if rolls can equal 7c. on a 1000-ton basis, reducing from 1½ in. to 10 mesh, and, as in the case of stamps, the ball mill has other advantages, such as first cost, etc. Where jigging is required, crushing is limited to ⅜ in. or ½ in., and for this work either a 18-in. or 24-in. disk crusher is now largely used instead of rolls. Where a smaller product is wanted, such as a 4-mesh for table concentration of carbonate ores, rolls are still being used and nothing has yet been found to take their place.

The size roll for 4-mesh product, which is most generally used in the large copper mills, is the 12x16-in. face and a noted improvement is shown in the design of David Cole at the new mill of the Arizona Copper Co., Morenci, Ariz., whereby he minimizes vibrations and the tendency to shaft-breaking by making a larger bearing area on the movable pedestal, and holding the pedestal against its seat. This latter condition is obtained by connecting the movable pedestal to the stationary or main [illegible] by means of a tension rod, which is a drive-fit at the [illegible] frame and a snug-sliding fit in the movable frame, so [illegible] the pedestal is prevented from vibrating by the leverage action through the tension rod against the main frame. This roll also has greater spring pressure than is usual, and has at least 50% more capacity with but about 15% increase in weight over the former 12x16-in. rolls, in which the tension rod is loose in both the fixed and movable ends of the roll.

USE OF STAMP BATTERIES

For tough ores it is probable that stamps will continue to be used on account of the high iron consumption of the ball mills on such ores, and it should be noted that on the Rand in South Africa a combination ball and pebble mill "Giesecke" was tested thoroughly against stamps and rejected supposedly on account of the heavy iron consumption. The stamps generally used in America are the 5- and 10-stamp multiple batteries, the stamps being from 1050- to 1400-lb. falling weight. The 2000-lb. Nissen stamp in tests on the Rand has demonstrated that it takes 25% less power and 10% less iron than the older type of the same weight, and this can be attributed to the quickness of discharge of the Nissen due to the circular form of the mortar surrounding the stamp shoe. Nissen stamps are also less costly to install when the foundations and less space occupied are considered. It is well known that in the Lake Superior copper district steam stamps have been used for years and it would seem that here a heavy power-driven gravity stamp could be employed to advantage, as although the same power per stamp would be used for the same falling weight, it should use less fuel per horsepower than the direct steam stamp. In gold and silver milling, as cyaniding is now most generally used, there is no longer the objection to the use of heavy stamps on account of the slimes which would be made, and coarse screens are now used, as the finishing is done in pebble mills.

TUBE MILLS FOR FINE GRINDING

Tube mills have been used for years in wet grinding of ores for making slimes. The mill which has been most generally used is known as the overflow type, the circulation through which depends on the amount of feed, and the discharge on the amount of slimes which are displaced, come to the surface of the pulp, and floating out at the center through a grid. There are tube mills of many makes and specification, but there are but two types—the cylindrical, or usual type, and the conical type, exemplified by the Hardinge tube and ball mills. The diameter of the mills used has been mostly from 4 to 5 ft., with a tendency toward 6 ft., and the length from 16 to 22 ft. The feed until recently has been about 10 mesh, but the tendency when using stamps is now toward coarser material; as high as ½ in. is now used at the Dome mines, Porcupine, in 5x22-ft. mills and ¾ in. in 6x20-ft. mills at the Nipissing. The reason is that it has been found that tube mills will handle coarse feeds, and enlarging the stamp battery screens increases tonnage to such an extent that the per-ton costs are lowered. As for length of mill, it has been demonstrated in South Africa that a 16-ft. mill would do the work of a 20- or 22-ft. mill, while at Tonopah, Nev., an 18-ft. mill has been found to do as much work as a 22-ft. mill, all mills being of the overflow type. This is accounted for by the fact that in the overflow type of mills there is a space at the discharge end of the mill where the material ground fine enough is held in the mill and overground, taking up space which is not efficiently utilized. It has also been demonstrated that this extra length of mill can be efficiently utilized if the already ground material could be discharged and the space used for grinding new material. The El Oro Mining & Ry. Co. several years ago made exhaustive tests on various types of discharges and obtained the best results by the use of a perforated diaphragm plate at the discharge end of the mill, about 6 in. from the discharge head on a 5x22-ft. mill. This design allowed a discharge through the entire end of the mill and created a settling or classifying chamber free from pebbles, increasing the capacity of the mills about 33⅓%, and made its mills efficient throughout their entire length. The amount of oversize was increased and was returned to the mill through the classifier, but with a resulting gain of —200 mesh material. These tests also determined that the critical speed of a point on the lining of a tube mill was about 410 ft. per minute.

It has been taken for granted that any tube mill, being designed for sliming, would not be capable of making a coarse or granular product, but this has been shown to be an error by an arrangement which consists of the addition of radial adjustable shutters to the El Oro type of discharge. A 5x14-ft. mill so equipped at the Gold Hunter Mining & Milling Co., Mullan, Idaho, ground 130 tons per day of silver-lead middlings from the jigs. The feed was ⅜ in. and the product 20 mesh designed for table concentration. The —200-mesh material averaged 30%, the horsepower 30, and the pebble consumption 0.9 lb. per ton. All oversize from the mill was returned to it after passing a Callow screen. A trial over a period of a month without the discharge in use and used as an overflow-type mill resulted in a tonnage of 112 tons per day for 33 hp., using 1.2 lb. of pebbles and making 40% of —200 mesh.

It is now recognized that the tube mill may grind coarse as well as fine and make either a granular or colloidal product, depending on the type of discharge; that it can handle feeds of size recently considered impracticable, and also that the speed of the mill and the percentage of moisture in the pulp affect the economy to a very great extent.

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Steel in Austria-Hungary

Steel production in Austria-Hungary in 1914 is reported as follows, in metric tons:

	Austria	Hungary	Bosnia	Total
Acid converter	694	4,009		4,613
Basic converter	159,500			159,500
Openhearth	1,312,988	607,361	28,520	1,948,869
Puddled	9,668	188		9,856
Crucible	16,421	1,133		17,557
Electric	[illegible]	1,189		19,811
Total steel	1,517,839	613,880	28,520	2,160,239
Puddled iron	20,932	9,588		30,520
Total	1,538,771	623,468	28,520	2,190,759
Total, 1913	1,840,425	808,538	33,656	2,682,619

The total decrease in 1914, as compared with 1913, was 491,860 tons, or 18.3%. Openhearth steel in 1914 was 89% of the total, basic converter being 7.3%. The proportional decrease was greatest in converter steel. The loss in production was mainly due to the war conditions in the latter part of the year.

Chronology of Mining for March, 1915

Mar. 1—Increase of wages granted by the Quincy Mining Co.—Hoisting of ore resumed at Ashland mine, Gogebic Range.—Mountain Copper Co. resumed operation of its smeltery at Martinez.—Newport mine, Michigan, resumed full-time work.

Mar. 2—Explosion in the Layland mines (No. 3) of the New River & Pocahontas Consolidated Coal Co., near Quinnimont, W. Va., entombing about 160 miners; 47 men subsequently rescued.—Decision rendered in favor of Ontario Mining Co. in its suit against the Stewart Mining Co., of Idaho, for trespass.—Metal-mining property of Golden Cycle Mining Co. sold to Vindicator Consolidated Gold Mining Co. for $1,500,000.

Mar. 3—Persons unknown dynamited and destroyed Green Copper shaft of Anaconda company at Butte.—President Wilson signed Foster bill providing for the establishment and maintenance of 10 mining experiment stations and seven mine-safety stations in addition to those already established.

Mar. 4—Victor and Virgin mines in Mohave County, Ariz., sold to Orion Mining & Milling Co.

Mar. 5—Explosion in copper mines at Cabeza del Buey, 86 miles from Badajos, Spain.

Mar. 9—Judge Van Fleet in U. S. District Court rendered decision that the Mammoth Copper Co.'s plant at Kennett was doing no damage to the agricultural lands. Company has resumed work.—New electric haulage system of Alaska-Juneau mine started.

Mar. 13—Strike among the zinc smelters in Kansas and Oklahoma.

Mar. 16—Full-time operations resumed at the lead mines in St. Francois Co., Missouri.—Mountain Copper Co.'s new concentrator at Keswick, Calif., started.—Cuyuna 1915 shipping season inaugurated.

Mar. 17—Twenty-stamp mill at Plumbago mine, Alleghany, Calif., destroyed by fire.—Compromise effected in strike of workers in Kansas and Oklahoma zinc smelteries.—Fourteen members of the faculty of the Univeristy of Utah resigned.

Mar. 18—Crushing began at new mill of Rocheste Mines Co., Nevada.

Mar. 19—Capt. J. R. DeLamar succeeded Ambros Monell as president of the Dome Mines, Ltd.

Mar. 22—Snowslide at Howe Sound, B. C., swept awa several bunkhouses at Britannia Mine; 55 killed and man injured.

Mar. 29—Butte-Alex Scott mine resumed operation

Mar. 30—Hancock mine, Michigan, resumed operation.—Work resumed at High Ore and Diamond mines o Anaconda company.

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Tasmania Mineral Production in 1914

The mineral production of Tasmania in 1914 is r ported by the Department of Mines as follows, the iten being arranged in order of descending values: Blist copper, 7509 tons; tin ore, 2573 tons; gold, includin gold contained in blister copper and silver-lead bullio 26,243 oz.; silver-lead ore, 11,566 tons; coal, 60,79 copper and copper ore, 3288 tons; osmiridium, 1019 oz wolfram, 17 tons; bismuth, 6 tons; shale, 75 tons.

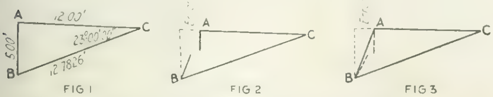
Details of Practical Mining

Azimuth Estimation from Incorrect Plumbing

By A. E. Flynn*

It often happens that in plumbing a shaft an error in either angular or linear measurements disqualifies the whole plumbing. However, when the triangulation method is used a careful consideration of the results in the office may locate and eliminate a single error, and thus avoid another plumbing, which possibly may be inconvenient at the time.

The location of an error in the triangle obtained from two plumb lines depends on the fact that four dimensions of the triangle are taken—one angle and three sides—while only three dimensions are required to solve the triangle. The fourth dimension is usually taken in order to check the accuracy of the work; but in case of an error the four dimensions are valuable for locating and eliminating the error, although this is not realized by the average surveyor.



Triangulation for Shaft Plumbing Errors

There are three fundamental formulas used for the solution of such a triangle:

$$(1)\quad \sin A = a\,\frac{\sin C}{c}$$

$$(2)\quad \tan\tfrac{1}{2}(A - B) = \tan\tfrac{1}{2}(A + B) \times \frac{a - b}{a + b}$$

$$(3)\quad \sin\tfrac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$$

Each formula employs only three of the four known dimensions and each one neglects a different dimension. Formula 1 does not involve one side, either a or b; formula 2 does not involve the base; formula 3 does not involve the measured angle.

It will be seen that if the location of the error is known, by choosing the right formula correct results will be obtained.

However, it seldom happens that the location of the error is known, and one must consider the most probable location according to the conditions in each particular ase. Generally speaking, it may be stated that there is more likelihood of error in the linear measurements than in the angular measurements, because the former necessitate the coöperation of an assistant, who is not so reliable as the surveyor, and this more than doubles the chance of rror. In the case of the base, the measurement at the other level gives a reliable check, which is confirmed in the office if the other triangle gives an accurate solution. Error is most likely to occur in the dimensions as follows, arranged in the order of probability: The sides, the angle, the base.

If there is an error in the triangle it will be shown by the fact that, after calculating the angles A and B by formula 1, the three angles do not add up to 180°. If now the triangle is solved by formula 2, new values for the angles A and B will be found, the three angles adding up to 180° by the nature of the formula. If there has been an error in the measurement of one side, then the value of one of the angles will be approximately the same by both formulas and the side opposite this angle is the one in error. This may seem paradoxical at first, but the following considerations will show the reason for it:

Fig. 1 shows a typical triangle with dimensions: a, 12.7826 ft.; b, 12.00 ft.; c, 5.00 ft.; C, 23° 00′ 00″.

Suppose the side b to be 11.98 ft. long, an error of −0.02 ft. Calculations by formulas 1 and 2 are shown in the following table and the conditions are represented by Figs. 2 and 3 respectively.

	Error of −0.02 Ft. in the Side b			
Triangle Correct	Formula 1	d_1	Formula 2	d_2
Angle A..87° 19′ 20″	87° 19′ 20″	0′ 00″	87° 33′ 06″	+13′ 46″
Angle B..69° 40′ 40″	69° 25′ 18″	−15′ 22″	69° 26′ 54″	−13′ 46″

The differences between the incorrect and the correct values of angle A and B are shown under d_1 and d_2. From the table and the figures shown it will be seen that the values of the angle B as found by formulas 1 and 2 are approximately the same, B being the angle opposite the side in error.

In the event of both sides or the angle C being in error, there would be approximately an equal difference between the values of the angles A and B as found by both formulas.

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*Mining engineer, Nipissing Mining Co., Cobalt, Ont

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Pulling Stuck Drills

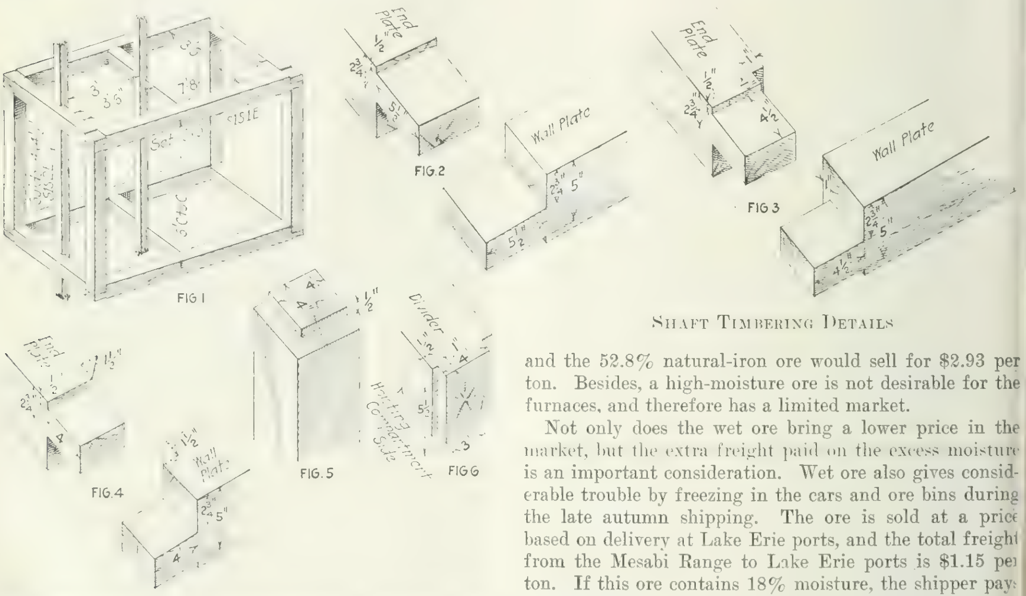
A scheme for pulling drills stuck in drill-holes has been patented by Howison Crouch, of Grass Valley (U. S. pat. 1,117,551). This device consists of a short piece of drill steel to go in the chuck of a stoper, the end of the steel being turned up a couple of inches and flattened out, with a punched hole to take the link of a short chain. At the other end of the chain is an ordinary drill-pulling clamp, a piece of flat metal with a hole through it corresponding to the drill steel section so it will slip over the stuck drill and when pulled by the chain will tilt and bite the drill firmly. The point of the stoper is set against the face of the drift or breast just under the stuck drill and held parallel to it. The clamp is slipped over the latter, and the short bent piece put in the chuck. Air is turned on the stoper and the rigging comes taut. Then the valve is opened until the stoper starts hammering. This accomplishes the desired result. Swinging a sledge to do this is often not possible because of the limited space at the breast, and besides this method is a consumer of elbow grease, which is not always wholly popular with the exasperated machine man.

Light Shaft Timbering

By Harold A. Linke*

A convenient size for a vertical, two-compartment, exploratory shaft is 3 ft. 6 in. by 7 ft. 8 in. inside timbers. The excavation for a shaft of this size measures about 5x9 ft., is of minimum cross-section for convenience and still large enough to permit drilling to sufficient depth for economical work.

The problem of timbering a shaft is governed by local conditions. In case the ground is not heavy and stands well, where only occasional lagging is required and where the shaft sets serve mainly as support for the guides, ladders, pipe, etc., the sets shown in Fig. 1 answer every purpose. The joint is detailed in Fig. 2. The ends of the posts for this set require no special framing other than squaring.



Shaft Timbering Details

If, however, all available strength of set timbers is required, then it is advisable to frame either as shown in Fig. 3 or in Fig. 4. The end of a post for a set framed in this manner is detailed in Fig. 5. Fig. 6 shows the details of a divider.

When lumber is to be transported by rail for any considerable distance it will be found that the laid-down price of, say, 6x6-in., S1S1E is much lower than 6x6-in. rough; that is to say, the saving in transportation on weight removed in surfacing more than compensates for the cost of dressing. The details of Figs. 2 to 6 are dimensioned for 6x6-in. S1S1E, which usually measures 5½ to 5⅝ in. square.

Pure Electrolytic Iron Forms an Effective Protective Coating for Steel, according to S. Cowper Coles, inventor of the process of Sherardizing, chemically pure iron being practically rustless.

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*Mining engineer, 401 Sixth St., Calumet, Mich.

Drying Iron Ore on the Mesabi Range*

Many iron-ore deposits on the Mesabi iron range contain so much moisture in their natural condition that the ore is noncommercial. In some of them this moisture amounts to 20%. A porous ore contains more water than a dense ore, and ore from water-soaked ground more than ore from dry ground.

Before assaying, the ore is dried at 212° F. Therefore an ore containing 18% moisture and assaying 57.4% iron when dried would contain (100 — 18) × 57.4%, or 47.1% iron natural, which is the basis on which the ore is purchased by the furnace man. If the moisture in this should be reduced from 18% to 8%, the ore would then contain (100 — 8) × 57.4%, or 52.8% natural iron. On the basis of 1914 prices for Mesabi nonbessemer ore, the 47.1% natural iron ore would sell for $2.40 per ton and the 52.8% natural-iron ore would sell for $2.93 per ton. Besides, a high-moisture ore is not desirable for the furnaces, and therefore has a limited market.

Not only does the wet ore bring a lower price in the market, but the extra freight paid on the excess moisture is an important consideration. Wet ore also gives considerable trouble by freezing in the cars and ore bins during the late autumn shipping. The ore is sold at a price based on delivery at Lake Erie ports, and the total freight from the Mesabi Range to Lake Erie ports is $1.15 per ton. If this ore contains 18% moisture, the shipper pays 18% of $1.15, or 20.7c. per ton, on undesirable water for which he is penalized by the furnace man. Hence, the moisture in the ore scores against the profits on every count.

Two drying plants for eliminating some of the moistur from certain ores are now in operation on the Mesab range. One of these is at the Brunt mine near Mountain Iron and was built by the M. A. Hanna Co.; the other i at the Whiteside mine near Buhl and was built by th Shenango Furnace Co. The ore from these two mine differs in physical character, so that slightly differen treatment is required, but the principle involved in th drying is the same in the two plants. Both plants dry th ore by passing it through cylindrical rotary driers charge with hot gases from attached coal furnaces. A suctio fan induces a strong draft through the drier and draw off the water vapor driven from the ore. The Brunt or contains lumps that must be crushed before drying. Also, owing to the physical character of the ore, considerable dust is drawn off with the moisture, so that each drier has a dust chamber attached. The Whiteside ore is dried without crushing, and it gives off practically no dust with the moisture, so that no dust collectors are needed.

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*An abstract of an article by Edwin J. Collins, mining engineer, Duluth, Minn., appearing in the Michigan College o Mines "Alumnus," October, 1914.

The Brunt plant contains two Ruggles-Coles driers, 90 in. in diameter and 55 ft. long, and two Economy driers, 81 in. in diameter and 55 ft. long. These differ in heating and furnace arrangement from the Ruggles-Coles driers. The Whiteside drying plant contains four Ruggles-Coles driers, 108 in. in diameter and 57 ft. long.

The operation of the rotary driers for drying iron ore is practically the same as for drying other materials. Of course, the cylinder and all parts of the driving mechanism must be much stronger than for a drier operating on lighter materials. The cylinder is inclined at a slight angle from the horizontal to assist the advance of the ore. On the inside periphery of the cylinder are a number of equally spaced flanged angles running longitudinally. As the drier rotates, these flanges elevate the ore nearly to the top of the cylinder, till the inclination of the angles becomes too great to retain it, when it drops through the hot gases to the bottom of the drier. The ore is thus elevated and dropped again and again, but each time, owing to the inclination of the drier, a little in advance of the position from which it began to rise. In passing through a 55-ft. drier the ore travels about 900 ft. in the hot gases.

The rate of evaporation of the moisture increases with the temperature of the gases and with an increase in the free surface of the ore in contact with the gases; it is further accelerated by the continued changing of the hot gases and the diminution of pressure caused by the suction fan. The amount of moisture removed per ton of ore is a direct function of the volume and the temperature of the hot gases available and the length of time the ore remains in the drier. The temperature, consequently volume, of the hot gases for drying the ore is a function of the amount of fuel consumed in a unit time and the efficiency of the furnace and drier. The length of time the ore remains in the drier depends directly on the rapidity of rotation of the drier and its inclination to the horizontal, because the faster the cylinder rotates and the steeper its inclination, the faster the ore will travel toward the lower end.

The amount of moisture in the dried product can thus be kept at any point desired, and the amount of moisture removed from the ore will be in inverse ratio to the tonnage put through the drier in a unit time. In drying the ore the moisture is not reduced below 7½%, because if it is, the ore has a tendency to break into fine particles not so desirable for the blast furnaces as the larger lumps.

At 1914 prices, wet ore containing 47.1% natural iron would be worth $2.40 per ton and dry ore containing 52.8% natural iron would be worth $2.93 per ton. Therefore the saving effected by drying the ore from 18% to 8% moisture would be as follows:

1 ton wet ore at	$2.40 =	$2.40
1 ton freight at	1.15	1.15
		$1.25 net
0.9 ton dry ore at	$2.93	$2.64
0.9 ton freight at	1.15	1.04
		$1.60 net

The increase in the value of the ore, drying it from 18% to 8% moisture, would therefore be 35c. per ton. The net profit would depend upon the cost of drying the ore, which may vary from 20 to 30c. per ton. The dry ore has the advantage of a ready market at times when the wet ore is unsalable. The drying plants are operated only during the shipping season, about six or seven months per year.

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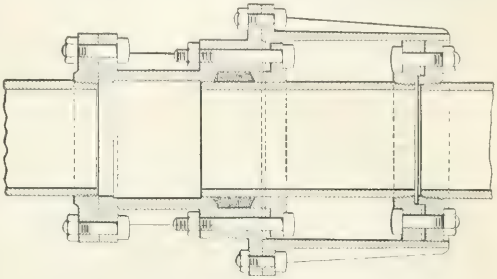
Ross Expansion Joint

The illustration shows an expansion joint, the primary feature of which is keeping the pipe line in alignment, thus preventing the ordinary wear and tear on packing experienced in slip-tube expansion joints. If it were not for the outer sleeve, this device would be nothing more than an ordinary slip-joint. The packing space is ample and the slip-tube is made of bronze so that it will not rust in the packing. This type of joint is made for pressure up to 200 lb. per sq.in., in all sizes to and including 24 in. Each size will accommodate 4 in. of travel for expansion and contraction. This joint is manufactured by the Alberger Heater Co., of Buffalo, New York.



SECTION THROUGH ROSS EXPANSION JOINT

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Powder Magazines

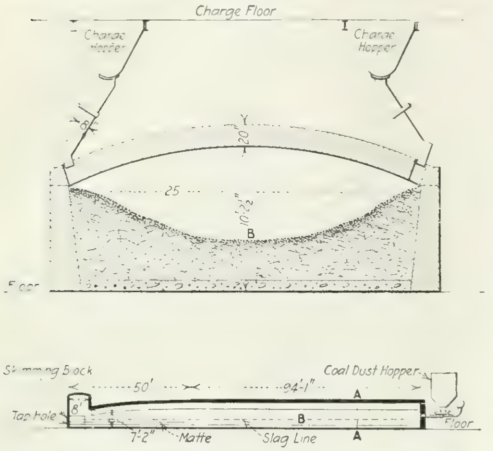
A dugout in the side of a hill is often considered a good place in which to store explosives. This, however, is a mistake, and such a magazine is ultimately an expensive one, because the efficiency of the explosive, on account of its moisture-absorbing properties, falls off very rapidly when stored underground for any length of time. Powder magazines should be constructed, and a good material is brick. Stone or concrete or similar materials—which in the event of an explosion would be converted into projectiles, which would do damage to surrounding property—should not be used. Brick is pulverized into dust by a dynamite explosion and does no harm. Powder magazines should have bullet-proof doors, and where this is not feasible the doorways should be protected by a screen or barricade. It is advisable to surround the entire magazine with a similar barricade. It requires 11 in. of sand to stop a bullet fired at ordinary range from a modern high power rifle using smokeless powder, such as is commonly used now by hunters.

As has often been suggested before, to sink the entire building behind a heavy earthen parapet is the safest method. Then anything which can be converted into a projectile by an explosion must travel with a high trajectory in order to do any damage, which is much safer for the surroundings than being in point-blank range.

Details of Milling and Smelting

New Coal-Dust-Fired Furnace at Anaconda

The No. 5 reverberatory furnace at Anaconda, which has been doing such good work with pulverized coal as fuel, was remodeled in accordance with the experience gained by the operation of the No. 8 reverberatory with coal-dust fuel. The No. 5 furnace, which is shown in the accompanying drawings, attained during its first week of operation a fuel ratio ranging from 7.1 to 7.9. Louis V. Bender gives[1] the dimensions of this furnace as follows: Interior, 144 ft. long by 25 ft. wide; height at firing end, 9 ft. 3½ in.; height at skimming end, 6 ft. 6 in.; flue area, 18 sq.ft. The skimming plate is 24 in. above the matte tap hole, which is at the skimming end of the furnace instead of at the side, as formerly, the method of charging forcing the matte to the skimming end of the furnace. The hoppers for charging the calcines and fettling material extend on both sides of the furnace for its entire length, and 8-in. charge pipes are used instead of the 6-in. pipes installed on the No. 8 reverberatory.



SECTION THROUGH ANACONDA COAL-DUST-FIRED REVERBERATORY

The machinery for preparing and delivering the coal to the No. 5 furnace is of the same type as that used for the No. 8 furnace. In October, 1914, the coal used in the No. 8 furnace was pulverized so that 92.5% passed 100 mesh and 71.1% passed 200 mesh. This is not so fine as formerly, but no difference was noticed in the work of the furnace.

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Heating the Solution for Leaching at Anaconda is to be done by passing the lixiviant through the ore coolers (U. S. pat. 1,115,689, granted to Frederick Laist) in the opposite direction to that taken by the ore which is being cooled.

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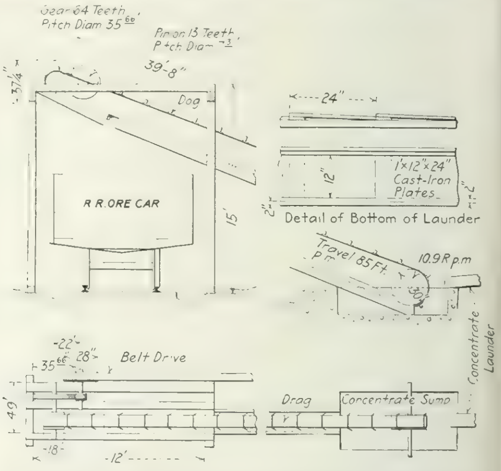
[1] "Bull. of A. I. M. E." January, 1915.

Handling Concentrates at the South Utah Plant

By Thomas H. Tulloch*

The system of loading concentrates here described was installed more than two years ago at the concentrator of the South Utah Mines & Smelters, Newhouse, Utah. This concentrator has a capacity of from 800 to 1000 tons per day, and the ore treated has a ratio of concentration varying from 9 to 15 into 1. The average production of concentrates is about 75 tons per 24 hr. The concentrates from the different groups of jigs, tables and vanners flow by gravity to a main trunk launder, which delivers them to a sump at the lower end of the mill near the railroad tracks. The concentrates are then dewatered and loaded into standard coal cars by an inclined drag.



CONCENTRATE-LOADING ARRANGEMENT AT THE SOUTH UTAH PLANT

The details of the drag are shown in the accompanying drawing. The travel of the scrapers is 85 ft. per min., and they are made of 3x¼-in. iron bent as shown and riveted to pieces of 3x3x¼-in. angle iron. The angle is fastened to the belt with elevator bolts, a piece of old belting being placed between the angle and the belt. When the straps are worn down to the angles, they are turned over and used again. An extra set of scrapers is kept on hand to shorten time in making change. The launder is lined with 1x12x24-in. cast iron plates. A narrow strip of belting is placed under the upper end of each plate to keep the scrapers from catching on the plates when new. The last plate has its upper end slightly elevated above the normal line of travel of the scrapers, and as the scrapers drop from this last plate the jar liberates all concentrates sticking to them. The belt used is a 10-in., six-ply Lanco balata. This belt has been in use about 10 months and shows little wear. Other types used lasted from four to 10 months.

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*Superintendent of concentrator, South Utah Mines & Smelters, Newhouse, Utah.

The overflow from the drag sump is elevated by a 3-in. centrifugal pump to a hydraulic pocket classifier, the spigot products of which are treated on Wilfley tables and the overflow in eight 8-ft. Callow tanks. The overflow of the tanks is returned to the mill-water system and the pulp is treated on Wilfley tables. The concentrates from the tables are conveyed in a launder to a two-compartment bin beside the railroad tracks, from which they are shoveled into the cars. One man working four hours a day keeps the bins empty. The table middlings are returned to the sump, the tailings are rejected and the headwater returned to the mill-water system.

The concentrates delivered into the cars by the drag contain about 17% moisture. Part of this drains out, leaving about 7% moisture in the concentrate shipped. A loading system replaced a hand-tramming method requiring the services of 12 men per 24 hr., and has simplified the water system and reduced the fine sands and slimes in the concentrates. The accompanying tables of screen tests show the character of the drag product and the overflow from the sump.

SCREEN TEST OF CONCENTRATE-LOADER PRODUCT

	Per Cent. by Weight	Cumulative Per Cent. by Weight
On 10 mesh	6.50	6.50
On 20 mesh	11.50	18.00
On 30 mesh	21.00	39.00
On 40 mesh	7.00	46.00
On 50 mesh	5.00	51.00
On 60 mesh	14.00	65.00
On 80 mesh	9.50	74.50
On 100 mesh	7.00	81.50
On 120 mesh	9.00	90.50
On 150 mesh	5.00	95.50
On 200 mesh	2.00	97.50
Through 200 mesh	2.50	100.00

SCREEN TEST OF OVERFLOW OF CONCENTRATE LOADER

	Per Cent. by Weight	Cumulative Per Cent. by Weight
On 60 mesh	0.00	0.00
On 80 mesh	7.41	7.41
On 100 mesh	9.00	16.41
On 120 mesh	9.52	25.93
On 150 mesh	22.22	48.15
On 200 mesh	22.22	70.37
Through 200 mesh	29.63	100.00

The railroad cars are loaded with about 50 tons of concentrates, a pile of about 25 tons being placed in each end of the car. These piles are leveled off and nine samples are taken from each pile with a hand auger. The cars loaded are all of the same type, and a template is used to determine the points at which to take the sample. The samples are taken in rows of three and are so spaced that each sample represents its proportionate volume and weight of concentrates. The samples are combined, mixed and cut for the final sample. The auger is made of 1x1¼-in. strap iron. In taking the sample the auger is first twisted to the bottom of the pile and then a close-fitting piece of boiler tubing is pushed down around it. The tubing with auger and sample inclosed is then removed and the sample dumped into a bucket by drawing off the tubing.

The samples taken in this manner have shown a difference of less than 1% over long periods, from the results obtained at the smelting plant, where sampling is done by tenth-shovel and quartering methods.

The Reduction of Cobalt Arsenide by a mixture of powdered calcium oxide and calcium carbide, or other similar carbide, is patented by Colin G. Fink, of Schenectady (U. S. pat. 1,119,588).

Inclined-Conveyor Housing

Like everything else, there is a right way and a wrong way to build housings for inclined-belt conveyors. This applies particularly to the roof arrangement. If simple trusses or rafters are used, the question immediately arises whether to put the posts vertical, and give the rafters their natural support, or to put the posts perpendicular to the floor of the housing—which is the normal and best construction—and contend with the difficulties of supporting and bracing the rafters. These questions are eliminated by a construction as shown in Fig. 1. The posts are set perpendicular to the plane of the conveyor, which is the normal procedure, and plates are run longitudinally on these as in the other case, only in this instance no framing or dapping is necessary. The ridge pole is supported by a short jack-post and the corrugated covering spans from the ridge to the plates. This type of construction saves both timber and labor. Fig. 2 shows the way not to do it.

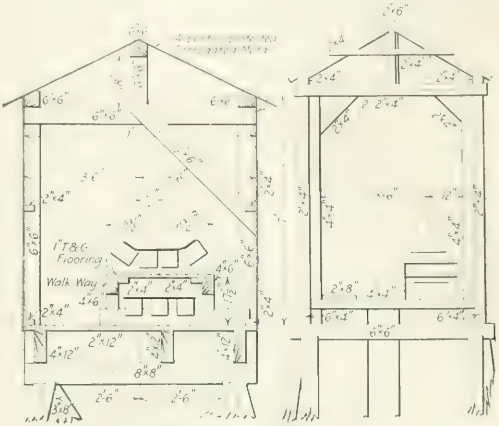

FIG 1 FIG 2

BELT-CONVEYOR HOUSINGS

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Care of Zinc Boxes

Dressing of zinc boxes should be timed by the appearance of the first compartment, and should not entirely depend on the question of the efficiency of precipitation, says the *Australian Mining Standard*. The maximum action of the solution on the zinc occurs at first contact, and it is therefore essential that there be no channeling in the first compartment. As soon as this is noticeable the box should be dressed. The moving and rearrangement of the zinc frees it from much of the adhering gold or silver slimes; and the repacking of the box so that the solution comes first into contact with the shortest zinc insures the handling of the minimum amount of base metal for the maximum amount of bullion when cleaning up. The use of large zinc boxes with the exposure of an abnormal amount of zinc, which permits the breaking up of some of the zinc in each compartment, is however, a method often adopted. In this case the boxes may be left for a considerable time without attention, but the gold is ultimately found distributed over a large area of zinc, and is not concentrated on the "shorts" in the first compartment, as it is when sufficient attention is paid to dressing.

The Assayer and Chemist

Determination of Platinum, Palladium and Gold

By A. M. Smoot*

Scorify the lead buttons from two or more ½-a.t. crucible fusions together, adding at least six times as much silver as the combined weight of the Pt, Pd and Au present, and cupel *hot*. In rich materials such as slimes or concentrates, two ½-a.t. fusions suffice, but low-grade ores may require 10 or more ½-a.t. fusions combined for each determination.

Part the silver beads with HNO_3 (1:6), followed by stronger parting acid (1:1) and wash with water as usual. All Pd goes into solution, together with considerable Pt. The residue consists of Au plus some Pt. Dissolve residue in strong *aqua regia* and reserve the solution (solution *A*). Precipitate the silver in the nitric-acid solution—containing Ag, Pd and some Pt—with HCl. Practically all the Pt will remain in solution; but the precipitated AgCl is pink in color and contains considerable Pd. Filter off the AgCl, scorify and cupel it and part again with HNO_3 (1:6); all should dissolve. Reprecipitate the Ag with HCl. The liquid now contains most of the remaining Pd, but some is co-precipitated with AgCl. Filter off the AgCl and add the filtrate to the first filtrate from AgCl. Again scorify and cupel the silver chloride, dissolving the silver in nitric acid as before and re-precipitating the silver as chloride. In most cases the filtrate from this silver chloride contains all the remaining Pd. If, however, the AgCl is distinctly pink, another separation must be made.

Unite all filtrates from AgCl precipitations and evaporate to small bulk, adding the *aqua-regia* solution of the Au and Pt (solution *A*). The liquid now contains all the Au, Pt and Pd present in the original ore, together with traces of Ag due to solubility in AgCl in excess of HCl, and also traces of Pb gathered from the lead retained in the silver buttons from the several re-cupellations.

Evaporate the liquid to dryness on the steam bath; take up with dilute HCl (1:3) and evaporate again to dryness; take up with five drops of HCl and 40 c.c. H_2O. Pay no attention to any insoluble residue of AgCl or $PbCl_2$.[1] Precipitate gold by adding, say, 3 gm. of oxalic acid to the solution and boiling it. Let stand over night and filter off the Au. If Pt and Pd are high, it is necessary to re-dissolve the Au in *aqua regia*, evaporating with HCl to dryness and repeating the oxalic-acid precipitation, uniting the filtrate with that from the first gold precipitation. Burn the filter containing the gold and scorify it with six times its weight of silver and a little test lead; cupel, part and weigh the gold as usual.

To the oxalic-acid filtrates from Au add 5 c.c. of HCl and make volume up to 150 c.c.; heat to boiling and precipitate Pt and Pd with a rapid current of H_2S in *hot* solution, passing the current of gas for some time and keeping the solution hot during precipitation. Filter and wash the Pt and Pd sulphides with H_2S water containing a little HCl. Wash the precipitate from the filter with a fine water jet into an original beaker; spread the filter paper (which will contain a small amount of precipitate impossible to wash off) with the precipitate side down over the lower side of a watch-glass cover. Add *aqua regia* to the precipitate in the beaker and place the cover on the beaker; warm gently to dissolve the Pt and Pd sulphides. The fumes arising from the acid dissolve the traces of Pt and Pd adhering to the filter paper. When solution is complete and the filter paper is white, remove the watch-glass cover and wash the paper with hot dilute HCl thrown against it in a fine stream.

Evaporate the *aqua-regia* solution to dryness, take up the residue with HCl and evaporate again to dryness to remove all HNO_3. Take up the residue with two or three drops of HCl and about 2 c.c. of H_2O. The solution is usually perfectly clear, but it may be slightly cloudy owing to the presence of a little AgCl in it. No attention need be paid to this, however. Add 5 to 10 c.c. of a saturated solution of NH_4Cl, stir well and allow to stand over night. Platinum is precipitated as ammonium-platinum chloride—$(NH_4)_2PtCl_6$. Filter and wash the precipitate with 20% NH_4Cl solution. All Pd passes into the filtrate which is reserved (solution *B*). Dissolve the Pt precipitate in boiling hot 5% H_2SO_4; heat the liquid to actual boiling and precipitate with H_2S as before, filtering and washing with H_2S water. Burn the filter and precipitate at a low temperature in a scorifier; add six times as much Ag as Pt, scorifying with lead, cupel and part the silver bead containing the platinum with H_2SO_4; decant off the silver solution and wash once with strong H_2SO_4, followed by 50% H_2SO_4 until practically all silver is washed away; finally wash with water, anneal and weigh. A minute quantity of Ag is retained with the platinum, but it can usually be neglected. In very important work where the amount of platinum is large dissolve in *aqua regia,* evaporate the solution to dryness, take up with a drop of HCl, dilute largely with water and let the AgCl settle over night; filter on a small paper, cupel it with a little sheet lead and deduct the weight from the weight of platinum. This refinement need not be considered in materials running less than 1 or 20 oz. to the ton.

It may seem an unnecessary step to precipitate the platinum as sulphide, scorify it with silver and part it a described in the foregoing. General practice has been t ignite the ammonium-platinum-chloride precipitate an weigh the metallic residue. When this is done, however there is danger of losing considerable platinum, which i carried away mechanically during the decomposition o the compound; furthermore, it is extremely difficult (i not impossible) to collect the finely divided residue fo weighing, and the precipitate invariably contains lead and silver. Precipitation as sulphide, scorification and cupellation with excess silver and parting with sulphuric acid overcome the difficulties inherent in handling the ammonium precipitate.

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*Chief chemist, Ledoux & Co., 99 John St., New York.

[1] In materials rich in palladium the small amount of AgCl + $PbCl_2$ may be distinctly pink in color and retain weighable quantities of Pd. If this is the case, the Pd may be recovered in the solution from the nitric acid parting of the gold. To do this, precipitate the silver in this liquid by adding HCl, filter off the silver chloride and evaporate the filtrate to dryness. Take up with a drop of HCl and a little water, let stand over night and filter through a very small filter. This liquid may be added to solution B before precipitating palladium with glyoxime.

The palladium is all contained in the filtrate and washings from the platinum-ammonium-chloride precipitates (solution *B*). Add to this solution at least seven times as much di-methylglyoxime as there is Pd present (in any case, at least 0.1 gm. glyoxime). The precipitant should be dissolved in a mixture of two-thirds strong HCl and one-third water. Dilute the liquid to 250-300 c.c., heat on a steam bath for half an hour and let stand over night. Pd. is precipitated as a voluminous, yellow, easily filtered glyoxime compound $(C_8H_{14}N_4O_4)_3Pd$, containing, when dried at 110° C., 31.686% of Pd. Filter the Pd precipitate on a weighed Gooch crucible and wash it, first, with dilute HCl, half and half, then with warm water and finally with alcohol; dry it at 110° to 115° C. and weigh. The disadvantage of weighing palladium on a Gooch crucible is overcome—at least to some extent—by the fact that the Pd compound contains a relatively small amount of Pd—less than one-third of its weight. This compound may also be weighed on carefully counterpoised papers; but it is better to use Gooch crucibles, if they are available, because of the relatively strong acid which is required for washing. The object in using half-and-half hydrochloric acid as a wash liquid is to dissolve out any excess of the glyoxime precipitant. This is easily soluble in moderately strong HCl, but is substantially insoluble in water.

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Determination of Silver in Ores and Concentrates Containing Platinum and Palladium

By A. M. Smoot*

Make the usual crucible fusion on one-quarter, one-half or full assay ton, according to the amount of silver present. Instead of cupeling the lead button, hammer it free from slag and dissolve it in dilute nitric acid. Most of the silver passes into solution together with palladium, and perhaps a trace of platinum; but gold and most of the platinum remain insoluble. The gold and platinum retain an appreciable proportion of silver which cannot be washed out. Filter out the insoluble residue and wash it thoroughly with hot dilute nitric acid, followed by hot water. Scorify the residue once more with a little lead and dissolve the lead button as before, filtering into the beaker containing the first filtrate. In this liquid precipitate the silver as AgCl by adding standing NaCl in sufficient quantity; stir well, and if the amount of silver is small, add about ½ c.c. of strong H_2SO_4 to form a precipitate of lead sulphate. Let the silver chloride, or the silver chloride plus lead sulphate, settle over night or until the supernatant liquid is clear; filter through double filter papers; ignite and scorify the residue of silver chloride with test lead.

If the amount of palladium contained in the sample is small, the silver bead obtained by cupeling the lead button obtained by scorifying the silver chloride may be considered as sufficiently pure for ordinary purposes. It contains, of course, some palladium, and in accurate silver determinations the lead button from the first silver-chloride precipitation should be re-dissolved and the silver re-precipitated, filtered and scorified as before. The amount of palladium retained after the second precipitation and scorification is so small as to be negligible.

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New Method for Determining Zinc in Alloys

In a recent paper before the American Institute of Metals (Chicago meeting, September, 1914), G. E. F. Lundell and Nai Kim Bee suggested as a method for the analysis of brass and other alloys the precipitation of zinc with potassium-mercuric sulphocyanide. The precipitate has the composition $ZnHg\ (CNS)_4$ and may be dried at 100-108° C. and weighed.

The precipitating agent is made by dissolving 39 grams of KCNS in 200 c.c. water and then stirring in 27 grams of $HgCl_2$, slowly diluting to 1000 c.c. as this is done. If a residue remains, filter this solution.

Prepare the zinc solution to be assayed as though the pyrophosphate method were to be used, although the acid present need not be carefully neutralized. However, the solution should not contain nitrous acid nor over 5% by volume of free acid. Then add 25 to 30 c.c. of sulphocyanide reagent for each 100 c.c. of the solution. After adding the reagent, set the solution aside for from five to 30 min., during which time it should be well stirred three or four times. Filter on a gooch, dry at 100-108° C. and weigh.

$$\text{Wt.} \times 0.1266 = \text{Zn.}$$

The interfering substances are Hg', Cu, Bi, Cd, As''', Co, Mn and large amounts of Ni. These give high values. K_2SO_4, $NH_4C_2H_3O_2$ and NH_4CNS give low results, as does over 10% of free acid. Alkaline solutions cannot be used. H_2S and oxides of nitrogen are undesirable. The solution must be filtered cold. The precipitate is slightly soluble in water, but practically insoluble in water containing 2% of the precipitating solution; it begins to decompose at 110° Centigrade.

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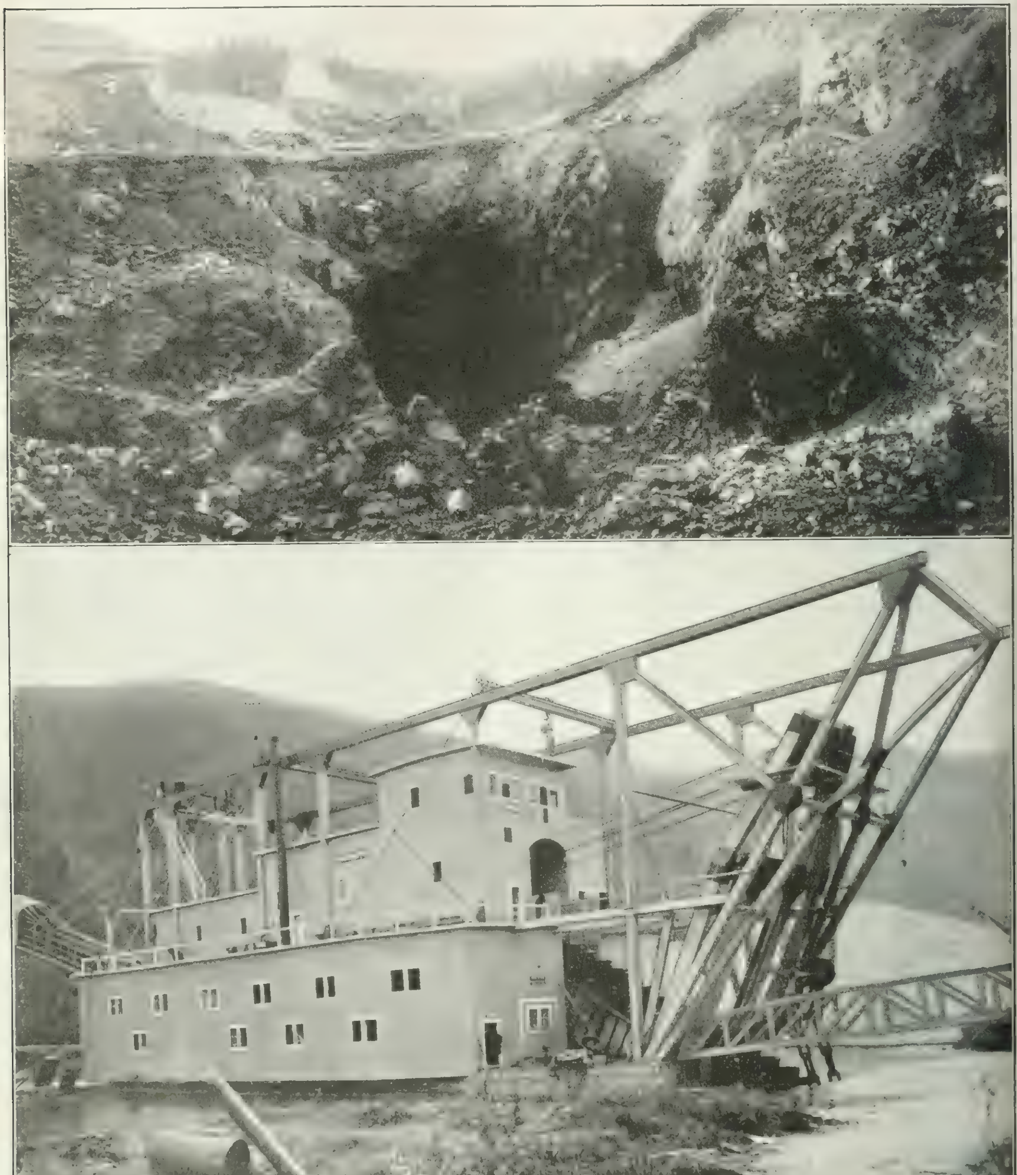
A Silver-Plated Electrode in the Zinc Assay

A silver-plated copper-gauze electrode can be made cheaply and is a good substitute for platinum in the electrolytic deposition of zinc, especially when alkaline cyanide solutions are employed, according to O. L. Barneby (*Journ. Am. Chem. Soc.*, June, 1914). Copper gauze of a desirable mesh is cut to a convenient size, the ends are brought together to form a cylinder and all the edges folded down. The ends are joined by interlocking folds. The spiral is supported by means of a heavy copper wire which encircles the cylinder within the upper fold and is bent at right angles for connection to the support. The folds are then sewed together by means of a copper wire. The cylinder and rod are now immersed in a dilute silver-cyanide bath and coated with silver by electrolysis, after which the unplated portion of the rod is cut off. A platinum wire is used for the anode connection. After each analysis, the zinc can be removed conveniently by the use of dilute hydrochloric acid.

Photographs from the Field

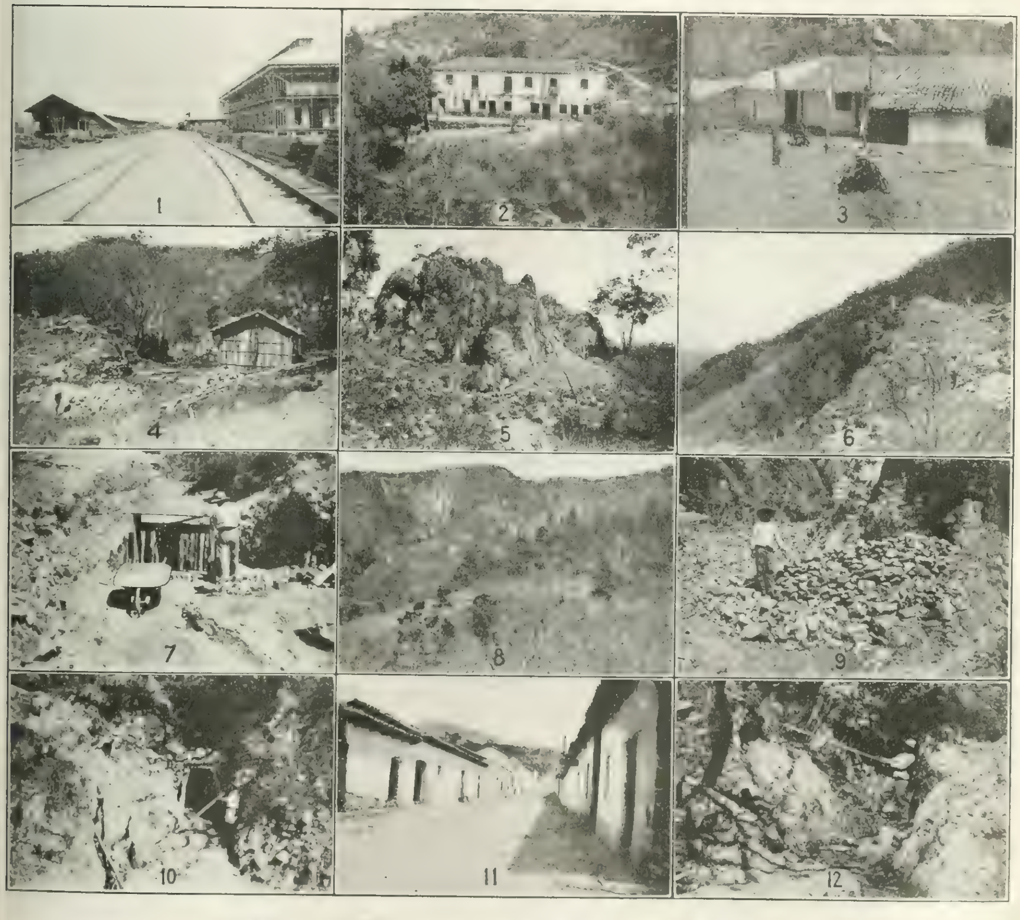


TWO VIEWS IN THE YUKON COUNTRY

Upper view—Glory hole of the Pueblo copper mine, near Whitehorse, Yukon Territory
Lower view—Canadian No. 4 dredge of the Canadian-Klondyke Gold Mining Co., Dawson

TAILINGS PILE AND STACKER AT FEDERAL LEAD CO.'S MILL, FLAT RIVER, MO.

One of the drawbacks of mill-building in a flat country



VIEWS OF THE "MINAS DE ALOTEPEQUE," EASTERN GUATEMALA

Zinc deposits which have, we understand, been examined by representatives of the New Jersey Zinc Co. 1. The station, Zacapa, on Guatemala Northern R.R. 2 and 3. An old building erected by an English company prior to 1873. 4, 5, 6 and 7. Tajo de Montenegro. 8. La Ballena. 9. Zinc-lead-copper ore from La Ballena outcrop. 10. La Ballena outcrop. 11. A street in Concepcion, a village near the mines. 12. Another outcrop of La Ballena.

NEW PUBLICATIONS

METALLURGICAL SMOKE. By Charles H. Fulton. Pp. 94, illus., Bull. 84, U. S. Bureau of Mines, Washington.

THE CONSTITUTION OF THE NATURAL SILICATES. By Frank Wigglesworth Clarke. Pp. 128. Bull. 588, U. S. Geological Survey, Washington, D. C.

GROUND WATER IN SOUTHEASTERN NEVADA. By Everett Carpenter. Pp. 86; illustrated. Water-Supply Paper 365, U. S. Geological Survey, Washington.

ANNUAL REPORT OF THE MINES OF NOVA SCOTIA FOR 1914. 6¼x9½, paper. pp. 167, illus. Commissioner of Public Works and Mines, Halifax, N. S., Canada.

THE CUSHING OIL AND GAS FIELD, OKLAHOMA. By Frank Buttram. 6x8¾, paper, pp. 106, illus. Bull. 18, Oklahoma Geological Survey, Norman, Oklahoma.

POOR'S SUMMARY OF INVESTMENT NEWS. A Reprint of the Daily Summary from April 1 to Dec. 31, 1914, for purposes of reference. 6x9, pp. 558. Poor's Manual Service, New York.

SALINES IN THE OWENS, SEARLES AND PANAMINT BASINS OF SOUTHEASTERN CALIFORNIA. By Hoyt S. Gale. Pp. 73; illustrated. Bull. 580-L, U. S. Geological Survey, Washington.

THE PETROLOGY OF THE ORIJARVI REGION IN SOUTHWESTERN FINLAND. By Pentti Eskola. Pp. 277; illustrated. Bull. 40, Commission Geologique de Finlande, Helsingfors, Finland.

LOS MARMOLES DE CARAPE. By Rolf Marstrander. In Spanish and English. 6¼x9½, paper, pp. 50, illus., Bull. 1. Talleres Graficos de la Escuela N. de Artes y Oficios, Montevideo, Uruguay.

HANDBOOK OF TABLES AND FORMULAS FOR ENGINEERS. Compiled by Clarence A. Peirce; with mathematical sections by Walter B. Carver. 4x6¾, 168 pp., illus. McGraw-Hill Book Co., New York.

POOR'S ANALYSES (of Operations of Railroad and Industrial Companies). First Series, from Mar. 12 to Dec. 30, 1914, for purposes of references. 8x10½, pp. 157. Poor's Railroad Manual Co., New York.

ORE DEPOSITS OF NORTHEASTERN OREGON. By Arthur M. Swartley. The Mineral Resources of Oregon, Vol. I, No. 8. Paper; 6¾x10; pp. 229; illustrated. Oregon Bureau of Mines and Geology, Portland, Oregon.

OFFICIAL YEAR BOOK OF THE COMMONWEALTH OF AUSTRALIA. Statistics for 1901-1913. By G. H. Knibbs. No. 7, 1914. 5¾x9¼, paper, pp. 1098, illus. Commonwealth Bureau of Census and Statistics, Melbourne.

THE TRANSACTIONS OF THE CANADIAN MINING INSTITUTE, 1914. Vol. XVII. 5¾x8½, paper, pp. 507, illus. Published at the office of the Secretary, H. Mortimer Lamb, Ritz-Carlton Hotel, Montreal, Que., Canada.

GEMEINFASSLICHE DARSTELLUNG DES EISENHÜTTENWESENS. Herausgegeben vom Verein Deutscher Eisenhüttenleute in Düsseldorf. Ninth edition. 6x9¼, pp. 438, illus. Verlag Stahleisen m. b. H., Düsseldorf, Germany.

PRACTICAL STAMP-MILLING AND AMALGAMATION. By H. W. MacFarren. Third Edition. With a Chapter on Arrangement and Construction Costs of Stamp Mills, by Charles T. Hutchinson. 6½x9¼ pp. 231, illus.; $2. Mining and Scientific Press, San Francisco, California.

MINERAL PRODUCTS OF THE UNITED STATES. REVIEW OF CONDITIONS AND OUTPUT IN 1912 AND 1913. By Edward W. Parker. With a Summary of Mineral Production in 1913, compiled by W. T. Thom. Mineral Resources of the U. S., 1913, Part I. Pp. 163. U. S. Geological Survey, Washington, D. C.

QUIN'S METAL HANDBOOK AND STATISTICS, 1915. Price 3s. 6d. Published by L. H. Quin, 3 East India Ave., London, E. C.

This is a useful little handbook, which gives a good many interesting metal statistics that are not commonly to be found in similar American publications. In the main, good judgment as to authorities is exhibited.

METHODS IN METALLURGICAL ANALYSIS. By Charles H. White 4¾x7¼; pp 356; illustrated. $2.50. D. Van Nostrand Co., New York.

This is about the best student's text-book that we have seen, as it goes at great length into the niceties of manipulation which are ordinarily not treated. As a manual for the practical assayer or chemist it seems to present very little that is new.

ABSTRACTS OF CURRENT DECISIONS ON MINES AND MINING. December, 1913, to September, 1914 By J. W. Thompson Pp. 176 Bull 90, U. S. Bureau of Mines, Washington.

This bulletin is the third of its kind to be published by the Bureau. There has been a wide demand for information of this character, and the Bureau has decided to issue similar bulletins with sufficient frequency to keep reasonably current the records of decisions of courts of last resort on questions relating to the mineral industry.

AN INTRODUCTION TO THE STUDY OF PHYSICAL METALLURGY. Walter Rosenhain 5½x9; pp. 368; illustrated. $3.50. D. Van Nostrand Co., New York.

This is the first book in a new series on metallurgy under the author's general editorship. The subjects treated are: The microscopic examination of metals; the metallurgical microscope, the microstructure of pure metals and alloys; the thermal study of metals and alloys; the constitution diagram and the physical properties of alloys; typical alloy systems; the iron-carbon diagram; the mechanical testing of metals; the effect of strain on the structure of metals; the thermal treatment of metals; the mechanical treatment of metals, including casting; defects and failures in metals and alloys.

TECHNICAL METHODS OF CHEMICAL ANALYSIS, VOL. III. Edited by George Lunge. 6x9; pp. 1125; illustrated; in two parts. $18. D. Van Nostrand Co., New York.

The present volume is the last word on that portion of organic chemistry covered by it. This includes: Mineral oils; lubricants; oils, fats and waxes; special methods of analysis employed in the oil and fat industries; resins and balsams; drugs and galenicals; essential oils; tartaric and citric acids; organic preparations; rubber; vegetable tanning materials; leather; ink; sugar; starch and dextrin; alcohol, potable spirits and liqueurs; vinegar; wine; brewing materials and beer; paper; textile fibers; and inorganic colors.

MINING COSTS OF THE WORLD. A Compilation of Cost and Other Important Data on the World's Principal Mines. By Edmond Norton Skinner and H. Robinson Plate. 5x7¼, pp. 406, illus.; $5. McGraw-Hill Book Co., New York.

The presentation of costs from most of the principal mining camps of the world will prove a convenience to engineers who want to know approximately the economic conditions in any particular locality, and interesting reading for the mining fraternity in general. As a comparison of efficiencies, however, costs are worse than useless, and as a final factor in determining the possibilities of a new venture the book will not serve, since all conditions are never duplicated. The work is as well done as may be, but published costs are not always reliable, even when taken from official reports, since facts may readily be altered or concealed. As a guide the book is good, but as a tool to perform fine work it cannot be unconditionally recommended.

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The Australian Zinc Industry

At Broken Hill matters look brighter now that the Broken Hill Proprietary Co. has been successful in arranging for the sale of from 40,000 to 50,000 tons of zinc concentrates, reports the Sydney correspondent of the London *Mining Journal*. It is understood that under the agreement already entered into for the delivery of this product to the United States shipments will probably be made on the basis of 7000 to 8000 tons of zinc concentrates per month. Prior to the war the average output of zinc at the parent company's mill was well up to 6000 tons per month. When operations were suspended in last August there was a substantial dump of this product, and this has been in part utilized for keeping the spelter distillation plant at Port Pirie fully supplied. The Amalgamated Zinc (De Bavay's) produces 3000 tons of zinc concentrates per week under normal conditions and the Zinc Corporation upward of 1700 tons per week, the aggregate output of zinc concentrates at the Barrier prior to the war being at the rate of about 8000 tons per week.

The attitude of the British Government in regard t the application from the Commonwealth Government fo assistance in terminating the contracts with German firm for the supply of zinc concentrates, now suspended, a given in the Adelaide *Press* appears as follows: Th Colonial Secretary (Mr. Harcourt) put the positio clearly to Sir John McCall, the representative of th Australian Trade Committee in London, when he said "There are many valuable contracts with Germany whic Britishers might desire to enforce after the war." Th natural assumption is that we as a nation have more t lose than gain by entering upon that course. But independently of any other action which may be considere necessary, the Federal Government can effectively dea with the position by entirely forbidding exports, or, a has been done with other products, forbidding export except to Empire territory, or that of our Allies. T specific requests for special consideration for the zinc industry, the Colonial Secretary has replied: First, that the Government will not entertain a loan for the provision of smelting works in England; second, that it is unwise to encourage the breaking off of contracts; and, third, that the Government cannot undertake to defend any company, which takes up the business, from unfair competition after the war.

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Production of Copper in 1914

The production of copper in the United States, Canada, Mexico and Cuba in 1914 and previous years is given in the accompanying tables. Our figures are based uniformly upon reports received from the several producers and represent the smelters' output, which is a different thing from either the mine output or the refinery output. In the case of the Michigan production, however, the smelters are also refiners, and their figures for smelting and refining productions are consequently the same. The figures that are now presented are the revision of our preliminary figures, published last January. The alterations, either in total or in details, are insignificant.

SMELTERS' PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1911	1912	1913	1914
Alaska.........	19,412,000	32,602,000	24,452,000	24,288,000
Arizona	300,578,816	357,952,962	399,849,745	387,978,852
California......	36,806,762	31,069,029	32,390,272	29,515,488
Colorado.......	8,474,848	7,502,000	7,670,090	10,104,579
Idaho..........	3,745,210	5,964,542	8,434,028	4,856,460
Michigan.......	216,412,867	231,628,486	159,437,262	157,089,795
Montana.......	271,963,769	309,247,735	285,336,153	243,139,737
Nevada........	65,385,728	82,530,608	84,683,961	60,078,095
New Mexico	1,518,288	27,488,912	46,953,414	64,338,892
Utah . .	138,336,905	131,673,803	147,591,955	153,555,902
Washington.....	....	1,121,109	448,805	165,023
East and South.	19,656,971	18,592,655	24,333,014	19,213,965
Other States....	1,564,207	4,396,667	4,155,135	4,257,088
Totals.......	1,083,856,371	1,241,770,508	1,225,735,834	1,158,581,876

COPPER PRODUCTION OF CHILE AND PERU, 1913 AND 1914

(In Pounds)

	Chile—1913	Chile—1914	Peru—1913	Peru—1914
Blister copper to U. S....	18,315,000	23,814,659	42,667,436	44,488,809
Copper in ore to U. S.	24,911,465	29,056,280	10,089,592	5,680,592
Copper to England and France..............	43,460,480	37,024,960	3,180,800	1,742,720
Sundries, estimated......	250,000	220,000	250,000	220,000
Totals, lb.............	86,936,945	90,115,899	56,187,828	52,132,121
Totals, metric tons....	39,434	40,876	25,487	23,647

SMELTERS' PRODUCTION

(In Pounds)

Source	1911	1912	1913	1914
N. American ore	1,284,932,019	1,489,176,562	1,438,565,881	1,327,488,479
Foreign ore.	34,392,091	53,701,307	55,803,202	50,101,308
Scrap	18,529,547	11,949,348	22,427,889	20,894,559
Totals.......	1,337,853,657	1,554,827,217	1,516,796,972	1,398,484,346
To foreign refiners........	32,413,440	45,735,673	36,682,605	36,765,920
To American refiners	1,305,440,217	1,509,091,544	1,480,114,367	1,361,718,426
Crude copper imported.......	146,422,851	144,480,144	169,315,869	131,125,076
Total crude copper.......	1,451,863,068	1,653,471,688	1,649,430,236	1,492,843,502

SMELTERS' PRODUCTION OF COPPER IN NORTH AMERICA

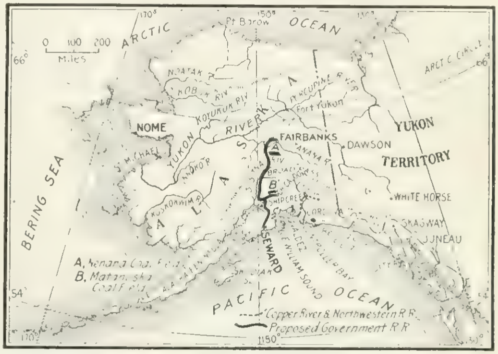
(In Pounds)

Country	1911	1912	1913	1914
United States...	1,083,856,371	1,241,770,508	1,225,735,834	1,158,581,876
Canada.........	56,370,754	75,425,575	76,796,586	75,015,758
Mexico......	136,430,331	162,295,545	128,579,656	80,108,165
Cuba....	8,274,563	9,684,934	7,453,805	13,782,680
Totals..	1,284,932,019	1,489,176,562	1,438,565,881	1,327,488,479

Our system of collecting the statistics from the smelters of North America enables us to arrive at the totals not only for the United States, but also for Canada, Cuba, Chile, Peru and Mexico. The details of the production in Chile and Peru are given in an accompanying table.

Route of the Government Alaskan Railroad

President Wilson on Apr. 10 announced the route of the new Alaskan railroad which the Government is to build. It is known as the Susitna route, and extends from Seward, on Resurrection Bay, to Fairbanks, on the Tanana River, a distance of 471 miles. The route includes the existing Alaska Northern R.R., which runs from Seward through the Kenai Peninsula for a distance of 71 miles to Turnagain Arm. This route is to be bought from its present owners by the Government for $1,150,000, $500,000 of which will be paid on July 1, 1915, and the remainder July 1, 1916. The contract for the purchase of the road was signed by Secretary Lane and approved by the President, subject to approval of title. From Turnagain Arm the route is to be extended through the Susitna Valley and across Broad Pass to the Tanana River, and from there on to Fairbanks. It is to be a standard-gage road. A side line is to run from Matanuska Junction into the Matanuska coal field, a distance of 38 miles. The road is to be built with its present base at Ship Creek, on Cook's Inlet, and from this point it is expected that the Matanuska coal will be shipped during the greater portion of the year. The grade from the Matanuska field to Ship Creek is 0.4%. The Alaska Northern has been purchased for a price less than its physical valuation as estimated by the Alaskan Engineering Commission and by the engineers of the Interstate Commerce Commission. Under the contract approved by the President the road is taken over free from all debt or obligation of any kind. The estimated cost of construction of this line from Seward to Fairbanks, including the Matanuska branch, is $26,800,000.



Route of the Government Alaskan Railroad

The President has made an order directing that the work be carried on by the Alaskan Engineering Commission, which is to have the general duty of preparing and adopting plans for construction, the employment of the force and the making of contracts for the purchase of supplies for the work. The Secretary of the Interior is authorized to designate one of the members of the commission as its chairman, who shall be in immediate charge of the work and have power of approval or disapproval of all administrative matters connected with it. In accordance with this authorization, Secretary Lane has designated W. C. Edes, the present chairman of the commission. Chairman Edes is to have charge of the assignment of duties to the heads of departments, which heads shall be appointed by and report to the chairman, who shall also fix their salaries, subject to the approval of the commission as a whole. Contracts for the purchase of supplies are to be made after advertisement in the district where the supplies, in the judgment of the chairman, may best be purchased, except in cases of emergency. In construction work, competitive bids shall be secured by invitation or advertisement when practicable. The members of the commission, which consists of William C. Edes, chairman; Lieutenant Frederic Mears, late superintendent of the Panama R.R., and Thomas Riggs, Jr., are directed to proceed to Alaska at once. The chairman is to make his headquarters at Seward, Lieutenant Mears is to be stationed at Ship Creek and Mr. Riggs is to conduct surveys in the Broad Pass region.

The President charges the commission particularly with the preparation and maintenance of proper arrangements for the health of the men engaged in the work of construction and to adopt a proper system of compensation for accidents which may occur on the work in general on the lines of the system now in force in the construction of the Isthmian Canal. The system shall be such that its benefits will be applicable not only to those who are directly in the service of the commission upon salary, but also to those who may, by contract with the commission, be actually engaged in the work of construction in Alaska.

Secretary Lane said: "The work on the railroad is to begin at once. Lieutenant Mears is already on his way to Alaska. Chairman Edes and Mr. Riggs will soon follow. The first work will be the building of a wharf at Ship Creek and the dredging of a more adequate channel. From this point the railroad will be constructed northward to the Matanuska field. The probability is that not more than 40 miles of road can be constructed this year, owing to the fact that our appropriation is but $2,000,000. We have something over $500,000 remaining from the $1,000,000 authorized last year, and this will be used as the first payment on the Alaska Northern road. The work will be done in large part by stationmen, who will make direct contracts with the commission for building distinct units of the road. This method has been recommended to the President by some of the most prominent railroad constructors and is adopted generally in railroad construction in the West. At the end of this season the work done in this way will form a basis from which it may be determined whether it is wise to have the road constructed as a whole or in parts by contract. It is expected that the commission will employ a small force, chiefly composed of engineers, to supervise the construction. The few places which are to be filled will be filled exclusively upon the ground of merit and experience. I have received word of a threatened stampede to Alaska this season. The work to be undertaken by the Government does not justify any such rush. The Government itself will employ but few men, and these men of a high order of railroad engineering experience. I desire to advise those contemplating going to Alaska that there is little opportunity for employment at this time, and they must be prepared in advance for their return in the fall. We have withdrawn townsites along this route at Ship Creek, Matanuska Junction, in Susitna Valley, one in the vicinity of Broad Pass and another in Nenana River.

"The route adopted by the President will open up a territory not now served by any railroad line, and two of the great coal fields in Alaska, one the Matanuska field, which contains high-grade bituminous coal acceptable to the Navy, and, second, the Nenana coal, near the Tanana River, which is a great body of high-grade lignite that will serve the interior of Alaska."

The description of the route approved by the President is as follows:

For a main line of railroad: Commencing at the Town of Seward on the westerly shore of Resurrection Bay, Alaska; thence following along said westerly shore in a northerly direction to the head of said bay; thence following up the drainage of Salmon Creek to a summit between said drainage and the drainage of Snow River; thence following the drainage of Snow River to Kenai Lake; thence continuing northerly along the easterly shore of Kenai Lake, along Falls Creek, along the shores of Lower and Upper Trail Lake, and up Trail Creek to a summit in the Kenai Mountains near Mile 45 from Seward; thence descending along the drainage of Placer River to the head of Turnagain Arm of Cook Inlet; thence following the northeasterly shore of said Turnagain Arm and crossing Portage Creek and Twenty Mile River to the mouth of Kern Creek near Mile 71 from Seward; thence in a northwesterly direction along the shore of Turnagain Arm to near the mouth of Big Rabbit Creek; thence leaving Turnagain Arm and running northerly to a summit in section 26, Township 14 North, Range 3 West, Seward Meridian; thence running northeasterly to near the head of Knik Arm of Cook Inlet; thence running northerly across the flats at the head of said arm and crossing Knik and Matanuska Rivers, to a point about two miles north of the Matanuska River; thence running in a westerly and northwesterly direction, crossing the Little Susitna River and following along the southwesterly slopes of Bald Mountain to Willow Creek, a tributary of the Susitna River; thence in a northerly direction following the drainage of the Susitna and Chulitna Rivers to Broad Pass, situated in the main Alaska range of mountains; thence crossing Broad Pass and entering the drainage of the Nenana River; thence continuing northward following the drainage of the Nenana River to the Tanana River, the total distance from Seward being 416 miles, more or less.

Also starting from a point on the above-described line, situated two miles more or less northerly from where said line crosses the Matanuska River, and thence running in an easterly direction following the drainage of said Matanuska River and its tributaries, a distance of 38 miles, more or less, to the Matanuska coal fields.

⁂

Mine La Motte

St. Louis Correspondence

The Mine La Motte property, embracing about 52 sq.mi. in Madison and St. Francois Counties, Mo., has been sold for $600,000 to the company that has been operating the mines under a lease for more than a year. This company, which is known as the Mine La Motte Co., is said to be affiliated with the National Lead Co.

Mine La Motte was sold about 12 years ago for $800,000 to Daugherty and Albers, who organized the Mine La Motte Lead & Smelting Co. with a capital of $3,000,000. About one-half of this stock was sold for a little more than $1,000,000, and the money paid for the mine, new mills and various improvements. Then $100,000 was borrowed to build a new smeltery and refining plant; but before the latter was ready to operate, the stockholders got into a quarrel among themselves, and as they preferred to wrangle rather than to pull together and make a success of the business, the property has paid nothing until taken over by the present owners. The old stockholders who paid $7 to $8 per share for their stock will now realize about 10c. per share for it.

The new company, which is composed of competent men, or at least has competent mining men to manage it.

has been making money, and if all the metals are utilized the property can be made to pay considerably more.

The Catherine mine, which was shut down last year owing to the low price of lead, will soon be in operation again. This mine and the Fleming land adjoining are under lease to the Federal Lead Co. Other tracts of mining lands in Madison County have been inspected recently and it is believed that some of these will soon change hands.

* * *

Ray Consolidated in 1914

The report for 1914 of the Ray Consolidated Copper Co., Ray, Ariz., shows a production of 57,004,281 lb. of refined copper, 51,608 oz. of silver and 306,532 oz. of gold. Dividends were paid in March and June aggregating $1,089,322, making total dividends to date of $2,720,826. The mill treated 2,427,700 tons of ore averaging 35.2 lb. of copper per ton, and 2591 tons of ore averaging 237.34 lb. per ton were shipped to smelters. The average net yield in refined copper per ton of ore treated was about 23.5 lb. The accompanying table gives a summary of the total production:

TOTAL PRODUCTION OF RAY CONSOLIDATED

Year	Tons of Ore	Lb. Cu per Ton	Total Lb. Refined Copper Prod	Value of Other Metals
1911	681,519	21.9	14,935,047	$926
1912	1,565,875	22.2	34,674,275	8,269
1913	2,365,296	22.2	52,341,029	51,396
1914	2,430,291	23.5	57,004,281	34,761
Total	7,042,981	22.6	158,954,632	$95,352

During the first seven months of 1914 the plants were running at about full capacity, but with the beginning of the war production was cut to 50% of normal capacity. The financial statements show an increase of 4376 shares in issued capital stock and the redemption of $269,000 of first mortgage bonds. The total outstanding capital stock at the end of the year was 1,454,929 shares and $2,708,000 of bonds. Of the new stock issued 4300 shares were issued in conversion of bonds and 76 shares in exchange for Ray Central stock. In order that the financial transactions of the company may be easily understood the statements given in the report have been fully analyzed and put in form shown in the accompanying tables.

TOTAL RECEIPTS AND TOTAL EXPENDITURES OF THE RAY CONSOLIDATED COPPER CO. DURING 1914

Receipts.		
From sale of metal products		$7,597,733
Income from investments and miscellaneous sources		338,923
From capital stock at par value		43,760
From premiums on sale of stock		28,800
Total receipts from all sources		$8,009,216
Expenditures:		
Expenditures charged to operations	$5,281,484	
Bond interest paid and advances	259,540	
Property account	1,029	
Construction and equipment	92,138	
Deferred development	286,778	
Investments	55,151	
First mortgage bonds redeemed	269,000	
Total expenditures........	$6,245,120	
Paid out in dividends	1,089,322	
Added to quick assets........	674,465	
To balance with total receipts	$8,009,207	
Balance of quick assets at end of 1914		$2,185,552
Balance of quick assets at end of 1913		1,511,087
Increase in quick assets in 1914........		$674,465
Dividends paid in 1914........		1,089,322
Amount actually available from 1914........		**$1,763,787**

The total development during the year was 75,261 ft., which is 9468 ft. less than in 1913. Development since the commencement of mining operations to the end of 1914 amounts to 452,233 ft., or about 85 miles. Of this about 34 miles has been destroyed by mining operations. It is stated that the mine is now thoroughly developed, so that all production requirements may be easily met.

The ore reserves have been recalculated and were estimated at Dec. 31, 1914, to contain 74,765,789 tons averaging 2.214% copper. This ore underlies an area of 205.2 acres. This recalculated tonnage is about 1.5% less than the former estimate; but to offset this the copper contents indicated by the new data obtained raise the average grade about 1%. This new estimate was made after exploring the margin of the main orebody.

ANALYSIS OF TOTAL RECEIPTS AND EXPENDITURES

Receipts from Operations		
From sale of metal products		$7,597,724
From investments and miscellaneous income		338,923
Total operating revenue		$7,936,647
Expenditures for Operations—Current and Deferred		
Current operations:		
Mining, milling and taxes...	$2,742,900	
Treatment, refining and freight	2,158,624	
Selling commissions........	76,497	
Mine development extinguishment	303,463	
Total current operating expenses reported		5,281,484
Total income reported		$2,655,163
Less bond interest and advances		259,540
Net profit as shown in report for 1914		$2,395,623
Deferred expenditures to operations		
For property account........	$1,029	
For construction and equipment	92,438	
For deferred development........	286,778	
Total expenditures charged to capital accounts		380,245
Balance over current and deferred expenditures		$2,015,378
Other Expenditures		
Investments	$55,152	
First mortgage bonds redeemed	269,000	
	$324,152	
Less receipts from capital stock.	72,560	
Net amount paid out from earnings for investments and bonds.		251,592
Amount from 1914 actually available for dividends		$1,763,787
Dividends paid		1,089,322
Balance added to quick assets		$674,465

During the second quarter of the year the average daily output was 8296 tons. A total of 2,429,330 tons was mined, of which 2591 tons was shipped to the smelter; the remainder was concentrating ore and averaged 1.7604% copper. The following table illustrates the constant increase in tonnage produced from the reserve drawing during the last three years and for the operating period to date, which has an important bearing on the decrease in mining costs:

	Per Cent of Total Tonnage			
	1914	1913	1912	To Date
Development	9	10	29	17.5
Mining, active stopes	21	33	45	32.3
Mining, reserve drawing	70	57	26	50.2

It is estimated that there is a reserve of 5,000,000 tons of broken ore in the stopes. Mining cost was 62.42c. per ton, compared with 73.23c. in 1913. This cost includes general fixed charges and the cost of coarse crushing and loading the ore into cars. The cost of crushing and loading into cars costs 3.1c. per ton, making the mining cost proper 59.32c. per ton. Eliminating No. 3 shaft, where the cost of mining is higher on account of square setting, the cost was 54.21c. per ton.

If the milling plant had operated during the last of the year at the same rate as during the first half, the year's tonnage would have been 3,006,129 tons. Mill ore averaged 1.76% copper, and the average rate of extraction was 67.88%. The cost of milling was 49.88c. per ton, compared with 51.93c. for 1913. The average grade of concentrates was 19.25%, compared with 18.55% in 1913.

The average cost per pound of refined copper was 8.868c. after crediting earnings from the railroad. The combined cost of refined copper from milling and shipping ore was 8.839c. per lb. These costs include all operating and general charges and 12.5c. per ton of ore milled for development charges. By crediting all miscellaneous income to cost, the net cost of copper produced was 8.763c. per lb. No new construction work is contemplated during the coming year. Some changes are contemplated in the milling practice that will require incidental changes so far as mechanical arrangement is concerned.

Villa's New Mining Regulations

According to press dispatches of Apr. 13, the British Foreign Office has instructed the British chargé d'affaires at Mexico City to lodge a protest with Gen. Villa against the new mining regulations promulgated by the Villa régime.

The Foreign Office took this action upon the receipt of advices from the chargé to the effect that the mining regulations in question amounted virtually to confiscation of foreign mining interests.

In response to inquiries from the State Department, the Villa authorities at Chihuahua have given assurances that the new mining regulations are intended to prevent the purchase of idle mining properties by speculators, and that there is no intention of injuring "all legitimate mining industries."

The Department issued the following statement on Apr. 13:

> With reference to the new mining law, the Department is informed that it is not the intention of the authorities at Chihuahua to injure all legitimate mining industries, and that each company or individual may make representations to the Minister of Fomento at Chihuahua and secure exemption from the provisions of the recent decree, if such exemption is thought to be justified.
>
> It is stated that the new laws are intended to prevent the purchase of mining properties that are now dormant by speculators who would hold them to sell at immense profits.
>
> The Department is in receipt of an official report on this mining decree, in which it stated that it appears to be advisable for mining men, especially those who have working properties, to take up the matter at once in Chihuahua.

It would perhaps have been more reassuring had the Department said "any" instead of "all legitimate mining industries."

Alaska Ebner

The United States Smelting, Mining & Refining Co. has secured control of the Ebner gold mine at Juneau, Alaska, at a foreclosure sale in New York this week. If the ownership, as the result of this sale, is not set aside by court proceedings, the Ebner properties will have cost the Smelting company approximately $500,000.

In the JOURNAL of Mar. 27 were given the details of the financial scheme suggested for liquidating the claims of the Smelting company against the Ebner. An extension of one week was granted to the bondholders' committee to enable it to make an effort to provide some different financial arrangement, but it failed to accomplish this and the foreclosure sale resulted.

According to local newspapers, suit has already been instituted in the Federal Court in New York on behalf of some of the bondholders of the Ebner company, seeking to set aside contracts between their company and the Smelting company on the ground that the bondholders' committee exceeded its authority in permitting new debts to arise without permission from the bondholders and that clauses of the contract with the Smelting company were usurious. This suit by the bondholders was brought against the committee, but the Smelting company also is named as a defendant.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINUM OXIDE—Production of Aluminum Oxide. Gustave Schwahn, Belleville, Ill. (U. S. Nos. 1,132,736, 1,132,737 and 1,132,738; Mar. 23, 1915.)

AMALGAMATOR. Charles H. Farmer, Ashland, Ore. (U. S. No. 1,132,317; Mar. 16, 1915.)

AMALGAMATOR. John C. Wood, Monero, N. M. (U. S. No. 1,133,210; Mar. 23, 1915.)

COPPER—Electrolytic Process of Producing Copper. Marcel Perreur-Lloyd, Boulogne-sur-Seine, France. (U. S. No. 1,133,059; Mar. 23, 1915.)

COPPER LEACHING—Process of Extracting Copper. Centennial Harry Benedict, Lake Linden, Mich. (U. S. No. 1,131,986; Mar. 16, 1915.)

CRUSHING—Apparatus for Crushing or Recrushing Rocks, Ores, Etc. Milton T. Thompson, Mexico, Mexico. (U. S. No. 1,132,047; Mar. 16, 1915.)

CRUSHING—Lining Plate for Ball Mills. Walter Brinton, Wilmington, Del., assignor to Edgar Allen American Manganese Steel Co., Augusta, Me., and Chicago, Ill. (U. S. 1,132,909; Mar. 23, 1915.)

DESULPHURIZING—Process for Desulphurizing Ores. Giovanni Fusina, Genoa, Italy. (U. S. No. 1,131,691; Mar. 16, 1915.)

DRILL—Rock Drill. Vilhelm P. Kessel, San Francisco, Calif. (U. S. No. 1,132,276; Mar. 16, 1915.)

DRILL — Rock-Drill Chuck. Martin Thomas Taylor, Phoenix Mines, near Liskeard, Cornwall, England, and John Francis Gardiner, Mount Chalmers, Queensland, Australia. (U. S. No. 1,132,636; Mar. 23, 1915.)

DRILLS—Attachment for Drill Chucks. John E. Erickson, Tonopah, Nev., assignor of two-thirds to J. E. McNamara and J. H. Frisby, Tonopah, Nev. (U. S. No. 1,131,918; Mar. 16, 1915.)

DRILLS—Extension Frame for Mining Drills. George W. Morgan and Lon Evans, Commerce, Okla. (U. S. No. 1,133,492; Mar. 30, 1915.)

ELECTRIC FURNACE. John W. Brown, Lakewood, Ohio, assignor to National Carbon Co., Cleveland, Ohio. (U. S. No. 1,134,817; Apr. 6, 1915.)

FERROSILICON — Crystalline Ferrosilicon Product and Method of Making the Same. Herbert Champion Harrison, Lockport, N. Y., assignor, by mesne assignments, to Electro Metallurgical Co. (U. S. No. 1,134,127; Apr. 6, 1915.)

FERROSILICON ALLOYS of a Definite Composition. Herbert Champion Harrison, Lockport, N. Y., assignor, by mesne assignments, to Electro Metallurgical Co. (U. S. No. 1,134,129; Apr. 6, 1915.)

FLOTATION PROCESS—Apparatus for Separating Minerals by Flotation. Bernard MacDonald, Los Angeles, Calif. (U. S. No. 1,134,690; Apr. 6, 1915.)

GASES—Apparatus for Cooling, Washing and Mixing Gases. Hans E. Theisen, Munich, Germany. (U. S. No. 1,131,966; Mar. 16, 1915.)

GASES—Apparatus for Separating Suspended Particles from Gases. Walter August Schmidt and George Clifford Roberts, Los Angeles, Calif., assignors to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,132,124; Mar. 16, 1915.)

GASES—Apparatus for Trapping Particles in Suspension in Gas Currents. Thomas E. Murray and Charles B. Grady, New York, N. Y.; said Grady assignor to said Murray. (U. S. No. 1,132,677 and 1,132,678; Mar. 23, 1915.)

JIG. Guy H. Elmore, Swarthmore, Penn. (U. S. No. 1,132,464; Mar. 16, 1915.)

LAMP—Miner's Safety Lamp. Ernest F. Koehler, Hudson, Mass., assignor, by mesne assignments, to E. H. Kingsbury agent, Marlborough, Mass. (U. S. No. 1,132,522; Mar. 16, 1915.)

LUBRICANT and Process of Making Same. Alexande Warrell, Worcester, Mass., assignor to Continental Asbesto Corporation, Worcester, Mass. (U. S. No. 1,133,204; Mar. 23 1915.)

ROASTING—Metallurgical Furnace. Utley Wedge, Ardmore, Penn. (U. S. Nos. 1,133,828 and 1,133,829; Mar. 30, 1915.)

SMELTER SMOKE—Process of Preventing Escape of Noxious Gases in Smelting. William A. Hall, New York, N. Y (U. S. No. 1,133,637, Mar. 30, 1915.)

SULPHUR—Production of Sulphur from Pyrites and Othe Metallic Sulphides. William A. Hall, New York, N. Y. (U. S No. 1,133,636; Mar. 30, 1915.)

ZINC Roasting of Compounds or Ores Containing Zin Augustin Leon Jean Queneau, Philadelphia, Penn. (U. S. N 1,132,681, Mar. 23, 1915.)

Editorials

What of Copper After the War?

The remarkable improvement of copper during the first quarter of 1915 renewed the courage of copper producers. They are now enjoying a prosperity that six months ago no one ventured to hope. However, it is recognized that the recent great demand for copper has been chiefly for military purposes (the consumption for peaceful purposes in this country has failed so far to increase materially) and producers are already considering the question of the prospects for copper after the war.

There are two views. The pessimistic view is that termination of the war will be accompanied by a collapse in the copper market, owing to the production being far in excess of the consumption when the military buying ceases. Those who take this view consider that after the war the countries of Europe will be prostrate, lacking the means even to rebuild what has been destroyed.

On the other hand, the optimists consider that Europe will not be prostrate, that rebuilding will be inaugurated immediately and that enormous quantities of copper will have to be purchased at once in order to replenish the normal stocks of manufacturers, estimated at several months' supply on the average, which already have been drawn down to the irreducible minimum, especially in Germany, in order to carry on the war. Those taking this view believe that termination of the war will be followed not by a slump in copper but by a further rise.

Among the offices of the big producers there is a sharp division of opinion respecting the above-cited forecasts. We are disposed to think that the optimistic view predominates. It is fresh in the minds of everybody that six months ago, when opinions were practically unanimous that copper was in a hopeless situation, the views were wholly wrong, and in forecasting another six months nobody pretends to be cocksure. The unexpected happened once, and probably will happen again. It is sufficient now for everybody to rejoice over the good times that have come, and it is not worth while to worry about the future.

*

A Revival in Mining?

The improvement in sentiment in this country is already being reflected by increased interest in new mining enterprises. The Alaska-Juneau Gold Co., which owns a portion of the great lode back of Juneau, Alaska, two weeks ago offered 400,000 shares of its treasury stock at $10 per share in New York. On Monday of this week it was announced that allotments would be only 25%, the issue having been oversubscribed four times. The Alaska-Juneau property adjoins that of the Alaska-Gastineau. The company is directed by Messrs. Bradley, Requa and McKenzie, of San Francisco.

Naturally the success of this company and the Alaska-Gastineau (Alaska Gold Mines Co.) is inspiring all kinds of advertising of other companies, claiming to have extensions, offshoots or spurs of the Juneau lode. The development of a bull market in Wall St., where much money is being made speculatively, leads directly to interest in mining speculation. The man who has just made $100,000 in stocks is promptly receptive to the idea of putting a tenth of it into a project for driving a tunnel somewhere which will cut a vein 1000 ft. below its outcrop and prove millions of tons of ore, the only risk being that the ore may not extend downward so far. However, when speculative persons are making money they are eager to take sporting chances, which often result in making mines and, anyway, produce activity in the mining industry. We think that now we are just beginning to discern renewed interest in mining. The temper of our people has become optimistic.

*

Dredging in the Philippines

Comparatively little attention has been directed by Americans to the Philippine Islands as a field for placer operations. To a great extent this is due to the failure of some of the early ventures in this field. Australasians, however, came in and with inferior dredging equipment proved that there was auriferous gravel capable of profitable exploitation. Later more modern American dredges were brought in, but the established dredging operators in the United States remained apathetic until the high yields and continued increase in the number of dredges caused some awakening of interest and the sending of exploratory parties.

Most of the dredging to date has been in the Paracale district of the Province of Ambos Camarines, Island of Luzon. Other gold placers exist in the archipelago, but not enough work has yet been done to demonstrate their adaptability to dredging. Several regions, including Tayabas, Rizal and Surigao, have been investigated and equipment ordered; in the latter province a hydraulicking plant has been placed on the Cansuran property.

The first two dredges, sent to the Philippines about 10 years ago, were both failures; one was wrecked by a storm and the other was dismantled and rebuilt in the Paracale field, where the number of dredges has increased rapidly since 1912. At the beginning of 1913 four dredges were operating in this field, and another was added to the list before the end of the year. Two new dredges were completed early in 1914 and an all-steel dredge for this district was being manufactured in Australia.

There are a number of Australasian dredges already operating in this field, but the best and most modern dredges, on the whole, are those supplied by American manufacturers. Up to the present the areas exploited have been comparatively small and rich. The gold, as a rule, is fine and the auriferous gravel is usually overlain by an overburden containing clay and sunken timber. Onerous conditions are thus imposed. When dredging was begun in the Paracale field, 50c. ground in one instance proved unprofitable; but now a well known operator predicts that with improved equipment 12.5c. ground will be profitably dredged. The dredges are gradually being adapted to the conditions of the district as the local problems are being more thoroughly realized. A contract has recently been let to an American designer and part of the material has been shipped for another dredge in Ambos Camarines. This dredge, like the others in the Paracale district, will operate in salt water, and embodies a number of interesting features, which we hope to describe later.

A deterrent to Philippine enterprises of all sorts has been the proposal of the present Administration to withdraw our protection from these islands; with the prospect of native control, new enterprises in the Philippines have not appealed to capitalists. Many Americans, however, feel that conditions in the Philippines will not warrant withdrawing our guarantee of order for many years, and it seems probable that the United States protectorate will actually outlast the life of most mining enterprises that might now be undertaken. At any rate, a number of dredging operations there are proving profitable, and may be more so as the designers and operators of the dredges become more familiar with the problems of this field.

*

Factors in the Zinc Situation

The news in our market report this week that one of the old coal smelteries at Pittsburg, Kan., idle for 15 years, is to be put into commission again shows that the extraordinary price for spelter it not only restoring to use the moribund and inactive smelting capacity, but also the abandoned capacity, which has not appeared on the smelting list for many years. This illustrates one of the factors operating to ameliorate the present acute situation. Those factors are increasing production and decreasing consumption. Their development will be gradual, their results for a while may be imperceptible, but the process is inexorable, and ere long it will be manifest to everybody. This may be in a month, maybe a little later, maybe a little sooner, but it will be. The process began emphatically in March, but was checked by the strike among the Kansas-Oklahoma smelters and other things. We may even see a recurrence of 10c. for prompt spelter before the tendency toward a return to normal conditions is clearly shown; but already the factors are at work.

An important point is that the shortage in spelter supply has been simply the result of shortage in smelting capacity, not of ore supply. Indeed, zinc ore is a drug on the market, which explains adequately why the price for ore is relatively low. Smelters taking in ore on sliding-scale contracts have generally restricted shippers to the contractual minimum. Not only is it dangerous to stock up with ore at present prices, but also ore may be bought far more advantageously in the open market. This is equivalent to saying that smelting margins are now large, and the smelters, after several lean years, are temporarily making large profits, which of course is precisely what brings into use the antique smelteries of Pittsburg, Kan.

Naturally the same developments are taking place in Great Britain and presumably everywhere else, outside of Belgium, Germany, Poland and Galicia, where zinc smelting is practiced.

On the other side, consumption—i.e., consumption for peaceful purposes—is being drastically curtailed. Reports from our own galvanizing districts and from those of Great Britain agree as to this. This has been invariably the experience whenever the price for spelter has risen above 7c. The cost of galvanized sheets is then so increased that the ultimate consumer prefers to buy black sheets and paint them.

*

Dressed Lumber

It is worth while to call attention to a somewhat interesting point made by Mr. Linke in an article published as a detail of practical mining in this week's issue. Mr. Linke brings out the fact that it is cheaper and better to buy for shaft timbering lumber which has been surfaced on two sides, *S1S1E,* inasmuch as the cost of the surfacing is more than paid for in the lower cost of freight. This of course depends on the situation of the point at which the timber is to be delivered. If the mine were near a sawmill, particularly if this sawmill did not have a planing mill connected with it, it would not pay to attempt to use dressed lumber, in all probability.

It might also be brought out that the dressing of the timber on two sides makes the framing much easier, as giving proper surfaces from which to work. If it is worth while to use properly surfaced lumber in shaft timbering, it is doubly or trebly so when the material is to go into a mill structure or any other building. In such case the saving in carpenter work compensates over and over again for the extra cost of the more highly finished material. And if it is used in such a way as to require painting, a still further, and perhaps even greater, saving is effected in the much smaller quantity of paint required to cover a smooth surface.

In this connection it may be said that dimensions in mine timber are only rough approximations in many cases; the mining engineer has often to work with lumber which, to put it colloquially, is pretty fierce. This is particularly the case when the mine gets its lumber from some small local mill in which the accuracy of the cutting is anything but mathematical. We remember a New Mexican property which was forced to use lumber of which every stick was a wedge. That is, a nominally 4x4-in. piece might start at 2x4 in. on one end and bring up to 4x6 in. on the other. Yet even this was better than the case of many Mexican mines where the only supply available is either whipsawed or hewed, when a square section is desired at all. The results from hewing are sometimes extraordinary. One property in central Mexico, where the timbers had to be hauled in by a bull team for five or ten miles, in order to get a stick planed true to 10x10 in., had to order a 12x12-in., and to deliver a 12x12-in., the woodcutters had to start with a 14x14-in. stick in the woods, to allow for the excessive wear over the rough roads and trails.

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Boston Gone Zinc-Crazy

About every so often somebody rises to criticize the quotations of the metal markets by the JOURNAL, always of course for being too low, for surely in the mind of a seller of ore they never would or could be too high. Here is the latest from the *Boston News Bureau* in an article about the Butte & Superior company: "And in spelter as well as in copper some of the recent prices quoted by this paper have been a joke. . . . These quotations have been for weeks under the real market."

Such comments are apt to emanate from Boston, where there are many axes to grind. It is always useful to consider what they are. In the present case Boston has gone crazy over zinc. The interesting journal that we have quoted gravely publishes editorials about spelter at 9c. (an advance of 100% in six months) having come finally to its own. The public is expected by autosuggestion to become interested in zinc shares. The "real market" for spelter is the top price that anybody realizes on small tonnages of prompt spelter in a naturally cornered market, and anything indicating return to ordinary conditions is resented. It looks as if the good luck that has befallen the zinc industry is producing some plain hoggishness.

BY THE WAY

There appears to be no lack of engineers in this country, though an "abundant" lack of jobs. According to an Associated Press dispatch from Washington, 35,000 applications have been received by the engineering commission in charge of the proposed Alaskan railroads, and "none specifies or asks for common labor."

*

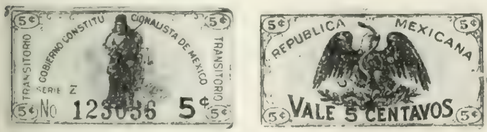
Efficiency is a great thing. Efficiency Society is so efficient that it always leaves out a "the" before its name. The prefix is inefficient. But some recent literature from Efficiency Society (without a "the") requests the recipient to fill out an inclosed application for membership and inclose with it a check covering the dues, but nothing is said as to what the dues are. This is applied efficiency to the $(n + 1)$th power.

*

In some recent promoters' literature is (to the miner) a rather amusing description of an interview in his New York office with an engineer in charge of one of the big Alaskan mines, which ends: "And Mr. —— read the tenth telegram from Alaska that had been placed on his desk as he talked." Which moves us to offer three suggestions to the engineer, one of which should be followed: (1) Fire the garrulous mine foreman; (2) or build a private telegraph line to Alaska; (3) or get on the job in Alaska.

*

Every Mexican commandant drives dull care away by manufacturing his own currency, thus enabling his army to live honestly and to pay as it goes. To be sure, arguments sometimes have to be used to circulate a new brand of paper and ink, but an argument à la Mauser is indeed unanswerable! A recent happy thought in high financial circles is to issue so-called money about the size of a subway ticket, but which has a time limit. This has the effect of keeping the *peones* hustling to get rid of it before its value disappears, which is a day or two before the time at which it would naturally wear out.



Dinero Mexicano

Borax Consolidated, Ltd., has in times past enjoyed great advantages from the world-wide character of its business, since if trade were bad in one or more countries, compensation was to be had elsewhere. At present, however, the company is in the position of being hit in many places at the same time. The company supplies most of the raw material to refiners of borax and boric acid, and had an especially large trade in Germany and Austria, where the enameling and glass industries consume thousands of tons annually. This is of course entirely cut off during the war, and in respect to other countries, such as France and Russia, there is so far only a small demand, owing to stoppage of manufacture and also to difficulties in distributing goods over the railways. An improvement in the last-named countries, however, is hoped for. The profits for the year ended Sept. 30, 1914, were $1,672,078, about $88,000 less than for the previous year, which was the highest in the history of the company. In regard to its mining operations, the chairman, after referring to the completion of the Death Valley R.R. in California in November, said: "We have in connection with the building of the railway taken the opportunity to erect at a central spot a large calcining plant for the treatment of the ore, and this establishment will enable us to deal with a large amount, sufficient not only for the requirements of our refineries in the United States, but also for such quantities as we may require for export. This has necessitated a large outlay, but the expenditure places us in a position to produce at the lowest possible cost all the calcined material we may require for export. In Chile, where we have hitherto had a large output from our deposits (ulexite, $CaNaB_5O_9.8H_2O$), an export duty of 10s. per ton has just been imposed upon 'borate of lime,' and in Peru, where our negotiations for an exemption from duty for a period of years have, owing to the change of government, fallen through, it has been proposed that a duty should be imposed. It seems to be injudicious to place an export duty upon a raw material which exists in several countries, as competition will necessitate a reduction of output where costs tend to increase and divert it to that place which can export at the lowest cost. Owning, as we do, properties not only in Chile, Peru and Bolivia, but also in the United States and Asia Minor, we can make our largest production from the most economical point. . . . Our boracite ($Mg_7Cl_2B_{16}O_{30}$) mines are situated in Asia Minor. [Pandermite, a variety of colemanite ($Ca_2B_6O_{11}.5H_2O$), is reported by Moses & Parsons as occurring in gypsum near Panderma on the Sea of Marmora.—Editor.] The inclusion of Turkey in the war has stopped the working of the mine, but we have recent information that, while confiscation of alien property in the form of gasworks, waterworks, railroads, etc., has taken place, no interference with our property has occurred other than that fuel has been commandeered." There is little danger of a shortage in the borax supply, either by war or by governmental restrictions in South America. There is, indeed, a prospect of a greatly increased supply from the United States when the commercial exploitation of Searles Lake begins. Its brine is estimated to contain about 6,000,000 tons of borax. As borax would practically be a byproduct in connection with the utilization of the Searles Lake brine as a source of potash, the concurrent production of borax from Searles Lake may easily dominate the borax market.

PERSONALS

H. F. Le Fevre is manager of La Union mine in Costa Rica.

B. B. Thayer left for Butte Apr. 8, expecting to be back in New York about May 15.

G. L. ("Tex") Rickard has returned from his ranch in South America for a short visit.

"Diamondfield Jack" Davis was recently in the Amalie mining district, Kern County, California.

Wm. Spence Black has recently become manager of the Mobile mine, in the Goodsprings district of Nevada.

Gen. Frank Hall, veteran mining editor of the "Denver Post," has returned to his desk after a three-months' vacation in Texas.

William Braden arrived in New York on Apr. 1 from Chile. After a trip to Butte, he will return to New York and expects to sail for Chile late in May.

S. W. Cohen is in Nicaragua superintending investigation of the Bonanza gold mine, which is under option to the Crown Reserve Mining Co. of Cobalt.

F. Chas. Merry, formerly superintendent for the Ferguson Mines, Ltd., with silver-lead mines in the Lardeau District of British Columbia, has gone to Utah.

F. M. Sanders, of Sanders Brothers & Co., London, dealers in iron and steel, is now in the United States on business connected with exports to Great Britain.

William Bremer has resigned as president of the Standard Aluminum Co. at Two Rivers, Wis. Herman Wentdorf, late secretary, succeeds Mr. Bremer as president.

W. V. DeCamp, recently connected with the United Verde engineering staff, has succeeded Henry Wirtz, resigned, as superintendent of the Bluebell mine in Arizona.

J. F. Mitchell-Roberts has resigned his position as chief engineer to the Wilfley Mining Machinery Co. of London to take up private work; he will be absent from London for about nine months.

W. F. Davis, superintendent of the bessemer department of the Cambria Steel Co., Johnstown, Penn., now has charge of both the bessemer and openhearth departments. C. A. Alexander, former head of the openhearth department, is engaged in special work for the company.

Lucius W. Mayer, for the past seven years connected with the New York office of A. Chester Beatty, has joined the organization of Eugene Meyer, Jr. & Co., 18 Wall Street, as mining engineer for that banking house which has extensive interests in a number of important copper-mining companies.

Robert G. Drinnan, who for 15 years has been closely associated with the management of coal mines in the Crowsnest District of British Columbia and others in Alberta, has been appointed general manager for the Hillcrest Collieries, Ltd., with coal mines in the Blairmore-Frank District, Alberta.

Frederic Keffer, for 17 years with the British Columbia Copper Co. as general manager, and later as consulting engineer and geologist, has resigned and will open offices at Spokane, Wash., as consulting engineer, in partnership with Henry Johns, who was for many years mine superintendent for the same company.

Baird Halberstadt, long assistant state geologist of Pennsylvania and well known for his work as geologist and cartographer in the anthracite region of that state, will have a reception at Pottsville, Penn., Apr. 21, to celebrate the conclusion of one-third of a century in geological work. A large number of guests will attend.

B. L. Thane, general manager of the Perseverance mine at Juneau, Alaska, announces the promotion of G. T. Jackson, the present superintendent to assistant manager, and the promotion of B. B. Neidling of Kensington to take Jackson's place. It was also announced that more buildings would be erected at once at the mine and mill for the housing of the men, a larger crew being put on the ground this summer.

A. Chester Beatty has removed his New York office to 25 Broad Street, where he will occupy a suite in the offices of Hayden, Stone & Co. Though he will spend several months of each year in the United States, Mr. Beatty has taken up his residence in England on account of his extensive interest in British companies developing and operating mines in Siberia and India. His London office is at 1 London Wall Buildings.

OBITUARY

George Mitchell, who in the early Klondike days made quite a fortune in promoting the White Pass Ry., died recently at Harrison Hot Springs, aged 65. He was a great friend of Sir Wilfrid Laurier and lived in Ottawa much during recent years. Last year he had financed a railway project to build from Taku to Atlin, B. C., but the coming of the war caused his arrangements to fall through.

Thomas William Fitch died in Brooklyn, N. Y., Mar. 8, aged 70 years. He began life in the United States Navy, but retired many years ago and entered the wire business in St. Louis. He remained there for some time, but came to Pittsburgh about 35 years ago. He was one of the founders of the Consolidated Steel & Wire Co., and was general manager of that company, which later became part of the American Steel & Wire Co. Mr. Fitch then organized the Pittsburgh Wire Co. This company also became a portion of the American Steel & Wire Co., and Lieutenant Fitch then helped organize the Pittsburgh Shafting Co., which was purchased later by the Columbia Bridge Co. Lieutenant Fitch was for some time president of the shafting company. He was instrumental in the formation of the Griswold Wire Co. of Braddock and of the Braddock Machine Co. His widow, who was a daughter of General W. T. Sherman, survives him, with two sons and two daughters.

William T. Simpson, first vice-president of the American Rolling Mill Co., Middletown, Ohio, died at his home in Cincinnati, Mar. 31, aged 59 years. He was associated with George M. Verity, president, and R. C. Phillips, secretary, in the organization of the company in 1899, and had been first vice-president from that time until his death. He was a native of Saratoga County, N. Y., and had been actively engaged in the iron and steel business since he was 18 years of age. He was proprietor of the first galvanizing plant established west of the Allegheny Mountains. In 1899, with Mr. Phillips, Mr. Simpson organized the Cincinnati Rolling Mill Co., whose plant was located at Riverside, Ohio. For the past 10 years Mr. Simpson spent practically all his time in looking after the interests of the American Rolling Mill Co.'s plant located at Zanesville, Ohio, and in superintending the development and production of Armco terne plate to which he paid particular attention.

SOCIETIES

Massachusetts Institute of Technology—The Department o Mining Engineering and Metallurgy has received, throug the courtesy of Col. Charles Hayden, '90, a member of th corporation, an interesting addition to its laboratory equip ment. This is a complete working unit of the Janney o flotation apparatus, the machine being fitted with more tha the usual adjustments for producing and meeting variou conditions. It has an electrical control to enable it to b worked at different speeds and observation windows fo noting the interior happenings

New York Michigan College of Mines Club—An organiza tion of alumni of the above-named institution has been forme with the following officers: William E. Parnall, presiden Louis A. Wright, vice-president; James S. Dunstan, secretary treasurer. The address of the secretary-treasurer is 42 Broad way, New York City. The object of the club is to brin together alumni of the Michigan College of Mines who a located in New York and vicinity or who may be visitin New York. The members plan to meet for luncheon on Frida of each week at Baracca's restaurant, 39 South William St New York. The presence of all M.C.M. men at these luncheo is desired.

INDUSTRIAL NEWS

The Hecla Mining Co. has recently purchased a 5x6- Chalmers & Williams adjustable quick-discharge tube mi

Chalmers & Williams has recently sold to the Cusi Minin Co., Chihuahua, Mex., a 5x16-ft. adjustable quick-dischar tube mill.

The first of the 10-ft. Hardinge mills which are going be installed by the Anaconda Copper Mining Co. were shipp last week from Pittsburgh.

The Burd High Compression Co. announces that its general offices have been moved from the Masonic Temple to 307-309 South Main St., Rockford, Ill.

The Dorr Cyanide Machinery Co. announces that after May 1, 1915, its New York office will be Room 2843, Whitehall Bldg., New York City, instead of 30 Church St.

The Wilson-Snyder Manufacturing Co. and the Wilson-Snyder Centrifugal Pump Co. of Pittsburgh, Penn., have opened a branch office at 52 Vanderbilt Ave., New York, in charge of Mr. A. H. Sherwood.

Chicago Pneumatic Tool Co. announces the removal of two of its branch offices to new quarters as follows: New York office, from 50 Church St. to 52 Vanderbilt Ave. Boston office, from 191 High St. to 185 Pleasant St.

The Denver office of the Sullivan Machinery Co. after May . will be located at 837 Equitable Bldg., and it will continue to carry the same stock of repair parts and complete machines at Denver as heretofore. George W. Blackinton is manager.

A manufacturer near New York desires a supply of amorphous silica (either the gelatinous form or dehydrated) such as is produced in analytical operations. Will anyone in nearby territory producing this as a byproduct please advise the editor as to quantity and prices?

The Deister Concentrator Co. announces that about eight weeks ago one of its No. 3 tables was placed in the Colburn Ajax Mill, Victor, Colo., on trial, and after the table had been in operation a short time, an unsolicited order was received for seven more slime tables for immediate delivery; later an additional order came from the mill for four more slime and one sand table.

Alfred Kauffmann is now vice-president of the Link-Belt Co. in charge of operations at Indianapolis. Mr. Kauffmann served in the engineering department at Philadelphia for a number of years, from which he was promoted to take charge of the erection work of the company. He then proceeded to the sales department, looking after the coal mining business in the East, and particularly in the West Virginia field. His many friends in this industry will be glad to learn that in recognition of his competent and able work he has been elected vice-president of the Link-Belt Company.

The introduction of the Oliver filter into the Cœur d'Alene district for dewatering flotation concentrates is creating interest among the mill men of that district. The Oliver filter installed at the Gold Hunter Mill, near Mullan, Idaho, is reducing the lead flotation concentrates to an average of 6.5% moisture, and has so far exceeded expectations that Oliver filters have recently been ordered by the Bunker Hill & Sullivan Co., at Kellogg; Hercules Mining Co., at Burke; and the Consolidated Interstate-Callahan Mining Co., at Wallace. The Inspiration Consolidated Copper Co., of Miami, Ariz., is installing four Oliver filters with a total capacity of 1000 tons per day, and the Anaconda Copper Mining Co. is adding five additional Oliver filter units to the three which have been in operation there for the last year. Those at the Anaconda plant are 11 ft. 6 in. in diameter by 12 ft. face, and have an average capacity of 330 tons each per day.

The Snyder Electric Furnace Co., 53 West Jackson Blvd., Chicago, has closed a contract with the Daimler Motor Car Co. for an electric steel furnace, with a total daily capacity of four tons. This furnace will be operated on a refining basis and will melt cold material. This makes the fifth furnace which the Snyder company has sold in Europe within the last two months. The Daimler Motor Car Co. at the present time, in addition to its well-known line of automobiles and trucks, is manufacturing aëroplanes for the British Government. The steel supplied by the electric furnace just contracted for will be used in the manufacture of castings for aeroplane motors. G. J. Stock, formerly manager of the Stock Oil Fired Convertor Co., has sold out his interest in that company and is now the English representative for the Snyder Electric Furnace Co. His office will be at the Villas, Middleton St. George, Darlington, Durham, England.

At the annual meeting of stockholders, Feb. 18, 1915, it was decided to change the name from the Metallurgic Engineering Co. of Chicago, Ill., to the Snyder Electric Furnace Co. This action was taken because it was felt that the old name did not accurately describe the company's business and was confusing to the public. The company is just completing the installation of a second three-ton furnace for the Otis Elevator Co., Buffalo, N. Y. This furnace will have a basic lining, and will be used in the manufacture of refined-steel castings. The contract for this second furnace was closed nine months after the first one was put in operation. It is expected that the new furnace will be running about the middle of April. The Snyder Electric Furnace Co. is also installing a small furnace for the Niagara Electric Steel Corporation, at North Tonawanda, N. Y. This furnace will be basic lined and will have a daily output of six tons of refined steel. In addition to these two furnaces the Snyder company is just completing the installation of three different electric furnaces to be used in special chemical work.

The Traylor Engineering & Manufacturing Co. of Allentown, Penn., has recently supplied to the Consolidated Interstate-Callahan Mining Co. additional equipment for its [illegible] at Wallace, Idaho. The new equipment includes two [illegible] Traylor rolls, 30x14-in., fitted with fleeting mechanism [illegible] Traylor all-steel jigs and a short tube mill, 6 ft. in diam[illegible] The Boyd-Smith Mines, of Mineral, Va., has ordered a set of Traylor rolls, 24x12 in., with automatic side adjustment. The Traylor company has also supplied to the General Chemical Co. an 18x30-in. Blake crusher fitted with manganese-steel wearing parts, a 30x48-in. heavy jaw crusher, having cast-steel frame and manganese-steel fittings; a 7x11-in. Dodge crusher, fitted with forged-steel crushing plates. The St. Louis Smelting & Refining Co. has ordered three sets of 42x18-in., extra-heavy, type AA, crushing rolls and an all-steel, 30x60-in., heavy-duty Blake crusher; Mine La Motte, a 30x60-in. heavy-duty crusher. The Traylor company has also sold to the Irvington Smelting & Refining Co. at Irvington, N. J., a crushing plant for handling matte, consisting of a 10x16-in. Blake crusher, screen, elevator and a set of 24x12-in. type A automatic rolls.

The Traylor Engineering & Manufacturing Co., of Allentown, Penn., has recently received a contract from the Granby Consolidated Mining, Smelting & Power Co. for an additional copper-matting furnace for the Anyox plant. The Traylor company furnished the equipment for the original plant at Anyox, including three 56x360-in. blast furnaces. The new furnace is a duplicate of those previously furnished except that it will be 5 ft. higher, this being accomplished by putting in a row of jackets around the top. The Consolidated Mining & Smelting Co. of Canada, Ltd., has ordered from the Traylor company 30 water jackets for its copper smelting furnaces at Trail, B. C. The Balbach Smelting & Refining Co. has purchased a complete set of water jackets for its lead furnaces, and the Tennessee Copper Co. a 56x270-in. furnace fitted with cast-iron superstructure, which was machined to make it air-tight; the Tennessee Copper Co. has also ordered a carload of water jackets, fitted with welded tuyeres and having no riveted or beaded joints on the fire sheets. Phelps, Dodge & Co. has ordered a set of jackets with welded tuyeres for the Detroit Copper Co. The St. Louis Smelting & Refining Co. has purchased a lead blast furnace, 36x126 in., and the General Chemical Co. a 24x118-in. special furnace for its Delaware works.

TRADE CATALOGS

Circular of a new sand and gravel washing device invented by the Biesanz Stone Co., Winona, Minn.

Armstrong Cork Co., Pittsburgh, Penn. Folder. Nonpareil high pressure covering for boilers, etc. Illustrated.

The Deister Concentrator Co., Fort Wayne, Ind. Loose leaf catalog. Ore concentrators. Illus., 6x9½ inches.

Scranton Steam Pump Co., Scranton, Penn. Bulletin No. 101. Duplex piston pumps. 16 pp., illus., 6x9 inches.

Snyder Electric Furnace Co., Chicago, Ill. Bulletin. Electric steel melting furnaces. 24 pp., illus., 8x10½ inches.

Trussed Concrete Steel Co., Youngstown, Ohio. Catalog Kahn Pressed Steel Bldg. Construction. 20 pp., illus., 11x8½ inches.

The Lagonda Mfg. Co., Springfield, Ohio. Catalog W-1. Lagonda locomotive arch tube cleaners. 12 pp., illus., 6x[illegible] inches.

Marion Steam Shovel Co., Marion, Ohio. Catalog No. 92. "Digging and Mixing Clay—One Operation." 30 pp., illus., 5½x8 inches.

Fort Wayne Electric Works (Rock Drill Dept.), Madison, Wis. Bulletin No. 1143. Electric rock drill, type A. 20 pp., illus., 8½x11 inches.

Steel City Electric Co., Pittsburgh, Penn. Price list of Marchland Clamps and Reproduction of Test Reports Submitted by the Pittsburgh Testing Laboratory.

Sullivan Machinery Co., Chicago, Ill. Bulletin No. 65. Diamond core drills. 36 pp., Illus., 6x9 in. Bulletin No. 71-A. Air lift pumps. 32 pp., Illus., 6x9 inches.

The Monarch Engineering & Mfg. Co., American Building, Baltimore, Md. Bulletins. Furnaces and fo[illegible] gas, coke and coal) for melting, heating, annealin[illegible] Illustrated.

Editorial Correspondence

BUTTE—Apr. 8

Every Socialist Candidate Was Defeated and every Democratic candidate was elected at the Butte municipal elections Apr. 5. The result, it is hoped, will usher in an era of prosperity such as Butte has not seen for some time. With the resumption of operations of many of the Anaconda company's and other mines, with the probable increase of miners' wages due to the advanced price of copper, everything points toward a revival of activity not only in the mining industry but in all others that are directly or indirectly affected by it.

Phosphate Mining in Granite County—J. D. Fields of the Royal Basin company at Maxville, in an address made Mar. 31 before the Helena chapter of the American Mining Congress, made the announcement that early in June construction work will start on a plant at Philipsburg and another at Maxville for the production of phosphate fertilizer. The company owns 194 acres of phosphate deposits in Granite County and all arrangements for its exploitation on a commercial basis have been made. Plants will have a capacity of 300 tons a day.

Mining Activity in the Saltese District—Preparations for an active mining season in the Saltese district, Missoula County, are being made and the outlook is good for development of many valuable properties. The territory north of Saltese is largely a gold and galena district. The solving of the transportation problem by the construction of the Milwaukee and N. P. lines has aided materially. Among the most promising properties are the Tarbox mine, situated about 2½ miles north of Saltese on Packer Creek, the Hemlock mine, 1½ miles north of Saltese, the Last Chance mine, 5 miles northwest of Saltese and the Dorr group of mines in the same section. All these mines are carrying on active operations, some of them being heavy and regular shippers.

Options Being Taken on Dredging Ground in Ruby Valley—About a year ago the Oroville Dredging Co. of California did considerable prospecting with Keystone drills in the Ruby Valley near Twin Bridges, after which the prospecting crew departed without making known the results of their operations. Options are being secured again on lands nearly identical with those held under option by the California company. E. W. Cassel, a rancher on lower Wisconsin Creek, which is supposed to be in the dredging belt, has recently sampled ground on his property which assayed 15c. to the cu.yd. at a depth of 8 ft. from the surface. The Conrey Placer company at Ruby, which carries on the largest placer operations in Montana, is known to dredge similar ground at a profit. Wisconsin Creek has its source in the Tobacco Mountains, which abound in quartz ledges, which is considered the mother lode.

Montana Oil and Natural Gas Fields in the eastern and northern parts of the state are being developed rapidly and new companies are being formed to exploit these fields on an extensive basis. Those who have been over the ground in the vicinity of Glendive, Miles City, Billings, the Sweetgrass hills, Havre and Great Falls are confident that in all these sections the gas and oil strikes will be fully as promising as those made across the Canadian line at Medicine Hat and at Bow Island, where some of the largest gas wells in the world have been developed. The topographical and geological features of the Sweetgrass hills in northern Montana seem to indicate that in those hills are the oil reservoirs responsible for the remarkable production of the Canadian wells. Near Havre two gas wells are already producing 1,000,000 and 5,000,000 ft. of gas per day, respectively, which is being piped to the city for commercial purposes.

DENVER—Apr. 7

A Unique Attitude Toward a Corporation is being manifested by Boulder County mining men. Throughout the history of Colorado there has been a determined opposition by ore shippers to any increase in freight rates, but in this instance mine owners and prospectors are advocating an increase. For some years the Denver, Boulder & Western R.R.—otherwise known as the Switzerland Trail of America—has been operating at a loss. This state of affairs became so acute that recently the company announced its decision to cease operating the property and forfeit the franchise. At this juncture, the few shippers in this mountain region, served alone by this picturesque, narrow gage railway, decided they could ill afford the discontinuance of railroad service, and by personal solicitation secured a general sentiment favoring higher rates which would justify the railroad company in continuing. Accordingly, announcement is made of an advance of appproximately 20% in both passenger and freight rates.

Splitting Up of Former Holdings of Golden Cycle Mining Co. has had the almost paradoxical effect of enhancing the market value of stock in this company as well as of the stock in the Vindicator Consolidated which has just purchased the Golden Cycle mine. President Adolph J. Zang, in a letter to Vindicator stockholders, says: "It is the intention of your board of directors to devote the net earnings from the Golden Cycle mine to the liquidation of notes issued to complete its purchase and, in so doing, it is expected to cancel the final note some months before its maturity. There have been rumors in the press that the Vindicator company would increase its capitalization, also that it would suspend payment of dividends until the entire note issue was canceled. No change in capitalization has been or is contemplated and it is not anticipated that the retirement of the notes will, in any way, affect the payment of the regular quarterly 3% dividends." Golden Cycle stockholders will hold a special meeting to consider changing corporate name to Golden Cycle Mining & Reduction Co. As a publicity stunt, Manager E. F. Smith, of the company's mill at Colorado City, entertained press representatives and other guests with an exhibition clean-up and bullion melt followed by "tiffin." The plant now treats 1100 tons daily at an average milling profit of $2 per ton.

SALT LAKE CITY—Apr. 8

The University of Utah Affairs show little advance toward satisfactory solution or adjustment. At a meeting of the board of regents a motion to remove the president was voted down 10 to 3. Professor Lovejoy of Johns Hopkins University, representing the American Association of University Professors, is here investigating the causes of trouble. The purpose of this professors' society is to investigate conditions at all American universities as to what professors may do in the way of free speech.

George Graham Rice, publisher of the New York "Mining Age," promoter, etc., is in Salt Lake for the purpose of getting information about mining properties in the Alta and Big Cottonwood districts, and incidentally for the purpose of booming these camps. He has been welcomed here by the brokers, but sentiment among mining men is divided, or opposed to a boom of the camps in question, holding that conditions are good enough as they are and that a reaction would follow.

A Utah Chapter of the American Mining Congress was formed at a meeting of mining men held at the Newhouse Hotel on Apr. 5. The purpose of the organization is to enable mining men of the state to act as a unit in matters of especial import to them, such as fighting adverse legislation effecting taxation, labor, smelting, freight rates, and other matters, and to disseminate reliable information relative to Utah's mineral resources and other opportunities for investment in all parts of the state. G. H. Dern, third vice-president of the American Mining Congress, acted as chairman. The congress has taken rooms on the third floor of the Boston Building for its headquarters. Further steps in perfecting the organization will be taken.

Proposed New Town for Bingham District—Much opposition has developed to the attempt to incorporate the new town of Phœnix in the Highland Boy district in upper Carr Fork Cañon. A petition asking for incorporation signed by 49 residents was filed with the county commissioners. The day following most of the signers of the first petition and many others filed a protesting petition, declaring they had signed the first petition under a misunderstanding. It is alleged that the purpose of the proposed incorporation was to reinstate the saloons, closed by the local option election of 1911. The ground included in the proposed incorporation would extend from the Utah Apex mill up to 500 or 600 ft. above the Yampa, and would be about 400 ft. wide along the cañon. The mining companies are opposed to it, because it would increase their taxes without any benefit and would undoubtedly decrease the efficiency of their men. The new law regarding moving liquor into dry territory is more stringent than formerly, as the breweries or shippers are responsible, so that it has not been possible to ship so much beer into Bingham as heretofore. The principal pro-incorporators are liquor and saloon men. Three hearings have been held on the question before the county commissioners of Salt Lake, and the matter has been taken under advisement. A census may be taken to determine the population of the ground in question.

The San Rafael Oil Field in central Utah, comprising an area in Emery, Wayne and Garfield counties, lying west of the Grand River and south of the Denver & Rio Grande R.R., has been under investigation for about three years and strong interests have acquired control of the most favorable territory. The Des Moines Oil Co., T. A. Harding, president, and the Duquesne Association, organized by W. L. Curry and associates of Pittsburgh, have large areas in the field and after investigation of the geology and conditions have made preparation for drilling. The Des Moines company drilled a well 2910 ft. deep, encountering three oil and oil-and-gas sands but failed, by reason of the light rig used, to reach the big sand, 300 ft. thick, which is calculated to be about 3600 ft. deep here. The Mount Vernon company also drilled a deep well about six miles southwest of the Des Moines hole but did not reach the big sand. The upper sands cut in these holes were not tested for oil but are reported to have possibilities. Plans for further drilling are under way. The strata of the field are exposed to a depth of from 2000 to 5000 ft. in adjacent cañons. The survey of the Southwestern Pacific R.R., a projected new line from Denver to Los Angeles, runs diagonally through the field.

The New Plant of the Hercules Powder Co. at Bacchus, Utah, has been completed, and was formerly opened Mar. 29, when it was visited by a party of 175 mining and business men as guests of the company. The plant was inspected and the various processes in the manufacture of high explosives and black powder were shown. Members of the party, who registered at the office, were relieved of matches preparatory to going through the works. The sodium-nitrate storage house and the drying house for wood pulp were first visited; then the nitric-acid plant, where the acid is made from sodium nitrate and sulphuric acid; next the ammonium-nitrate plant; the sulphuric-acid plant, where acid is manufactured from pyrite by the contact process, the pyrite being obtained from Bingham. Some distance from these is the building where the acids and glycerin are weighed and mixed, the nitroglycerin being taken in a rubber-tired wagon to a building where it is incorporated with the base, for gelatin powder. The mixing is done in a machine made largely of phosphor-bronze. A similar process for mixing the nitroglycerin with wood pulp, etc., for regular dynamite, in a kind of chilean mill with rubber-tired rolls is carried on in another building. Lunch was taken at the club at Bacchus, followed by a speech by Governor Spry, welcoming the Hercules Powder Co. to Utah, and calling attention to the policy of the state to encourage the investment of capital. J. T. Skelly spoke for the company, mentioning the care taken of the employees, whom it encouraged to become stockholders. He said that stock awards were made for inventions, improvements, etc., around the works. After lunch the section of the plant where black powder is manufactured was visited. The black-powder section is in a gulch, where natural protection in case of explosion is afforded, no artificial embankments of earth, such as used around the buildings in the dynamite section, being necessary. The plant covers 2280 acres, and is the most modern of the company. To start with, the working forces consist of 95 men, taken from other plants of the company. The capacity of the plant is 1,250,000 to 1,500,000 lb. dynamite a month, and 500 kegs of black powder per day. Bacchus is on the west bench of the valley, 20 miles from Salt Lake City, and 13.5 from Bingham; elevation 4899 ft. The town has 38 modern houses, a club run by the employees, hotel, store, etc. These are a mile from the main works. Stanley B. Moore, from Hercules, Calif., will be the superintendent.

SEATTLE—Apr. 6

The Earliest Thaw in the history of the Yukon is now under way. The winter trails are fast going to pieces, dredges are preparing for summer work, and Dawson and the entire surrounding country has more men than can obtain employment.

A New Dredging Field will be opened this summer in the Six Mile Creek district near Seward by the Sunrise Dredging Co., which is now having constructed in Seattle by the American Dredge Building & Construction Co. a 2-ft. bucket, double-flume, screen dredge, which will be placed on the ground in June. The claims which are owned by Charles E. Herron and Dr. P. T. Barnes were opened last summer with a Keystone drill and good pay found. The district was first opened up about 18 years ago and yielded more than $1,000,000 in gold won by wing damming the stream. Because of the thawed condition of the ground and the heavy flow of water it was impossible to work the bed gravel or islands in the creek. The only gold taken out was that found on the high rimrocks. In the country contiguous to Seward there is an immense area of low-grade placer ground which will yield big profits if operated by labor-saving devices, and the dredge to be installed this summer, it is believed, will be the [illegible] of a large number of these machines. Kenai River, about 50 miles long and very wide, for many years [illegible] been producing grubstakes for miners operating with [illegible] boxes and some satisfactory cleanups have been made with a hydraulic plant.

LOVELOCK, NEV.—Apr. 8

The New Gold Strike nine miles east of Lovelock has aroused considerable excitement. The ore is gold quartz in a ledge about 10 ft. wide. The find is in a gulch and no depth has as yet been attained. The outcropping ledge is being sacked for shipment, most of it showing free gold. The discovery claim was sold a few days ago for $2000. The day of this correspondence, 15 or 18 automobiles with from two to seven people each have visited the camp. All comments are favorable and considerable activity is expected. The camp, which has been named Willard, after the little white hope champion, is five miles from the Southern Pacific and four miles from the electric power line between Hazen and Rochester. There is no water nearer the camp than the Humboldt River, which is six miles distant.

PATAGONIA, ARIZ.—Apr. 5

An Interesting Reminder of Former Days is a bar of lead from an old smeltery, plowed up in a field below the Mowry wash. It is marked S. M. and is supposed to have been smelted by Sylvester Mowry during war times. The United States Government finally seized the mine upon suspicion that it was supplying the Confederacy with lead. The bar, which weighed about 50 lb., has not yet been assayed but it is thought that it carries considerable silver. Another reminder of former days, is the visit of Raphael Pumpelly to the scenes of his early activity when chemist of the Santa Rita Co. He came out with his children to show them, he said, where he had his well known adventures in the Apache days. The old hacienda can still be traced by the walls of adobe standing on Magee Creek. One of the old mines worked by the Santa Rita Co., now called the Mills, is located just above the old buildings and had fabulous values in silver. Just now the whole neighborhood is tied up in the Baca litigation, and there is nothing being done with any of the mines.

JOPLIN—Apr. 9

It Is Rumored Here that a "Press Bureau" is in process of formation by a number of mine promoters. Investors who may be tempted by the present high price of zinc should take warning.

TORONTO—Apr. 10

The Nickel Question came up again in the Canadian Parliament on Apr. 3, when the Government was asked what action would be taken in view of the numerous petitions sent in asking that the refining of nickel should be done in Canada. The reply of Sir George Foster, Minister of Trade and Commerce, though nonofficial, was taken to indicate decisively that nothing would be done in the matter. He stated that while the Government had a large interest in the question, it had reached no conclusion either as to prohibiting the export of matte or undertaking the refining of nickel, which would involve many questions respecting the necessary capital and equipment. The matter may be regarded as finally set at rest so far as any action on the part of the Canadian Government is concerned.

Rumors Regarding a Dividend on Dome Stock have been quieted by the semiofficial statement that no such move is contemplated at the present time. Recent developments on the sixth or 544-ft. level have been very encouraging and the diamond drill has cut a horizontal section 157 ft. wide that assays $16.48 a ton. This is the greatest width of any such grade of ore that has been found in the mine below the 100-ft. level. Much work remains to be done on this property before the present plans now under way are completed. The capacity of the mill is to be raised from 23,000 to 28,000 tons a month. Underground electric haulage is being installed, and a large crushing plant is being put in on the 544-ft. level. At present the greater portion of the ore comes from the glory holes, so that the returns from the higher grade ores on the bottom levels will not be felt for some time to come. The cash in the treasury amounts to about $350,000, and there is some talk of [illegible] of the treasury shares at par. In this event the [illegible] would be used to finance additional development, and for further increasing the capacity of the mill.

The Mining News

ALASKA

JAY LIVENGOOD, who made gold discovery on Livengood Creek which started stampede, has sold interest in eight claims to David Cascaden for $40,000. Cascaden has been investigating property for past three months and finds that values run $3 per foot.

RAMBLER GOLD MINING (Valdez)—Has been taken in charge by U. S. Marshal on writ of attachment. Most of claims which amount to $2293 are for labor.

PATSY & BAY VIEW (Valdez)—Driving tunnel on ledge 25 to 30 ft. wide with 7 ft. of gold ore that will average $27.50 per ton. Dunk Stewart is superintendent.

YUKON GOLD (Dawson)—Is stated will acquire all Treadwell concessions here on account of financial difficulties latter find themselves in. Labor liens and other indebtedness amount to about $100,000.

ALASKA JUNEAU (Juneau)—During past 18 years 30-stamp mill has handled 295,807 tons ore from selected surface workings yielded $2.26 free gold per ton. Ore was sorted and about 37% rejected. December run-of-mine ore, 7652 tons, averaged $1.66; January run-of-mine, 7900 tons, averaged $1.56 per ton.

ARIZONA

Gila County

OLD DOMINION (Globe)—After shut-down since Mar. 5 on account of partial flooding of mine from unusual rainfall, operations have been resumed. Concentrator and smeltery also started.

INSPIRATION (Miami)—Copper production will begin in new combination water-concentration and oil-flotation mill in June. Mill will have 18 sections, each with capacity of 800 tons daily. First nine sections almost complete; second nine will be ready by end of year.

MIAMI (Miami)—Five sections of mill in operation though not up to capacity. Sixth section has been altered according to plans to get better results. Fifth section changed some months ago with resulting gain of two pounds more copper per ton will be further altered to conform to latest plans. Work on all sections to be pushed to bring production up to 50,000,000 lb. copper per year.

Mohave County

GOLD REED M. & M. (Oatman)—New head frame is being erected. Hoist is to be installed.

ARIZONA SOUTHWESTERN COPPER (Yucca)—Work on this property to be resumed at early date.

CARTER GOLD (Oatman)—Company is negotiating for an air compressor and drills. It is intention of company to continue sinking shaft.

RAINBOW MOUNTAIN (Chloride)—Is getting ready for shipments of ore. Large tonnage of high-grade smelting ore is in sight. Mineral content is chiefly lead.

TYRO (Union Pass District)—Orebody exposed by crosscuts from shaft average 30 ft. in width, of good milling grade. Company is negotiating for full equipment of mining machinery to enable it to sink to 500 feet.

WALNUT CREEK M. & M. CO.—This property in Maynard District, in Wallapai Mountains includes old Pride of the Pines Claim, site of probably the first discovery of ore in this district about middle of last century. Work is to be resumed at an early date. Property under management of George E. Worton.

Yavapai County

SUNRISE (Prescott)—Sunrise mine in Hassayampa district has been reopened after long idleness.

CROOK CAÑON (Turkey)—James Shaers and J. H. Cross are operating arastres on their property. Theising & Schultz are also operating one at Turkey Creek.

EUREKA (Walker)—During last 60 days Eureka and Fortune mines have shipped 240 tons of ore to Poland mill. From Eureka, shipments of high-grade are made to Douglas smeltery.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Preparations being made for installation of new 40-stamp mill, notwithstanding appeal of Kennedy Extension Gold Mining Co. from decision of Court in favor of Argonaut in apex suit.

Butte County

F. B. STEIFER MINING (Oroville)—Superior Court granted injunction restraining directors from selling stock for nonpayment of assessments. Directors are charged with having sold stock to amount of $400,000 and to have mined only $1700 worth of ore since 1901. Stockholders want to know.

Kern County

GOLD PEAK (Caliente)—A. T. Copley representing southern California men is reported to have taken over this property in Amalie district. Stamp mill is being installed.

Madera County

ENTERPRISE (Grub Gulch)—Preparations are being made to resume mining. Installation of new machinery is contemplated.

TEXAS FLAT (Coarsegold)—New electric power line, part of San Joaquin Light & Power Corporation system, nearing completion. Mining operators have put in poles; wire is on ground ready for stringing. Power company will make connections. Effort will be made to extend line into Grub Gulch district.

Nevada County

RAGON FLAT (Nevada City)—New electric hoist is nearing completion. Electric power line has been built to mine. Old inclined shaft is being repaired and pumping will begin as soon as installation is complete.

Placer County

GARDELLA DREDGE (Auburn)—Dredge completed and given first trial run. Lawrence Gardella who operates dredges at Oroville is owner and contemplates putting dredged land in condition for planting oranges.

Shasta County

MAMMOTH (Kennett)—Supplies are being taken to Spread Eagle in preparation for extensive development. John Muir is superintendent of this newly acquired property.

LITTLE NELLIE (Kennett)—Large body of copper ore recently encountered has induced owners of Pittsburgh-Mt. Shasta Gold Mining Co. to consider installation of treatment plant. Property formerly worked as gold mine is equipped with 15-stamp mill. Concentrates were shipped to Martinez.

Sierra County

NORTH FORK (Forest)—After exhaustive examination by Blue Sky Commission, permission has been granted to company to sell sufficient stock to develop and equip this mine.

TWENTY-ONE & RAINBOW (Alleghany)—Companies have been consolidated and new organization is preparing to work both mines on large scale. Will install 20-stamp mill. D. W. Mitchell, manager of Twenty-one, will continue under consolidation.

PLUMBAGO (Alleghany)—New building to house 20 stamps to be built to replace plant recently burned, although but 10 stamps will be installed at present. Plumbago has been rich and steady producer for over 20 years and is now owned and operated by Croesus Gold Mining Co. W. B. Pearson is superintendent.

Siskiyou County

McKEEN (Callahan)—Making preparations to install 20-stamp mill.

Tuolumne County

BLACK OAK MINES & MILLING CO. vs. JOHN B. CURTIN. Suit brought in U. S. District Court for $13,715 to satisfy balance claim of creditor and for accounting of $227,500 purchase price of Black Oak mine at Soulsbyville. Curtin was agent in transfer of property and present owners allege that he did not make strict accounting. Curtin Democratic candidate for governor in 1914 election.

TARANTULA (Jacksonville)—Property purchased by Henry T. Gage, former governor of California, from United Gold Mining & Milling Co. of Paris. The purchase price said to be $12,000, of which one half is paid. Balance in six months.

COLORADO

El Paso County

GOLDEN CYCLE MILL (Colorado City)—Made a new monthly record during March, producing bullion worth approximately $1,305,000, from Cripple Creek ores, representing treatment of 29,000 tons of ore, according to figures made public by E. F. Smith, mill manager, who claims, also, that the mill treated 70% of district's production during that month. This plant is purchasing high grades of ore that have heretofore been treated exclusively by smelteries, the Cresson ore being among those successfully treated thus far by roasting and cyaniding.

Teller County

CRIPPLE CREEK PRODUCTION for March heaviest for years amounting to 77,618 tons, estimated value $1,986,493. Producers were: Golden Cycle, 29,000; Portland, 10,000; Smelters, 5200; Portland (C. C. District), 16,100; Stratton's Independence, 9668; Colb. Ajax, 4300; Neville Free Coinage, 2000; Kav. Jo Dandy, 1000; Wild Horse, 350 tons.

DANTE MILL (Cripple Creek)—After a four-months' shutdown for repairs and improvements mill is again in service treating $5 ore.

JERRY JOHNSON (Cripple Creek)—This mine on Ironclad Hill being equipped with new 100-ton cyanide mill, expected to be complete in 60 days.

IDAHO

Lemhi County

PITTSBURGH-IDAHO (Gilmore)—Thirty leasers and 28 men company account operating property. More leases will be let.

Shoshone County

AMY & MATCHLESS (Wardner)—Erection of 50-ton mill will soon be under way, mill to be running in early summer. Gus Smith is principal owner and manager.

INTERSTATE-CALLAHAN (Wallace)—Has let a contract for construction of 10,500-ft. aërial tram from its mill to Sunset station, on Nine-Mile branch of Northern Pacific Railway. Expected carrier will be completed and ready to operate not later than May 15. This tram will be longest in Cœur d'Alenes, and third longest in West.

MICHIGAN

Iron

BRISTOL (Crystal Falls)—Order will be placed shortly for new 2500-ft. compressor for this mine.

OLIVER IRON MINING CO. (Escanaba)—Crushing plant will be started within next 10 days.

CARPENTER (Crystal Falls)—This is first mine in Michigan to ship ore this year. Several trainloads sent to Escanaba docks this week. Carpenter is new mine operated by M. A. Hanna company.

CHASE (Ishpeming)—Ore at this place about worked out and mine will be closed sometime in May. Exploratory work has been done in region of Chase and Dexter mines by Cleveland-Cliffs Iron Co. but nothing of value has been revealed.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—Diamond drill set up on ice on North Lake close to North Lake mines of company. Piles have been driven through ice and into lake bottom. Body of hematite known to underlie lake, but further testing is thought advisable. Two drills now at work short distance to west of lake on lands of Barnes Land Co. Water in lake will probably be pumped out within next few years.

MINNESOTA

Duluth

ZENITH FURNACE CO. (Duluth)—Arrangements now being made to manufacture benzol as byproduct from their coke ovens.

MINNESOTA STEEL CO. (Duluth)—Construction work on Steel Corporation's plant at Duluth will be resumed immediately. Last fall all construction was stopped, although 150 men were kept at repair and maintenance work throughout winter. Resumption on steel plant will also mean resumption on Universal Portland Cement Co.'s plant at same place.

Cuyuna Range

CAVOUR (Kinney)—After four years of shipping, much of which has been unprofitable, mine is now being dismantled and will be abandoned.

ROBERTSON-KINGSTON (Virginia)—Two shovels will be started in few days. This independent operation shipped large tonnage last year.

INLAND STEEL (Brainerd)—Will build experimental concentrator near Ironton and Crosby to serve its Armour No. 1 pit mine, Armour No. 2 underground, and Thompson pit mine. Contracted for 70 hp. electric current from Cuyuna Range Power Co.

Mesabi Range

DUNWOODY (Chisholm)—One shovel was started here Apr. 1. About 100 men are employed. Considerable overburden to be removed. Some ore may be shipped before close of season. Stripping stopped first of year when cold weather set in.

HIBBING—Several electric shovels have made their appearance and will soon be at work in pits. Electric shovels are new in Minnesota. Frank Armstrong, master mechanic for Penn Iron Mining Co. in Michigan, has been experimenting with an electric shovel for two years at Vulcan on Menominee range. He has not made known the results.

MOHAWK (Aurora)—Pumps being pulled from mine, indicating no contemplated activity this season. Many improvements have been made to surface plant in late months, including new shaft house. Mine has large stockpile, which it is assumed will meet all requirements for Mohawk ore during the coming season.

MISSOURI

Jasper County

MAGNET (Carthage)—Stone & Printz reported to be about to build 200-ton mill on Magnet lease, six miles southeast of Carthage.

MONTANA

Beaverhead County

BANNOCK CONSOLIDATED (Bannock)—Consisting of 17 claims bought by J. F. Cowan of the Columbus Extension, Salt Lake, and B. Binnard of Butte. Active development will be begun immediately.

Deer Lodge County

HIDDEN LAKE MINE (Georgetown)—Stockholders of this property have given 90-day option on property to Boston capitalists, whose action will be determined by report of J. A. Shoemaker, of Butte, who went to mine to make examination. Property one of most promising in Georgetown district

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—During the month of March, North Moccasin mine of this company produced and milled 4807 tons of ore. The resulting bullion cleanup amounted to 3060.8 oz., which should return approximately $55,000. Yield per ton of ore, $11.41.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Output of Black Rock mine and mill treating this output broke all its records during the month of March, averaging 1345 tons per day.

ANACONDA (Butte)—March output was 19,000,000 lb. of copper. Company operated at about 70% of capacity April showing is expected to be about 85% of normal capacity, with starting up of four additional mines and resuming work at Great Falls smeltery

ANACONDA VS. PILOT-BUTTE (Butte)—On Apr. 5 Judge Lynch granted motion for leave to amend complaint. An exception was taken by Pilot-Butte. Amendment was to cover additional ground developed since original restraining order was issued in October, 1913, and is to embrace new lines within which Pilot-Butte may not conduct operations pending final decision of merits of dispute as to ownership of vein below 1800 level of Pilot-Butte Anaconda claims it is part of Emily vein. Pilot-Butte claims it is separate vein within its own grounds. Recently the Pilot-Butte was declared in contempt of court for violating first restraining order.

NEVADA

Clark County

WHALE (Goodsprings)—Compressor and other equipment being installed, production of good-grade zinc ore will start in short time. Considerable activity in Goodsprings district, 11 properties producing and much development work under way.

Elko County

CLOVER MINING CO. (Wells)—Group of five claims, 30 miles south of Wells, operated by lessees, making regular shipments good-grade zinc ore.

BLUSTER CONSOLIDATED (Jarbridge)—Built a sawmill during winter and got out timbers for 10-stamp mill now being erected Considerable tonnage of $12 to $15 ore blocked out.

Esmeralda County

NEW EMPIRE GOLDFIELD MINES (Goldfield)—Corporation formed to develop property of Old Empire Mining Co., adjoining Blue Bull, Lone Star and Commonwealth groups. Will install 40-hp. electric hoist at 150-ft. shaft and continue sinking to 400- or 500-ft. level.

GOLDFIELD COMMONWEALTH (Goldfield)—Control acquired by California men. Property consists of 130 acres, patented, in southeast part of district adjoining Lone Star and Merger groups. Main shaft, 410 ft. deep, equipped with 50-hp. electric hoist; sinking will commence at once.

Humboldt County

GLASGOW & WESTERN (Winnemucca) — Leaching plant 200 tons daily capacity contemplated at old mill site.

BUCKSKIN-NATIONAL GOLD MINES (National)—Lease on block adjoining company workings let to Dunn and Staunton, of Winnemucca. Crosscut tunnel will be driven 800 ft. to cut vein at depth of 400 ft.

ROCHESTER MINES CO. (Rochester)—New stamp mill, recently put into operation, equipped with ten 1550-lb. stamps, two tube mills, five agitators and five continuous-decantation tanks. Crushing is done in solution; precipitation on zinc shavings.

Lander County

PLACER MINING IN IRON CAÑON, near Battle Mountain, is under way. Some coarse gold found.

SECOND PLACER CHANNEL ON WILLOW CREEK, near Battle Mountain, discovered recently. Channel is 30 ft. below surface and 26 ft. below upper channel. Channels are not parallel.

Lincoln County

PIOCHE ORE SHIPMENTS for week ended Mar. 27 were 86 cars; about 4300 tons, estimated value $43,000. This compares with 80 cars the week previous and 84 cars two weeks previous.

PRINCE CONSOLIDATED (Pioche)—During March 15,385 tons of ore shipped to Salt Lake smeltery.

Nye County

TONOPAH ORE PRODUCTION for week ended Apr. 3 was 10,117 tons, estimated value $208,066, as follows: Tonopah Belmont, 2830; Tonopah Mining, 2950; Tonopah Extension, 1700; West End, 1129; Jim Butler, 1100; Tonopah Merger, 150; North Star, 50; and Halifax, 208 tons.

TONOPAH BELMONT (Tonopah)—Shipment 131,535 oz bullion valued at $93,000 made from mill clean-up for first half March.

MONTANA TONOPAH (Tonopah)—Oreshoot, believed to be in Martha vein, cut on 390-ft. level; 2½ ft. wide assaying $25 per ton.

BIG PINE (Manhattan)—Lessees with crew of 24 producing 375 tons ore per day from glory hole and one stope on 200-ft. level. Ore crushed, tube-milled and all slime plated. Tailings average 40c. and are stacked Daily consumption of tube-mill pebbles from local quarry 170 lb Dynamite used per day 75 lb. Total cost mining and milling 45c. per ton.

Storey County

C. & C. (Virginia City)—Transformer burned on 2500-ft. level. Fortunately timbers did not ignite.

NORTH END COMSTOCKS (Virginia City)—Electric pumps expected to operate Apr. 15 and complete unwatering 2700 level to be effected Apr. 18

CONSOLIDATED VIRGINIA (Virginia City) Raising and sinking under way in oreshoot recently opened on 2500-ft level Ore assays $7 per ton.

Washoe County

RED METALS CO (Reno)—This copper property on Peavine Mountain acquired by Charles B Bills, president, Pioneer Fruit Co., Sacramento, Calif. Large installation machinery being made, leaching plant may be built.

White Pine County

CONSOLIDATED COPPERMINES (Ely)—Has resumed production from Ora claim of Giroux at entrance to Liberty pit of Nevada Consolidated. Latter company does [illegible] at no expense to Giroux which pays freight and treatment charges.

NEVADA CONSOLIDATED (Ely)—Operation [illegible] Ruth mine will be resumed, no work done since [illegible] will be mined by caving system and hoisted through [illegible] Pointer shaft. Considerable repair work necessary, [illegible] now employed. Expected production will commence [illegible] days. William Spencer from Bingham will be superintendent

UTAH

Juab County

TINTIC ORE PRODUCTION for March was 35 cars, or 17,800 tons, estimated at $450,000. This is compared with 297 cars in February and 430 cars in January. Shippers were: Centennial-Eureka, 80; Iron Blossom, 71; Chief Consolidated, 50; Eagle & Blue Bell, 34; Lower Mammoth, 17; May Day, 16; Gemini, 13; Dragon Consolidated, 12; Grand Central, 9; Victoria, 6; Bullion Beck, 6; Sioux and dump, 6; Colorado, 5; Gold Chain, 5; Beck Tunnel, 4; Uncle Sam, 4; Yankee Consolidated, 3; Dubuc dump, 3; Eureka Hill, 3; Opohongo, 2; Carisa lease, 2; Godiva, 2; Ridge & Valley, 1; Minnie Moore lease, 1; Clift lease, 1 car.

TINTIC DELMAR (Eureka)—An 18-in. vein of iron and quartz is exposed in a winze from the tunnel level.

EAGLE & BLUE BELL (Eureka)—A full face of silver-lead ore has been opened in new ground in a drift south from the 1700-ft. level

CENTRAL HILL (Eureka)—Work is to be done at this property on Godiva Mountain, from 400-ft. level of Grand Central. C. E. Loose and associates are interested.

KNIGHT-CHRISTENSEN MILL (Silver City)—Spark from drier started fire in oil room, causing destruction of mill. Total loss, $75,000 to $100,000; no insurance. Expected new mill will be built.

BULLION BECK (Eureka)—Goodwin, Watkins & Anderson, recently operating jigging plant at Uncle Sam, have taken lease on old Bullion Beck dumps. Four jigs are being installed.

CHIEF CONSOLIDATED (Eureka)—Development work on 1800-ft. has opened ore chute, from which part of the mine's output is coming. Diamond drilling has opened bodies of quartz, which will be further prospected.

LOWER MAMMOTH (Mammoth)—Zinc ore is being broken between the 1500- and 1800-ft. levels. Promising ground south from the 1000-ft. level is being developed on company account. A night shift has been added. Eight sets of lessees are working. A car of ore per day is being shipped.

MAY DAY (Eureka)—March output amounted to 26 cars, and since Mar. 10 production has exceeded car of ore daily. Zinc ore is being shipped by leasers, and company is mining silver-lead ore from western part of property. Annual report for year ended Mar. 31 shows 1785 tons of lead ore, valued at $60,088: and 446 tons of zinc ore valued at $4342; and 1313 tons of lead ore, valued at $27,065, from lease on Chief Consolidated ground to have been shipped.

Piute County

WEDGE (Marysvale)—Shipment of high-grade gold ore has been made from this property in Ohio district. Ore occurs in lenses up to 1½ ft. thick, along hanging wall of quartz vein, 5 to 8 ft. thick. Formation is rhyolite cut by porphyry dikes.

Salt Lake County

UTAH CONSOLIDATED (Bingham)—Earned last year $1.81 per share compared to $2.12 year previous. Mined 153,345 tons copper ore and 48,492 tons lead ore. Present ore reserves, slightly less than a year ago, 256,521 tons ore averaging 1.9% Cu, and 50,365 tons averaging 16.48% lead.

Summit County

PARK CITY PRODUCTION for March was 8182 tons of crude ore and concentrates estimated at $320,000, compared with 7859 tons valued at $313,000, for January and 8517 tons, valued at $338,000 for February. The totals for the leading producers were: Silver King Coalition, 3789; Daly West, 1660; Daly-Judge, 1655; Silver King Consolidated, 728; Daly, 50; others (estimated), 300 tons.

SNAKE CREEK TUNNEL (Park City)—Breast is now approximately 11,000 ft. from portal. Yet 3000 ft. to be driven to complete contract, after which contract for another mile will be let.

WASHINGTON

Pierce County

TACOMA SMELTING (Tacoma)—Safety methods being taught foreign employees by photographs. Hereafter when an accident occurs it will be pictured with workman posing as when hurt and with another pose showing him as he should have been. These pictures 10x12 in. are being framed in plain black frames and posted at the plant.

Spokane County

LAKE CREEK PLACER MINING (Spokane)—Has been organized to work placer deposits in northern Idaho. Operations will begin as soon as melting snow provides sufficient water. Concern is capitalized for 500,000 shares at $1, and has acquired 800 acres of dredging and hydraulic ground between the old camps of Florence and Warrens, in Idaho County

Stevens County

SCOTIA, on the east side of Kettle River between Marcus and Orient, will be opened and worked this spring. A 2500-ft. tramway is to be erected connecting the mine with Great Northern tracks. Ore, high in copper, will be shipped to Granby smeltery.

OLD DOMINION (Colville)—An appropriation of $25,000 has been made for reopening and timbering mine on Dominion Mountain, which has a rich silver-lead orebody, said to have produced more than $1,000,000 in last 30 years, of which $650,000 has been put back in development. Mine has 17,000 ft. of underground workings. W. H. Linney of Spokane is president.

Whatcom County

GREAT EXCELSIOR (Glacier)—Fred J. Wood and Frank Wright, Bellingham, Wash., have acquired control of Hammond Mining Co., owner of Great Excelsior mine, and are reported to intend installing cyanide plant.

WISCONSIN

Grant County

ALDERSON (Platteville)—Kistler & Stephens struck 2-ft. sheet of jack in drifting toward East End extension.

BIRDBECK (Days Siding)—H. S. Snow and others made valuable discovery of zinc ore in several drill holes at Days Siding.

WEIGLE (Platteville)—Spies & Habel drilled through 3 ft. of rich jack ground on Weigle land just west of the Klar-Piquett mine.

WISCONSIN ZINC (Platteville)—Company is opening up East End Extension and will install an aërial tram to connect with East End mill.

KLAR PIQUETT (Platteville)—Operations have been resumed after year's shutdown; 500 tons of concentrates stored in bin are being roasted at Homestead.

HARRIS-MURPHY (Big Patch)—J. M. Nelson and others of Davenport, Ia., have commenced shaft sinking at Big Patch where 400 acres were recently sub-leased.

WEST HILL (Platteville)—This new producer paid its first dividend of 20% on capital stock of $20,000. Last three cars of raw concentrates assayed 57% zinc.

Iowa County

B. M. & B. (Mifflin)—Company has completed milling plant on Biddick land.

Lafayette County

KITTO (Benton)—Vinegar Hill Zinc Co. has sunk shaft and erected mill on this new property.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—Is to resume to take advantage of better copper prices. Considering a new mill 1000 tons daily capacity.

GRANBY (Grand Forks)—During March 72,248 tons of ore were smelted at Grand Forks compared with 52,500 tons during February. Of the total Granby employees 39% are English speaking, 22% are Scandinavians and 20% are Austrians.

BLUEBIRD (Rossland)—E. L. Tate and Roy H. Clarke of Spokane have been inspecting the Bluebird mine owned by Rosalia Mining Co., from directorate of which Mr. Tate recently resigned in order to be in position to take up working option on property.

RAMBLER-CARIBOO (Three Forks)—It is announced by superintendent that 3 ft. of ore, assaying 268 oz. in silver and 65% lead, has been encountered in the 900-ft. level. The strike is said to be a new shoot, presence of which was unsuspected.

Ontario

SHAMROCK (Cobalt)—Will be reopened.

NIPISSING (Cobalt)—Mills have been closed down owing to shortage of power.

PEARL LAKE—(Porcupine)—This company has made an assignment to G. T. Clarkson, of Toronto.

PORCUPINE IMPERIAL—Compressor plant has been purchased and development will be proceeded with at once.

PORCUPINE CROWN (Porcupine)—Running at 50% capacity on account of power shortage. Production for March about $50,000.

McKINLEY-DARRAGH (Cobalt)—Annual report shows $53,515 spent on Jupiter property in Porcupine, under option to McKinley-Darragh.

APEX (South Porcupine)—A. M. Bilsky, one of directors, states that affairs of this company are to be reorganized and plan for refinancing prepared.

CHAMBERS-FERLAND (Cobalt)—Shareholders will fight proposed transfer of shares in Chambers-Ferland for shares in Aladdin, an English company.

JUPITER (Porcupine)—At annual meeting of McKinley-Darragh held recently question of taking up Jupiter option again was not mentioned.

MIRACLE (Porcupine)—New mill has started and is treating 40 tons per day. If results are satisfactory, capacity will be increased to 150 tons per day.

REA (Porcupine)—High-grade orebody discovered by diamond-drilling is stated to be 10 ft. wide. More holes are being drilled and crosscut will be run to it.

McINTYRE (Porcupine)—Officially stated that diamond drill operating from 400-ft. level of shaft No. 5 has cut the vein 100 ft. below and shows 12 ft. of good ore.

VIPOND (Porcupine)—New orebody opened up for 125 ft. In places through which the crosscut has been driven the deposit is 15 ft. wide and higher grade than shown in other veins.

BEAVER (Cobalt)—In 1914 mined 908,000 oz. of silver and sold 390,000 oz.; balance being held for higher prices. This is record year's production for the company. Ore reserves total 1,200,000 ounces.

COBALT LAKE—Electric pumps which are to be used in de-watering Cobalt Lake are now in position and only waiting for supply of power. Volume of water to be drained into Lake Timiskaming estimated at 800,00,000 gallons. Work will occupy greater part of this summer.

CANADIAN MINING & EXPLORATION—Annual report of President Ambrose Monell states large number of investigations made of properties in Canada, United States and Cuba but no purchases effected though several properties considered had merit and would have justified exploitation under favorable terms.

The Market Report

METAL MARKETS

NEW YORK—April 14

Copper was remarkably stronger upon fairly large transactions. Tin continued to be as erratic as in previous weeks. Lead turned a shade easier following the recession in the London market. The extraordinary situation in spelter continues unabated.

Copper, Tin, Lead and Zinc

Copper—The market rose sharply upon fairly large transactions, which for the major part were with domestic manufacturers, but also for the major part were supposed to be destined for military consumption in Europe. However, there were some further signs of increased buying for domestic peaceful purposes. On Apr. 13, the market had reached a basis of Apr. 14, there were still sellers in quantity at that price, but by the end of the day the market was firmly established on the basis of 16½c., regular terms. Sporadic sales of copper for delivery to out-of-the-way places have been made at fancy prices; fancy prices also have been realized on special brands of Lake copper.

Copper exports from the United States for the week ended Mar. 27 are reported by the Bureau of Commerce at 22,503,362 lb. The chief items were 6,571,652 lb. to Italy, 6,270,771 lb. to Great Britain, 4,822,991 lb. to Sweden, 3,767,021 lb. to France and 770,585 lb. to Norway. Imports were 2,835,229 lb. metal and 272,633 lb. in ore and matte; 3,107,862 lb. in all, chiefly from Peru.

Exports for the week ended April 3 are reported at 10,623,248 lb., chiefly to Great Britain and France. Imports were 404,539 lb. metal and 541,742 lb. in ore and matte.

Copper Sheets base price was advanced ¼c. per lb. on Apr. 8 and on Apr. 13 another ¼c., and is now 21¼c. per lb. for hot rolled and 22¼c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 17⅛@17⅜c. per lb., carload lots at mill.

Brass Prices were advanced about ½c. per lb. Apr. 8, the base prices being as follows: Sheets, high brass, 18⅝c. net per lb.; low brass, 19⅞c. Wire, high brass, 18⅜c.; low brass, 19⅞c. Rods, high brass, 18⅜c.; low brass, 20⅝c. Tubes, 22¼c. both brazed and open seam. Angles and channels, 22¼c. Scrap allowances, 13⅛c. net per lb. for high brass; 13⅞c. for low brass.

Tin—This market continued to be erratic, fluctuating sharply from day to day on trifling business. The total for the week was estimated to have been but little more than 100 tons. The new British regulations governing the shipment of tin hither have excited considerable discussion. Tin coming here must be, in the first instance, consigned to the British Consul, following which buyers have to comply with a variety of regulations, some of which are considered to be unworkable. Conferences respecting modifications of these are being held.

Lead—But little business was reported, the recession in London having cut off buying for export, following which independent producers turned sellers at the price of the A. S. & R. Company.

Exports of lead for the two months ended Feb. 28 continue to show the same increase that was noted in the second half of last year.

Spelter—Substantially the same conditions as last week continued to prevail in this market, but the aggregate of transactions was a little larger. This was due in part to buying by domestic galvanizers. No export sales were reported during the week. There was evident a little more readiness to enter into contracts for delivery as late as July, and even as late as August when coupled with the earlier months. There was a wide range in prices realized, both according to time of delivery and according to sellers. Sales were reported for prompt metal at above the range and for distant deliveries below the range of our quotations, which average the market as nearly as we are able to do so.

Zinc sheets, base price remains $13.50 per 100 lb., f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The demand is reported good and sales large.

The La Harpe Spelter Co., of which George E. Nicholson is general manager, is now operating the smeltery at Altoona, Kan. The old plant at La Harpe, Kan., is being dismantled.

The Pittsburg Zinc Co. has resumed smelting at Pittsburg, Kan. It is reported that the old Cockerill plant, or "north smelter" at Pittsburg is to be reopened after an idleness of about 15 years, a Joplin syndicate having secured control.

The American Zinc, Lead & Smelting Co. lost the power house and pottery of its smeltery at Caney, Kan., on Apr. 3, both being burned to the ground and being a total loss. However, smelting was continued without interruption, makeshift engines supplying necessary power while retorts are obtained from Dearing. The capacity of the plant is diminished temporarily by only a little. This is fortunate, for in the present situation the industry needs all possible smelting capacity.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Apr.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb
8	4.7963	50¼	15.80 @15.85	55	4.20 @4.25	4.15 @4.20	8.67½ @9.42½	8.50 @9.25
9	4.7988	50⅛	15.80 @15.90	55 @58	4.20 @4.25	4.15 @4.20	8.67 @9.42	8.50 @9.25
10	4.7975	50⅛	15.90 @16.10	56 @58	4.20 @4.25	4.15 @4.20	8.92½ @9.42½	8.75 @9.25
12	4.7938	50⅛	16.10 @16.20	55 @58	4.20	4.10 @4.15	8.92 @9.42½	8.75 @9.25
13	4.7913	49⅞	16.15 @16.25	55	4.20	4.10 @4.15	8.92½ @9.67½	8.75 @9.50
14	4.7931	49⅞	16.20 @16.35	55	4.20	4.10 @4.15	8.92½ @9.67½	8.75 @9.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brand. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Apr.	Silver	£ per Ton	Cts. per Lb	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb
8	23⅜	71⅛	15.53	71⅞		170	169	21¾	4.73	43½	9.45
9	23⅜	71¾	15.59	72½		169	167½	21½	4.67	43½	9.45
10	23⅜										
12	23⅜	72¾	15.81	73⅜		169¾	168¾	20 3/16	4.39	43½	9.45
13	23¼	71⅞	15.62	72⅝		171	169	20 13/16	4.52	44½	9.67
14	23¼	72⅜	15.72	73		169½	168¾	20 13/16	4.52	45½	9.88

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.86c. Variations, £1 = 0.21½c.

METAL EXPORTS AND IMPORTS

Exports and Imports of Metals other than iron and steel in the United States in the month of January are reported as follows:

	Exports 1914	Exports 1915	Imports 1914	Imports 1915
Copper, long tons	38,164	25,982	15,803	6,649
Tin, long tons	52	30	3,485	3,101
Lead, short tons	1,363	9,532	1,295	4,385
Zinc, short tons	257	15,383	149	28
Nickel, lb	3,501,505	3,475,318	3,831,075	2,588,046
Antimony, lb		112,438	1,531,951	2,470,903
Aluminum, lb			1,231,536	1,272,291
Quicksilver, lb	907	41,931	...	
Platinum, oz			6,817	2,106

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Exports include reëxports of foreign material. Imports of zinc ore for the month this year were 1892 tons, estimated to contain 1,516,597 lb. zinc. There were no exports of domestic ore reported.

Exports and imports of secondary metallic products in the United States in January were as follows, in pounds:

	Exports 1914	Exports 1915	Imports 1914	Imports 1915
Copper sulphate	757,682	697,676	...	...
White lead	1,407,294	1,737,578	...	...
Zinc oxide	2,640,335	2,793,300		...
Zinc dust	6,570	86,660	332,435	153,748
Zinc dross	80,014	328,575	...	...

Exports include reëxports of imported material.

Foreign Mineral Trade of Spain in the month of January, as reported by "Revista Minera," in metric tons:

	Metals 1914	Metals 1915	Ores, etc 1914	Ores, etc 1915
Iron	342	14,656	642,769	271,135
Copper	1,552	263	13,655	1,004
Copper precipitate	985	161	...	...
Lead	16,437	12,514	120	10
Zinc	26	28	12,077	...
Quicksilver		7	...	...
Manganese			2,757	1,771
Pyrites			228,633	72,334

Imports of coal in 1915 were 118,749 tons; of coke, 9464 tons. Exports of salt were 54,776 tons in 1914 and 24,957 tons this year.

FERRO-ALLOYS

Quotations of ferro-alloys at Sheffield, England, last week were reported as follows: **Ferrochrome,** base 60% chromium, £25@26 per ton, according to carbon content. **Ferro Vanadium,** 33 to 40% Va, per lb. of vanadium in the alloy. **Ferrosilicon,** 45 to 50% Si,, £14 10s. per ton, with a scale of 10s. per unit. **Ferrotitanium,** 15 to 18%, Ti, 6¼d. per lb.

Other Metals

NEW YORK—Apr. 14

Aluminum remains quiet, with sales and deliveries chiefly on contract, and not much new business. Quotations remain about the same, at 18¾@19c. per lb. for No. 1 ingots, New York—**Antimony** remains quiet. Supplies are limited but sales are not large. Ordinary brands—chiefly Chinese and Japanese—are sold at 23½@25c. per lb. Cookson's is held at 31@32c. per lb., nominally—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher—**Quicksilver** is still an uneasy and unsettled market. The New York price for large lots is nominally easier at $62 per flask of 75 lb., but no sales are reported. Small lots are held at $75@80 per flask for spot delivery. London prices is £12 5s. per flask, with £12 asked from second hands. San Francisco price is telegraphed at $64.50@65; some dealers still holding at $81 for small lots.

Minor Metals—Current sales of **Bismuth** have been at $2.75@3 per lb., New York.—**Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.—**Cadmium** is quoted in London at 6s.—$1.44—per lb.—**Tellurium** is reported sold at 80s.—$19.20 per lb. in London.

Gold, Silver and Platinum

NEW YORK—Apr. 14

Gold in the United States April 1, as estimated by the Treasury Department. Held in Treasury against gold certificates outstanding, $1,018,711,169; in Treasury current balances, $238,298,497; in banks and circulation, $619,313,873; total, $1,876,326,539, an increase of $43,897,584 during March.

A further shipment of 1,500,000 yen, or $750,000, in gold from Japan for New York is reported. This will make about $15,000,000 gold from Japan this year.

Gold production of the Transvaal in March is reported by cable at 753,186 oz., which is 77,215 oz. more than in February and 66,635 oz. more than in March, 1914. For the three months ended Mar. 31 the total value was $40,612,726 in 1914, and $44,329,729 in 1915; an increase of $3,717,003, or 9.2%, this year.

Gold output of Rhodesia in February was 68,669 oz., being 1413 oz. less than in January and 6921 oz. more than in February, 1914. For the two months ended Feb. 28, the output was $2,867,983, being $367,740 more than in the corresponding period last year.

Silver—Continental orders have been the chief support of the market according to our last advices, without much competition from the East. Orders from India, however, are likely to cause a slight advance at any time.

Exports of silver from London to the East Jan. 1 to Mar. 31, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£1,841,000	£1,528,500	D. £312,500
China	40,000	......	D. 40,000
Total	£1,881,000	£1,528,500	D. £352,500

Coined silver in the United States April 1 as estimated by the Treasury Department: Standard dollars, $565,975,478; subsidiary coins, $185,158,009; total, $751,132,637. Of the standard dollars $498,404,000 are held in Treasury against silver certificates outstanding.

Platinum—The platinum market continues largely nominal, with sales small. Dealers ask $38@40 per oz. for refined platinum. Hard metal is $43@47 per oz. according to grade.

Our Russian correspondent writes that the market is without change. Price for small lots at Ekaterinburg is 8 rubles per zolotnik—$30.08 per oz.—for crude metal, 83% platinum. At Petrograd 31,000 rubles per pood—$30.38 per oz.—is quoted but this is nominal, as there are no sales. Export of the metal is prohibited, but the State Bank advances 23,000 rubles per pood on stocks.

At the conference of gold and platinum producers in Petrograd last month it was stated that the smaller producers have entirely stopped work. The stock of platinum is large, but it is generally in strong hands.

Zinc and Lead Ore Markets

JOPLIN, MO.—Apr. 10

Blende, high price $63; assay base 60% zinc, low in lead, $60@58; down to $54 as lead content increased; metal base $54@46; calamine base, 40% zinc, $30@34; average, all grades of zinc, $55.36 per ton. Lead, high price, $53; base, $51@5 per ton of 80% metal content; average, all grades of lead $51.16 per ton.

Again buying was increased on medium, also on the poore grades, with several large purchases of best grade reserv stock. Despite the inactivity of producers, who are certai they should have a higher price, output is steadily growing a the weather improves.

SHIPMENTS WEEK ENDED Apr. 10

	Blende	Calamine	Lead	Values
Totals this week	11,784,780	856,060	1,457,340	$385,82
Totals this year	149,156,630	13,158,170	22,583,130	$5,293,53

Blende value, the week, $332,920; 15 weeks, $4,511,950.
Calamine value, the week, $15,610; 15 weeks, $238,010.
Lead value, the week, $37,290; 15 weeks, $533,570.

PLATTEVILLE, WIS.—Apr. 10

The base price paid this week for 60% zinc ore was $56 pe ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS, WEEK ENDED Apr. 10

	Zinc Ore, lb.	Lead Ore, lb.	Sulphu Ore, lb
Week	3,895,700	622,400	473,5
Year	54,868,640	1,386,390	5,716,8

Shipped during week to separating plants, 4,040,700 lb. zi ore.

Iron Trade Review

NEW YORK—Apr. 14

New business has been rather light this week. The Ste Corporation's statement shows a small decrease in unfill orders in March, and a great effort is being made to figure o alarming prospects for the near future. This kind of predi tion, made chiefly for political reasons, is not having mu effect in the trade, which is still hopeful of gradual improv ment.

In some lines, such as bars, sheets and plates, the demand almost up to that of a normal year; in wire and a few oth lines it is high. Structural steel orders continue light a railroad business is poor. Two rail orders, of 5000 tons ea have gone to the Sault Ste. Marie mill. The Dominion St Co. has taken a large rail order for Australia, to be rolled the Sydney mills.

The pig-iron market has been quieter; most of the new business has been in Southern iron, which has sold rather freely at $9.25@9.50 Birmingham for No. 2 foundry.

The increase in pig-iron production shown by the April reports is chiefly in the steel works furnaces. The make of the merchant furnaces increases rather slowly.

Pig Iron Production showed a further increase in March. The reports of the furnaces, as collected and published by the "Iron Age," show that on Apr. 1 there were 191 coke and anthracite stacks in blast having a total daily capacity of 70,000 tons, an increase of 7550 tons over Mar. 1. Making allowance for the charcoal furnaces the total make of pig iron in the United States in March was 2,090,000 long tons; for the three months ended Mar. 31 it was 5,416,900 tons. Of this total 3,904,400 tons, or 72.1% were made by the furnaces owned or operated by steel companies.

The United States Steel Corporation reports that the total orders on its books Mar. 31 amounted to 4,255,749 tons of material of all kinds. This is 89,622 tons less than on Feb. 28, but 419,106 tons more than on Dec. 31. It is 398,076 tons less than on Mar. 31 last year.

PITTSBURGH—Apr. 13

The Steel Corporation's reported loss of 89,622 tons in unfilled obligations during March rather surprised the steel trade, as bookings in unfinished steel and in bars, plates and shapes had exceeded the shipments, and there must have been preponderating losses in other branches of the trade, particularly in lines that are out of their contracting season, like wire products and tinplate. Tinplate shipments were extraordinarily heavy in March, the corporation's shipments being the largest for any month in its history, excepting July of last year.

The steel mills are operating at fully 70% of capacity, against an average of 65% in March, and are likely to continue this rate though there is no prospect at present of their increasing it. There are indications that more structural tonnage may come out soon, and this, with anything like normal railroad requirements, would increase mill operations considerably, bringing them nearly up to capacity.

The 1.20c. price on bars, plates and shapes, established by the large mills in western Pennsylvania and Ohio April 1, is taking hold, advices in the past few days being that the eastern mills intend to quote on this basis. In plates and structural shapes the Chicago market has not come up to the new level.

Wire products have softened, and the advanced prices announced Feb. 11, making nails $1.60, are not being obtained. The $1.50 contracts, made at the beginning of the year, were supposed to expire by limitation April 1, but nails can now be bought at $1.55 if not at less.

Export orders continue good, reports being that the Steel Corporation is booking at the rate of 60,000 tons a week, or more than double the rate of last year.

Pig Iron—The local pig-iron market continues very quiet and in some quarters is believed to be softer than appears on the surface. There have been no quotable changes for many weeks, these prices being at least as low as at any time in 10 years. We quote: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13.25; malleable, $12.75; forge, $12.50@12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Some shipments of ferromanganese are believed to be on the way, but reports are more or less uncertain. The steel mills are less uneasy than they were a month ago, expecting shipments to come forward in sufficient volume before stocks are exhausted. The contract price remains at $78, Baltimore, while small prompt lots command about $100.

Steel—The mills entered very large tonnages of billet and sheet bar specifications in March and will have heavier shipments this month than for six months or more. Prices are not well defined. We quote billets at $18.75@19 and sheet bars at $19@20, f.o.b. maker's mill, Youngstown, and about $1 a ton higher delivered Pittsburgh. Rods are $25, Pittsburgh, consumers being well covered at slightly lower figures.

IRON ORE

NEW YORK—Apr. 14

The March movement of Lake Superior iron ore from lower lake docks to furnaces was 618,848 tons, compared with 820,741 tons in March, 1914, 301,629 tons in February, 1915, and 249,123 tons in January, 1915. The ore on dock April 1 amounted to 6,861,840 tons, compared with 7,155,674 tons on dock April 1, last year.

Negotiations for the season's prices of Lake ores are said to be in progress, but nothing definite has yet been done. It is generally believed that prices will be the same as last season. So large a part of the ore is now mined by the companies consuming it that the prices fixed by independent miners are of much less importance than in most former years.

COKE

NEW YORK—Apr. 14

A contract is reported let to a furnace in the East for 7000 tons Pocahontas coke monthly for six months

Connellsville—The "Courier" reports production at 281,251 tons, a decrease of 3986 tons for the week, and shipments at 278,014 tons, a decrease of 6699 tons. The market is uneventful, but maintains the stronger sentimental tone noted a week ago. Prices are approximately as follows: Prompt furnace, $1.55@1.60; contract furnace to July 1, $1.60@1.65; to Jan. 1, $1.75; prompt foundry, $2@2.35; contract foundry, $2.15@2.30, per net ton at ovens.

Anthracite Shipments in March were 4,985,398 long tons, being 710,291 tons more than in February, but 179,305 tons less than in March, 1913. For the three months ended Mar. 31 the total shipments were 14,461,886 tons in 1914, and 13,995,090 tons in 1915; a decrease of 466,796 tons, or 3.2% this year.

Fuel Exports from Great Britain, two months ended Feb. 28, in long tons:

	1914	1915	Changes
Coal........................	11,520,647	7,242,453	D. 4,278,194
Coke	218,851	166,893	D. 51,958
Briquettes	324,081	145,146	D. 178,935
Steamer coal	3,346,144	2,678,164	D. 667,980
Total	15,409,723	10,232,656	D. 5,177,967

Imports are insignificant, amounting only to 4355 tons in 1914 and 802 tons this year.

Chemicals

NEW YORK—Apr. 14

The general markets are steadier and business in several lines seems to be improving.

Arsenic—There is little change. The business doing is on a moderate scale and prices remain about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is on a good scale and prices are unchanged. Current quotations are $6 per 100 lb. for carload lots, and $6.25 per 100 lb. for smaller orders.

Nitrate of Soda—Business is fair and improving on the whole. Prices are firm and 2.30c. per lb. is quoted for all positions this year.

United State consular reports state that the average monthly production of nitrates in Chile from Jan. 1 to Aug. 1, 1914, was 5,404,729 quintals of 101.4 lb. Since Aug. 1 the production, in quintals, has been as follows: August, 4,830,233; September, 2,856,600; October, 2,865,494; November, 2,659,875; December, 2,428,759; January, 1915, 2,082,549. Wages in the nitrate fields have gone down 25%, but falling exchange has increased by 40% the cost of imported articles used in the reduction of nitrates. The Government has assisted in sustaining 70% of the output. On Aug. 1, 1914, there were 134 plants in operation. On Feb. 1, 1915, there were 40, some of which were working half time. The nitrate on hand in Chile (24,000,000 quintals) is enough to supply the market for a year if monthly sales are not increased.

Pyrites—Imports at Baltimore for the week included 4638 tons of pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States in the month of January, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	532,243	579,659		
Bleach	5,365,604	1,793,591		
Potash salts	3,595,832	7,209,587	186,686	5,547
Acetate of lime			4,251,199	2,040,010
Calcium carbide			3,420,755	2,837,196

Exports include reëxports of foreign material. Imports of soda salts not given in quantity; values were $58,321 in 1914, and $99,769 in 1915. Potash salts do not include those imported as fertilizers.

Imports and exports of raw material for chemical manufacture in the month of January, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	1,685	110	2,761	161
Pyrites...	86,158	38,386		
Chrome ore	10,320			
Magnesite	17,230	5,520	11	

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total sulphur imported this year was 15,764 tons.

Assessments

Company	Delinq	Sale	Amt
Andes Silver, Nev.	May 4	May 25	$0 03
Big Elk, Ida	Apr 15	May 15	0.001
Bobby Anderson, Ida	Apr 12	May 3	0.0025
Challenge, Nev	Mar 31	Apr 21	0 05
Consolidated Imperial, Nev..	Apr 27	May 18	0.01
Con. Virginia, Nev...	May 4	May 25	0 10
Diam'field Black Butte, Nev	Apr 30	June 3	0 01
Eastern Star, Ida.....	Mar 25	Apr. 25	0.002
Emerald, Utah (three instal		June 9	0.01
Enterprise, Ida	Mar. 20	Apr 20	0 002
Florence, Ida	Apr. 15	May 4	0.001
Galena King, Utah	Mar. 25	Apr 25	0 0075
Gethin Le Roy, Utah	Apr. 21	May 6	0.01
Giant, Ida	Apr. 9	May 14	0.002
Great Falls, Utah..........	Mar. 18	Apr. 22	0.01
Idaho-[illegible], Ida	Apr. 24	May 15	0.005
Index, Ida. (post.)..........	....	Apr. 24	0.005
Iv[illegible]	Apr. 10	May 10	0.002
Ja[illegible], Ida (post.)	....	Apr 23	0.01
[illegible] Superior & West., Ariz.	......	......	0.10
[illegible] Boy, Nev.........	Apr. 9	Apr. 28	0.01
Majestic-Idol, Nev..........	Dec. 15	Jul. 20	0 005
Mullan, Ida.	Apr. 24	May 24	0.002
Mountain Rose, Ida	Apr. 19	May 19	0.001
Nevada-Douglas, Nev.......	Apr. 24	June 10	0 10
Old Veteran, Ida	....		0 002
Oreano, Ida	Mar. 25	Apr. 26	0 0015
Pandora, Ida..............	Apr. 15	May 7	0.003
Pioche Metals	Mar. 20	Apr 20	0.0025
Raven, Ida.	May 15	June 14	0 0006
Rio Grande, Utah..	Mar. 25	Apr. 17	0.003
Samson, Ida	Apr. 3	May 3	0.002
Sandstorm Kendall, Nev..	Apr 1	May 6	0 01
Silver Cliff, Ida............	Apr. 3	Apr. 24	0 0025
Smuggler	Apr. 17	May 17	0.0025
Sonora, Ida	Mar. 15	Apr. 15	0.002
Sunset, M & D, Nev....	Mar. 27	May 3	0.015
Tar Baby, Utah	Mar. 5	Apr. 5	0.005
Tarbox, Ida	Apr. 26	May 28	0 0025
Tonopah Midway, Nev......	Mar. 12	Apr. 12	0 01
Union, Nev	Apr. 6	Apr. 28	0.05
Utah, Nev	Mar 25	Apr. 15	0.02
Wolf Mountain, Utah.......	Mar. 15	Apr. 14	0 0015

Stock Quotations

In sales at auction we note: 100 shares Humboldt Mining Co. ($100 par), $100 lot, and 100,000 shares Ebner Gold Mining Co ($5 par), $200 lot.

COLO SPRINGS Apr. 13		SALT LAKE Apr. 13	
Name of Comp.	Bid	Name of Comp.	Bid.
Acacia	04½	Beck Tunnel......	07
Banner	01⅝	Black Jack.	.10
Cripple Cr'k Con.	01	Colorado Mining..	12½
C. K & N.	.06⅜	Crown Point......	02
Doctor Jack Pot..	08¼	Daly-Judge.......	5 25
Elkton Con.	43¼	Gold Chain	09½
El Paso	1 27	Grand Central	55
Findlay	.03	Iron Blossom	99
Gold Dollar	04¼	Little Bell	12
Gold Sovereign.	04⅜	Lower Mammoth	05
Isabella	15¼	Mason Valley.....	2 75
Jack Pot	06	May Day........	13
Jennie Sample...	‡ 02	Opohongo	01¼
Jerry Johnson....	03¼	Prince Con	39
Lexington	008	Seven Troughs...	02
Mary McKinney.	32	Silver King Coal'n	3 05
Pharmacist.	‡ 02	Silver King Con.	1 75
Portland	1 15	Sioux Con...	03
Raven B. H.....	03¼	Uncle Sam.......	.03½
Vindicator	1 64	Yankee..........	.05

TORONTO		Apr. 13	
Bailey	02¼	Dome Exten...	11
Coniagas	4 75	Foley O'Brien..	25
Peterson Lake	21	Hollinger	24 00
Right of Way..	02	Imperial	05
Seneca Superior	1 25	Jupiter......	15
Silver Queen	01½	McIntyre	50
T & Hudson Bay	30 00	Pearl Lake....	01½
Timiskaming	37	Porcu. Gold...	‡ 25
Wettlaufer-Lor...	04	Preston E. D..	04½
Big Dome	12 75	Rea	10

SAN FRANCISCO		Apr. 13	
Comstock Stocks		Misc. Nev. & Cal	
Alta	‡ 04	Belmont	4.50
Belcher..........	20	Jim Butler......	.87
Best & Belcher	04	Lone Star	09
Caledonia	23	MacNamara	04
Challenge Con	‡ 06	Midway	16½
Confidence	15	Mont.-Tonopah.	42
Con Virginia	06	North Star........	16
Crown Point (Nev.)	‡ 32	Rescue Eula	10
Gould & Curry	02	West End Con.	75
Hale & Norcross	04	Atlanta	41
Julia	‡ 01	Booth	42
Mexican	31	C. O. D. Con	05
Occidental.	79	Comb. Frac	13
Ophir	06	Jumbo Extension	1 30
Overman....	‡ 10	Pitts.-Silver Peak	12
Potosi...........	‡ 01	Round Mountain	.36
Savage	05	Sandstorm Kendall	11
Sierra Nevada	06	Silver Pick	11
Union Con	20	Central Eureka	17
Yellow Jacket.....	38	So. Eureka	‡2 25

N. Y. EXCH. Apr. 13	
Name of Comp.	Clg
Amalgamated	70¼
Am.Sm.&Ref.,com	71
Am. Sm. & Ref., pf	105
Am. Sm. Sec., pf B	79½
Anaconda	35¼
Batopilas Min	50
Bethlehem Steel	125
Bethlehem Steel, pf.	110¼
Chino	42¼
Colo Fuel & Iron.	32
Federal M. & S., pf.	25
Great Nor., ore., ctf.	39½
Guggen. Exp.	57⅜
Homestake	115
Inspiration Con.	30½
Mex. Petroleum...	75½
Miami Copper	24½
Nat'l Lead, com....	63¼
National Lead, pf..	109¼
Nev. Consol..	14⅜
Ontario Min	2¼
Phelps Dodge.....	‡175
Quicksilver, pf...	1¼
Ray Con..........	22
Republic I&S, com..	26½
Republic I&S, pf.	84
SlossSheff'd, com	36
Tennessee Copper..	32¼
Utah Copper	62¼
U. S. Steel, com	56¼
U. S. Steel, pf.	108¼

N. Y. CURB Apr. 13	
Name of Comp	Clg.
Alaska Juneau, w.i.	15¼
Beaver Con	37
Big Four.	07
Blue Bell..	05
Braden Copper....	8⅜
Buffalo Mines.	.40
Can. Cop. Corpn.	1¼
Can G & S	04
Caribou	55
Cashboy	09
Chambers Ferland	24
Con Ariz Sm	15/16
Con. Coppermines	2⅜
Davis-Daly	1¼
Diam'field-Daisy.	08
Dia. Black B.....	03
Florence.........	65
Goldfield Con...	1⅜
Goldfield Merger.	28
Greene Cananea.	30¼
Kerr Lake........	4½
La Rose	9/16
McKinley-Dar-Sa	34
Mines of Am	2¼
Nevada Hills	28
New Utah Bingham	97
Nipissing Mines.	6⅛
Ohio Copper...	27
Oro.	12½
Pacific Smelt	‡.09¾
South Utah.	‡ 25
Stand'd Oil of N.J	403
Standard S. L.	1½
Stewart	1 15/16
Tonopah	7¼
Tonopah Ex.	3 7/16
Tonopah Merger.	42
Tularosa	3/16
West End Ex....	06
Yukon Gold	2⅜

LONDON Mar 31	
Alaska Tre'dwell	£7 7s 6d
Camp Bird....	0 6 3
El Oro.	0 8 0
Esperanza.	0 8 6
Mexico Mines	3 17 6
Oroville.	0 12 0
Philippine Dr..	1 0 0
Santa Gert'dis	0 8 6
Tomboy	1 4 6
Tough Oakes.	0 14 0

BOSTON EXCH Apr. 13	
Name of Comp.	Clg.
Adventure..	2¼
Ahmeek.	‡320
Alaska Gold M...	36
Algomah	2¼
Allouez	47½
Am Zinc..	30¼
Ariz. Com., ctfs..	5¼
Bonanza.........	35
Butte-Ballaklava	3
Butte & Superior	47½
Calumet & Ariz...	65
Calumet & Hecla	485
Centennial	19¼
Cliff	‡1
Copper Range....	53½
Daly West	‡2½
East Butte..	12¼
Franklin.	8½
Granby	78⅜
Hancock....	14¼
Hedley.........	‡26½
Helvetia	‡ 75
Indiana	6¼
Island Cr'k, com.	44¼
Island Cr'k, pfd...	87
Isle Royale......	25½
Keweenaw.......	‡3
Lake	10⅜
La Salle.	5¼
Mass	9½
Mayflower	5½
Michigan.	1
Mohawk.	68
New Arcadian....	7¼
North Butte.....	32⅜
North Lake......	3
Ojibway.	1⅝
Old Colony.....	5½
Old Dominion....	49¼
Osceola..........	77
Quincy...........	75
Santa Fe	1¼
Shannon	8¼
Shattuck-Ariz...	27¼
Superior.	31¼
Superior & Bost....	2
Tamarack..	36
Trinity..........	4⅜
Tuolumne.	.55
U. S. Smelting....	29
U. S. Smelt'g, pf..	45
Utah Apex......	3⅝
Utah Con.......	10¼
Victoria.	‡1¼
Winona	3
Wolverine.	49
Wyandot...	.90

BOSTON CURB Apr. 13	
Name of Comp.	Bid
Alvarado...	60
Bingham Mines.	5¼
Boston Ely........	24
Butte & Lon'n Dev	28
Calaveras.........	1¼
Calumet-Corbin....	13
Chief Con	95
Corbin	.40
Cortez	.20
Crown Reserve	.85
Eagle & Blue Bell..	.98
First Nat Cop.	2⅛
Houghton Copper	2⅛
Iron Cap Cop., pf...	4
Majestic	.20
Mexican Metals...	.19
Nevada-Douglas..	49
New Baltic	2 9/16
Oneco............	1⅜
Raven Copper....	.07
Smokey Dev.	.35
So. Lake	8⅜
Tonopah Victor...	‡.17
Trethewey	10
United Verde Ext.	2 15/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57 572	48.855	28.983	26.553	22.731
February	61 642	57 506	48 477	28 357	26 573	22.753
March.	57 870	58 067	50.241	26 669	26 788	23.708
April	59 499	58.519	..	27 416	26 958	.....
May	60 361	58 175	......	27.825	26 704	......
June	58 990	56 471	......	27 199	25 948	......
July	58 721	54 678	......	27 074	25 219	......
August	59.293	54 344	......	27 335	25 979	......
September	60 640	53 290	.....	27 986	24 260	......
October	60 793	50 654	....	28 083	23 199	.....
November	58 995	49 082	....	27.263	22 703	.....
December	57 760	49.375	.	26 720	22 900	.....
Year	59 791	54 811	.	27.576	25 314	...

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January..	14.223	13.641	64.304	60.756	69 488	65.719
February..	14.491	14 394	65.259	63 494	70 188	*
March.....	14.131	14.787	64. 76	66.152	69.170	*
April.	14.211	..	64.747		69 313	
May	13.996	..	63 182	.....	67.786	
June	13.603	.	61.336	.....	66 274	
July	13.223	.	60 540	.....	64 955	
August	*	.	‡	....	‡	
September	*		‡	..	‡	
October	*		‡	.	‡	
November	11.739		53.227	....	*	
December .	12.801		56 841		*	
Year	..		..		......	

TIN

Month	New York		London	
	1914	1915	1914	1915
January.......	37.779	34.260	171.905	156.550
February.......	39.830	37.415	181.556	176.925
March.	38.038	48.426	173.619	180.141
April............	36.154		163.963	
May	33 360	..	150.702	
June	30.577	....	138.321	
July.	31.707	...	142.517	
August...	*	...	‡	.
September....... ..	32.675	.....	‡	....
October....	30.284	....	‡	...
November.........	33 304	....	139.391	
December.........	33.601		147.102	
Av. year..	34.301		... ..	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January...	4.111	3.729	4.011	3.548	19.665	18.606
February..	4 048	3.827	3 937	3.718	19 606	19.122
March.....	3.970	4.053	3.850	3.997	19.651	21.883
April......	3.810		3 688	..	18.225	.
May.....	3 900		3 808	.. ..	18.503	. .
June ..	3.900		3 810	.. ..	19.411	
July ...	3 891		3 738	.. ..	19 051	
August.	3.875	.	3.715	..	‡	
September	3.828	.. .	3 658	.. ...	‡	...
October ...	3.528	.	3 384	..	‡	. .
November.	3 683	.	3.585	..	18.500	. .
December .	3 800	.	3.662	..	19.097	....
Year	3 862		3 737	.. ..		. . .

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January..	5 262	6.386	5.112	6.211	21.533	30.844
February..	5 377	8.436	5.228	8.255	21 413	39 819
March.....	5 250	8.541	5 100	8.366	21.460	44.141
April. ...	5 113	.	4 963		21 569	
May...	5 074	..	4 924	.	21.393	
June ...	5 000	.	4.850	..	21 345	
July. ..	4 920	.	4.770	.	21 568	
August....	5 568	..	5 418	.	‡	
September	5 380		5.230	.	‡	
October..	4 909		4 750	. .	‡	
November.	5 112	.	4.962	.	25 016	
December .	5 592		5.430		27.369	
Year.	5.213		5.061	.	.	

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January...	$14.94	$14.59	$13.23	$13.45	$13 99	$13.90
February.	15.06	14 55	14.12	13.45	14 08	13.90
March.....	15 07	14.55	13.94	13.45	14 10	13.95
April	14.90		13.90	......	14 13	
May......	14.90		13 90	....	14 27	
June......	14.90	...	13.90	.	13 96	
July.......	14 90	......	13.90	. ..	13.90	
August .	14.90	......	13.90	.	14 08	
September	14 90	......	13 90	..	14.03	
October....	14.84	......	13 75	...	13.97	
November.	14.59	......	13.43	....	13.83	
December .	14.70	......	13 45	.....	13 83	
Year....	$14 88	.	$13 78		$14.01	

The Engineering and Mining Journal

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New Anaconda Leaching and Acid Plants

By E. P. Mathewson*

SYNOPSIS—Description of the 2000-ton a day leaching plant of the Anaconda Copper Mining Co. and of its important adjunct, the acid plant.

The new Anaconda leaching plant and its important adjunct, the acid plant, are now nearing completion and it is hoped will be in operation during the month of May, 1915. The buildings of the leaching plant are of steel, with wooden sheathing, and are on concrete foundations.

For unloading, a steel hopper bin is provided, having its top level with the ground. It is long enough to accommodate three railroad dump cars at a time and will hold six carloads of tailings, or 300 tons. The tailings will be excavated from their present situation by a locomotive crane operating a 4-cu.yd. bucket, loaded into dump-cars of 50 tons' capacity and hauled to the unloading pit in trains of 20 cars each.

Beneath the unloading pit there is a system of belts which delivers the tailings from the hoppers to a 36-in. conveyor belt. This belt delivers the tailings to the 6000-ton storage bins and dumps its load by means of a tripper. Under the storage bin there is a system of cross-belts—36 in all—delivering from the hoppers of the storage bin to a 24-in. conveyor belt running the length of the building. A second 24-in. conveyor belt, at right angles to the first, carries the tailings through a tunnel beneath the railroad tracks and up an incline to the top of the roaster building.

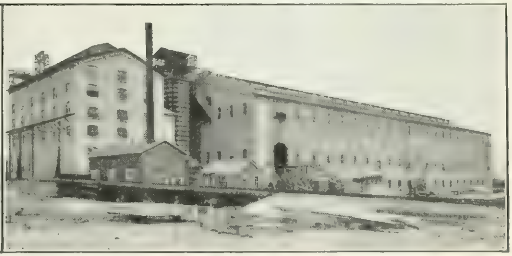
McDougall Roasting Plant

The roasting furnaces, 28 in number, are of a modified McDougall type, 20 ft. in diameter, with air-cooled shaft and arms. They have six hearths, and because of the low sulphur content of the tailings, heat is introduced on the third hearth from coal-fired fireboxes. The furnaces are set in four rows of seven furnaces each. A conveyor over the top of each two rows carries the tailings to the feed hoppers of the 14 furnaces. On a level with the top of the furnaces there are feed belts drawing from these hoppers, one for each furnace. The hoppers are kept supplied with tailings from the conveyor belt above mentioned, an automatic tripper dumping the material at the required point.

Beneath each furnace there is a cooler, consisting of a revolving iron cylinder lined with small pipes, through which water circulates. This, with the roaster-driving mechanism, is shown in an accompanying illustration. These coolers lower the temperature of the calcined tailings from a dull red heat to about 80° C. Each pair of coolers discharges into a cylindrical mixer, about 20 ft. long, into which about 1% of water is introduced for the purpose of dust prevention. These mixers discharge on conveyor belts which carry the calcine to the leaching building proper; and by means of other conveyors and trippers the calcine is brought to the distributors.

These distributors are crane-like in construction and travel across the building, each one above its own row of leaching tanks. Each carries a rotating bridge, along which runs a chain scraper, which discharges calcine from the center of the tank outward to the circumference. Each scraper runs over a plate which has one side cut in the shape of a parabola; so that as the scraper moves outward there is discharged an amount of calcine proportional to the area of the tank at that point. A curtain of calcine, the length of which is the radius of the tank, is dropping constantly. In this way the feed to the tank is kept practically level throughout.

New Leaching Plant at Anaconda



100-Ton Acid Plant (Acid to Be Used for Leaching)

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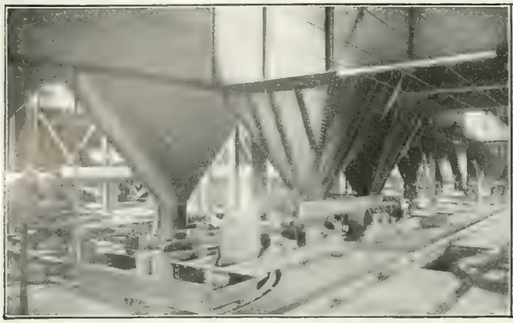
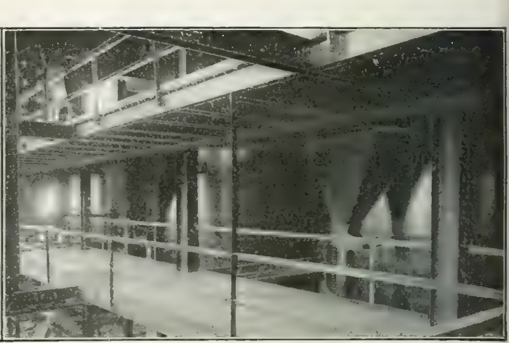
*Manager Washoe Reduction Works, Anaconda Copper Mining Co., Anaconda, Mont.

The leaching tanks are of redwood and are 50 ft. in diameter and 14 ft. deep. They are set in two rows of five tanks each. On a bench immediately below the leaching tanks there is a row of five solution tanks 50 ft. in diameter and 14 ft. deep. The solution tanks are connected to lead-lined sumps, the valves being regulated by floats so as to keep constant the depth of solution in the sumps. There are six of these sumps, one for each solution tank, and an extra one to catch the drainage from the solution and the leaching departments. Each sump is provided with a hard-lead centrifugal pump of the vertical-shaft type. Each of these pumps has a capacity of 300 gal. per min. They discharge into 4-in. lead mains, which connect to all the leaching tanks. Into each leaching tank there are connections for No. 1 solution, No. 2 solution, No. 1 wash, No. 2 wash, fresh water, and concentrated acid. No. 1 solution contains about 3½% aci ½ to 1% copper, 8 to 10% salt and 5% iron and alumin in the form of sulphates and chlorides. No. 2 solutio contains about 7.5% acid and should be free from copp when discharged from the scrap-iron tank. No. 1 wa is water, after No. 2 solution, and will contain a littl


FEED HOPPERS IN ROASTER BUILDING


BATTERY OF ROASTERS

PRECIPITATING TANKS, ANACONDA LEACHING PLANT

TANK FOUNDATIONS, ANACONDA 2000-TON LEACHING PLANT

CALCINE DISTRIBUTOR

50-FT. LEACHING TANK

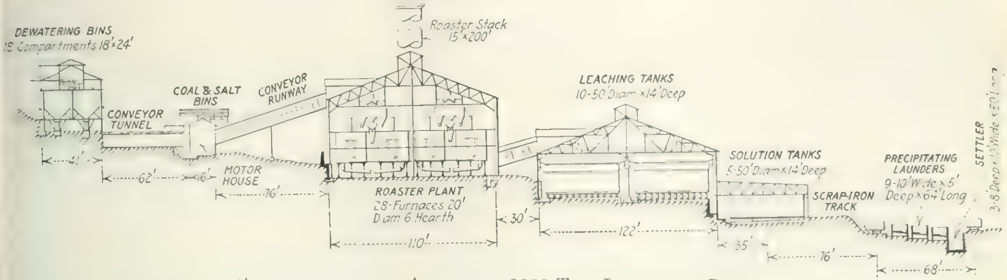
acid, copper and impurities. No. 2 wash has a little less acid, copper and impurities, while No. 3 wash is fresh water. The acid will be 52° Bé. chamber acid. Acimet valves are used throughout.

The stay-rods, or hoops, on all tanks are covered with lead pipe, so that in case of a leakage of acid solutions the rods will be preserved. The floors of both the leaching and solution buildings are built of concrete coated with tar and asphalt, and so arranged as to drain to gutters and thence to a sump, from which the solution is pumped back into the system. The solution drained from the

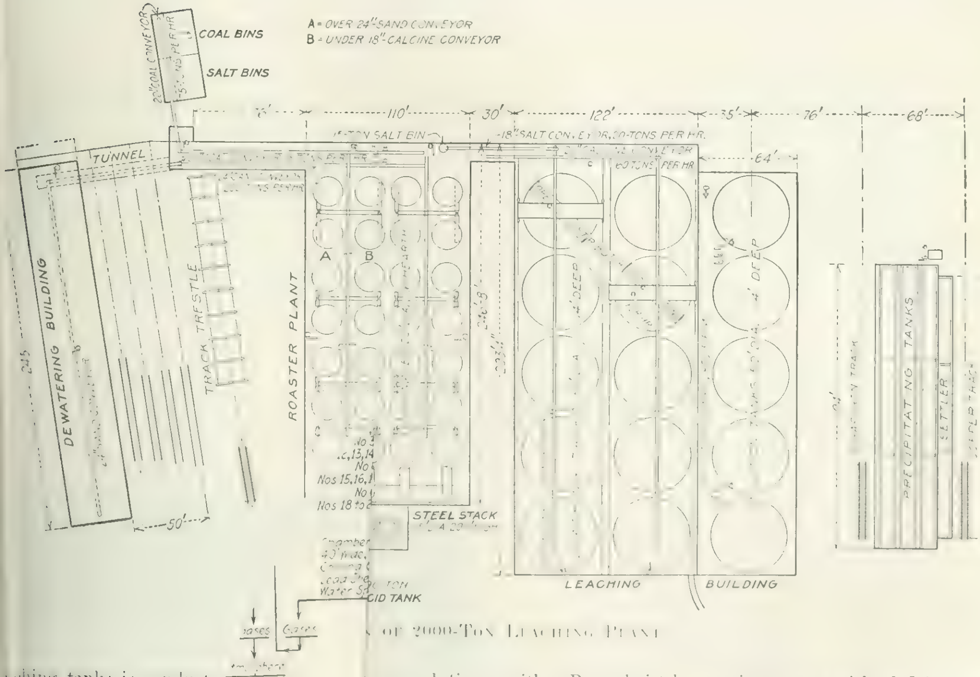
PRECIPITATION

The values will be precipitated from the solution by scrap iron. The precipitating plant consists of three concrete launders of an available section above a false bottom of 4x8 ft. Each launder is 190 ft. long, and is divided into three equal compartments, or nine compartments in all. Any one of these compartments can be cut out for cleaning without interfering with the flow of solution through the others.

The cement copper will be drawn into a settling tank placed at a lower level and there washed and excavated


DEWATERING BINS
19 Compartments 18'x24'
COAL & SALT BINS
CONVEYOR RUNWAY
CONVEYOR TUNNEL
Roaster Stack 15'x200'
LEACHING TANKS 10-50' Diam x14' Deep
SOLUTION TANKS 5-50' Diam x14' Deep
PRECIPITATING LAUNDERS 9-10' Wide x 5' Deep x 64' Long
SETTLER 3-8' Deep x 10' Wide x 50' Long
MOTOR HOUSE
ROASTER PLANT 28-Furnaces 20' Diam 6 Hearth
SCRAP-IRON TRACK
41'
62'
6'
76'
110'
30'
122'
35'
76'
68'

SECTION THROUGH ANACONDA 2000-TON LEACHING PLANT



S OF 2000-TON LEACHING PLANT

ching tanks is conducte roper solution
k by means of specially ONDA COMPANY nders built of
od, but acid-proofed wi PLANT . The leach
. tanks are equipped w s for circulat-
the solution in each te margin in roastink to another.
The No. 2 solution a acid in excess of be heated by
ulating through lea ot water from
calcine cooler systeis built at an elevading.

with a Brownhoist locomotive crane and loaded into railway dump cars.

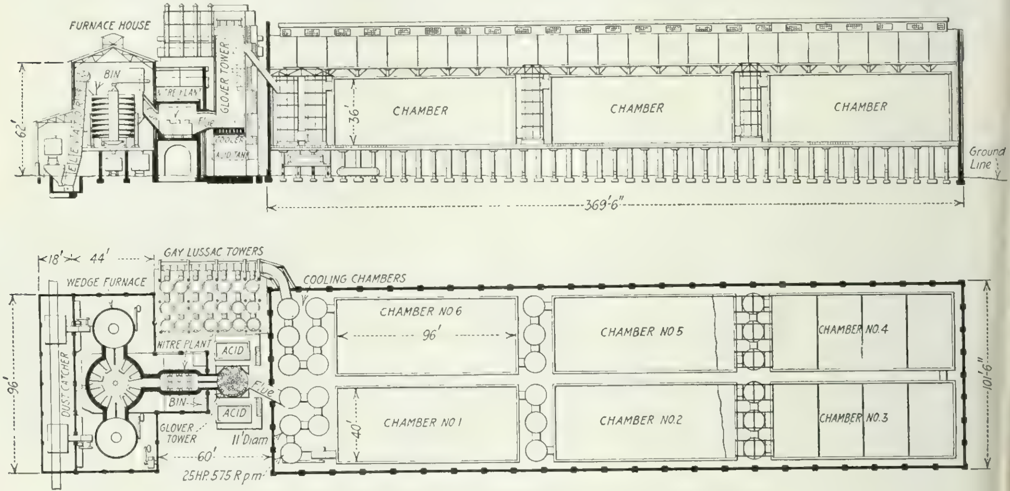
The solution, after copper and other metals are ext in this manner, is returned to the solution building by means of a centrifugal pump constructed of Dur give an idea of the size of the plant it is en that there is over one mile of conveyor belting in the buildings.

100-TON SULPHURIC-ACID PLANT

As an essential constituent of the leaching plant there is a sulphuric-acid plant, of a capacity of 100 tons daily, of 60° Bé. acid. This plant consists of the following apparatus, as shown in the gas-flow diagram.

There are two Wedge roasting furnaces 22 ft. 6 in. inside shell diameter, each provided with seven hearths. The rabble arms of these furnaces are air-cooled according to the Wedge system. Suitable steel hoppers are provided for handling concentrates and cinder. The gases from these roasters discharge into a common dust chamber of unusual and interesting design, consisting of a cylindrical steel shell 32 ft. in diameter, hopper bottomed, lined with 24 in. of brick and approximately 44 ft. over all in height.

The gas enters a central circular chamber 14 ft. in diameter and passes out radially through six openings; thence through brick walls, which are slotted vertically, and rises into an upper compartment; the latter is also provided with a hopper bottom discharging by a 16-in. cast-iron pipe into the lower hopper. The gas thus has its velocity greatly reduced and the direction of flow changed several times, so that in leaving the dust chamber it will be practically free from dust.



PLAN AND ELEVATION ANACONDA'S 100-TON ACID PLANT

NITER PLANT

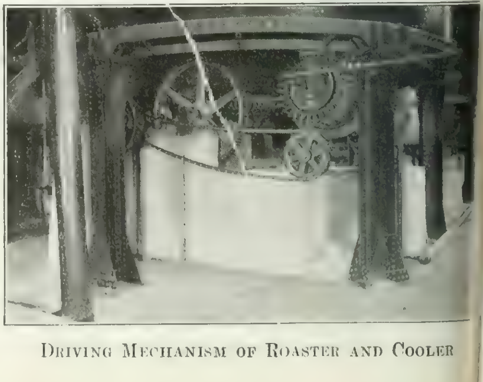
The niter plant consists of the reinforced-concrete chamber, brick-lined, and contains six niter pots, with suitable overflow pans beneath. Particular attention has been paid to the heat-insulating efficiency of all walls up to this point. The walls are heavy, contain many joints and are built with 4-in. blind air-spaces. These precautions are to insure a temperature in the niter oven high enough easily to decompose all the niter necessary and in the Glover tower to concentrate a large portion of the chamber acid.

The Glover tower is octagonal in section, 16 ft. across and 51 ft. in height. It is framed entirely of steel, lined, of course, with lead. It is packed with acid-proof Duro-tile laid up in Duro acid-proof cement. The packing proper is laid dry.

The chamber set consists of 23 cooling chambers, of circular section, 11 ft. diameter and 36 ft. high, and six main chambers 40x96x36 ft. high. One hard-lead fan, 8 ft. in diameter and of 4-ft. face, is placed between the first five cooling chambers and the first main chamber. The framing of the main chambers is of wood and the cooling chambers have steel-band reinforcement. The main chamber floor is 16 ft. above the ground level and is supported by brick pillars and wooden posts. This arrangement will mix the gases and provide great radiation surface. The gas entering the Gay-Lussac towers will be cooled and dried ideally for niter recovery.

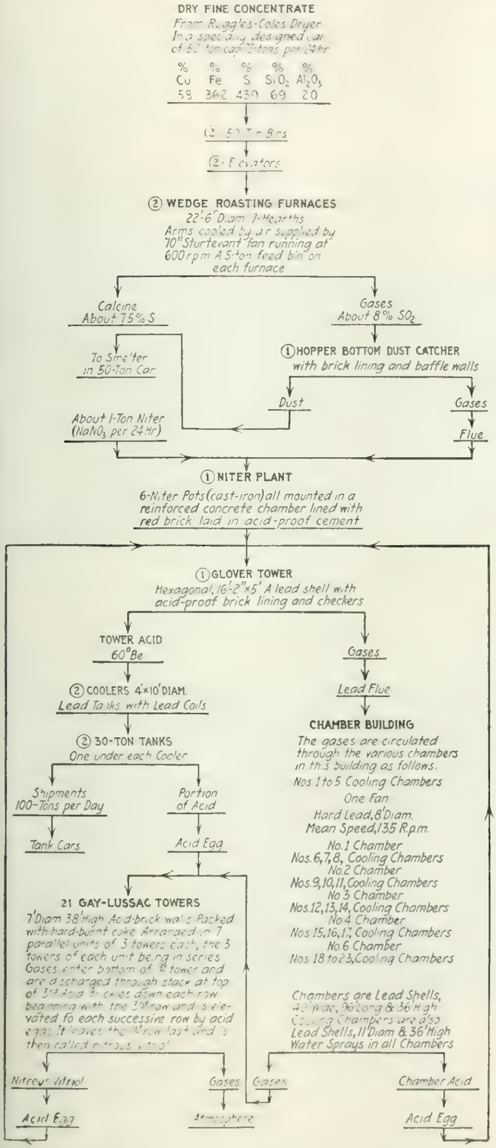
The Gay-Lussac towers present a new idea. There are 21 of these provided—circular in section, 7 ft. diameter and 38 ft. high. They are constructed, except the lead-pans, of Duro-tile blocks laid in acid-proof cement with a packing of 72-hr. coke. They are connected, three in a set, and each of the seven sets has its own jug-damper f regulation. Each set also has a separate lead-stack di charge.

The material from which the sulphur dioxide will l derived is fine concentrates from the concentrator, ru ning from 100-mesh to 10-mesh. This material carri



DRIVING MECHANISM OF ROASTER AND COOLER

about 36% sulphur and will be roasted to a 7% sulphur-content cinder. The latter will be taken to the reverberatory plant for smelting. About 600 lb. of sulphur per ton of concentrates will be roasted off in order to produce 100 tons of acid. It will therefore be necessary to roast 85 tons of concentrates per day, or $12\frac{1}{2}$ tons per furnace.


DRY FINE CONCENTRATE
From Ruggles-Coles Dryer
In a specially designed car
of 50 ton cap. tons per 24 hr
% % % % %
Cu Fe S SiO2 Al2O3
5.8 36.2 43.9 6.9 2.0
(2) 50 Ton Bins
(2) Elevators
② WEDGE ROASTING FURNACES
22'-6" Diam 7-Hearths
Arms cooled by air supplied by 70" Sturtevant fan running at 600 rpm A 5-ton feed bin on each furnace
Calcine
About 7.5% S
Gases
About 8% SO2
To Smelter
in 50-Ton Car
① HOPPER BOTTOM DUST CATCHER
with brick lining and baffle walls
Dust
Gases
About 1-Ton Niter
(NaNO3 per 24 Hr)
Flue
① NITER PLANT
6-Niter Pots (cast-iron) all mounted in a reinforced concrete chamber lined with red brick laid in acid-proof cement
① GLOVER TOWER
Hexagonal, 16'-2"×5' A lead shell with acid-proof brick lining and checkers
TOWER ACID
60° Be
Gases
② COOLERS 4'×10' DIAM.
Lead Tanks with Lead Coils
Lead Flue
CHAMBER BUILDING
The gases are circulated through the various chambers in this building as follows.
Nos 1 to 5 Cooling Chambers
One Fan
Hard Lead, 8' Diam.
Mean Speed, 135 R.p.m.
No. 1 Chamber
Nos. 6,7,8, Cooling Chambers
No. 2 Chamber
Nos. 9,10,11, Cooling Chambers
No 3 Chamber
Nos. 12,13,14, Cooling Chambers
No 4 Chamber
Nos 15,16,17, Cooling Chambers
No. 6 Chamber
Nos 18 to 23, Cooling Chambers
② 30-TON TANKS
One under each Cooler
Shipments
100-Tons per Day
Portion
of Acid
Tank Cars
Acid Egg
21 GAY-LUSSAC TOWERS
7' Diam 38' High Acid-brick walls Packed with hard-burnt coke Arranged in 7 parallel units of 3 towers each, the 3 towers of each unit being in series Gases enter bottom of 1st tower and are discharged through stack at top of 3rd Acid trickles down each row beginning with the 3rd row and is elevated to each successive row by acid eggs. It leaves the 1st row last and is then called nitrous vitriol
Chambers are Lead Shells, 40' Wide, 96' Long & 36' High
Cooling Chambers are also Lead Shells, 11' Diam & 36' High
Water Sprays in all Chambers
Nitrous Vitriol
Gases
Gases
Chamber Acid
Acid Egg
Atmosphere
Acid Egg

Flow Sheet, Anaconda Company's 100-Ton Acid Plant

This leaves an ample margin in roasting capacity, so that in case of necessity acid in excess of 100 tons could be produced per day.

The acid plant is built at an elevation of about 5300 ft. above sea level, with a normal barometrical pressure of about 621 mm. One cubic foot of sulphur dioxide at 0° C. and 760 mm. pressure will, at this altitude, occupy 1.22 cu.ft. of space. Therefore it will be necessary to put through the system about 20% more volume of gas in a given time than would be necessary in operating at sea level. However, as a chamber space of 18 cu.ft. per lb. of sulphur has been provided, no difficulty is anticipated in producing more than 100 tons of acid per day.

The general construction of the plant is most substantial and well proportioned. The furnace and niter building is entirely fireproof, being constructed of brick and steel throughout. The chamber building is an imposing brick structure, being 100x370x60 ft. to the eaves. The site is level, and there is ample provision for further units.

Acid of 52° Bé. will be sent to the leaching plant in tank cars. It will also be possible to deliver 60° acid for shipment if desired. The total chamber space is 900,000 cu.ft. The lead used in construction amounts to 1,420,000 lb.

*

High Yield of Iditarod Dredge

The Iditarod dredge of the Yukon Gold Co. has averaged a yield of over $1.47 per cu.yd. since it started in 1912. While other Alaskan dredges have returned a higher yield for short periods, this is a remarkable average for three seasons' work. When it comes to short-period yields, the Iditarod dredge may also be said to "bear the palm alone," for during the latter part of September, 1912, it cleaned up $83,000 from a little over three days' work. The high yield of the Iditarod dredge, however, is accompanied by a high cost—54.8c. per cu.yd.—on account of the severe conditions under which the dredge operates.

THREE SEASONS' WORK OF IDITAROD DREDGE OF YUKON GOLD CO.

Season	Began	Ceased	Cu.yd.	Yield Total	Yield Cu.yd.	Operating Cost* Total	Operating Cost* Cu.yd.
1912....	Aug. 15	Oct. 29	172,333	$404,040	$2 34	$79,114	$0 4591
1913....	May 8	Nov. 25	496,756	827,420	1.67	319,560	0 6433
1914	May 4	Nov. 11	668,737	739,631	1 10½	335,825	0 502
			1,337,826	$1,971,091	$1 47	$734,499	$0 548

* Includes $50,000 per annum depreciation.

The Yukon Gold Co. acquired control of Flat Creek, the principal producing creek of the Iditarod district, in 1912. This ground included 24 placer claims extending from the head of the creek to the mouth, a distance of four miles, and estimated to contain approximately 5,500,000 cu.yd. The Iditarod contract required the installation of a dredge immediately, so the company's No. 7 dredge, which had completed its work on Upper Hunker Creek in October, 1911, was dismantled and shipped to the new field. The dredge machinery was taken on barges as far as Dikeman, the head of navigation on the Iditarod River, where the shipments, amounting to 815 tons, were transferred to small gasoline boats, which delivered the material in small lots at Iditarod after many vexatious delays. The material was handled by tramway from Iditarod to the mouth of Flat Creek, and from there to the dredge site by wagon road, a distance of four miles. This road was constructed by the company to handle heavy loads and cost nearly $3000 per mile. The last of the machinery for the dredge and 300-kw. power plant arrived at Iditarod on Aug. 5, and was transported, erected and placed in operation on Aug. 15, 1912. The dredge then ran until Oct. 29, handling 172,333 cu.yd., yielding

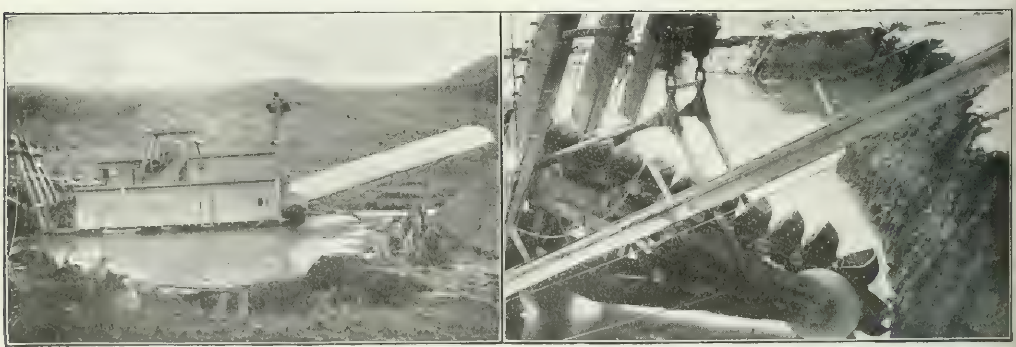
$404,040, equivalent to an average value of $2.34 per cu.yd. Some of the gravel in the main paystreak produced $8.90 per cu.yd. This was on the Marietta claim, which was considered one of the best on Flat Creek. The average cost during the first season was 45.91c. per cubic yard.

In 1913 the Iditarod dredge commenced operations on May 8 and closed down for the winter on Nov. 25. The dredge handled 496,756 cu.yd., having an average value of $1.67 per cu.yd. The cost, including depreciation, was 64.33c. per cubic yard.

Last season the Iditarod dredge commenced operations on May 4 and closed down for the winter on Nov. 11, handling 668,737 cu.yd., which yielded $739,631, or an average of $1.10½ per cu.yd. The total operating cost, including a depreciation charge of $50,000, was $335,825, or 50.2c. per cu.yd. The operating season was 191 days, and the dredge ran 91.91% of the possible time. During the last season 71% of the total area dug was thawed by steam. In previous seasons the proportion thawed has been less. The total yardage handled to date is 1,337,826 cu.yd.; hence on the basis of 5,500,000 cu.yd. of gravel at the beginning of the operation, the property is estimated to have a life of about six more seasons.

LOOKING DOWN FLAT CREEK, IDITAROD DISTRICT, ALASKA

The Yukon Gold Co.'s dredge shown in the foreground has had a remarkable yield, averaging over $1.47 per cu.yd. since it started three years ago. In September, 1912, it cleaned up $83,000 from a little over three days' work on the Marietta claim.



YUKON GOLD CO.'S IDITAROD DREDGE OPERATING UP 7% GRADE ON MARIETTA CLAIM

Rhode Island Anthracite

Rhode Island anthracite has long been a puzzle to mining men and capitalists. Is it a fuel or can it be best used for making refractory linings for blast furnaces? The coal has been known in Rhode Island for 150 years or more, and during the last 100 years scores of attempts have been made to mine it commercially in many places. With one exception, these attempts have not been successful, and most of the mines have been abandoned within three years.

In general it has been found that Rhode Island anthracite is difficult to handle, and that the cost of handling, on account of the large quantity required to produce a given amount of heat and the higher percentage of ash, will be greater than that of other coals; furthermore, when burned it can produce only from 40 to 80% of the heat units produced by the coals with which it necessarily must compete. In general it may be said to show about two-thirds the heat value of Pocahontas coal, and when the extra cost of handling the coal and ash is reckoned it may be estimated to yield not over one-half the heat afforded, dollar for dollar, by Pocahontas coal according to the U. S. Geological Survey.

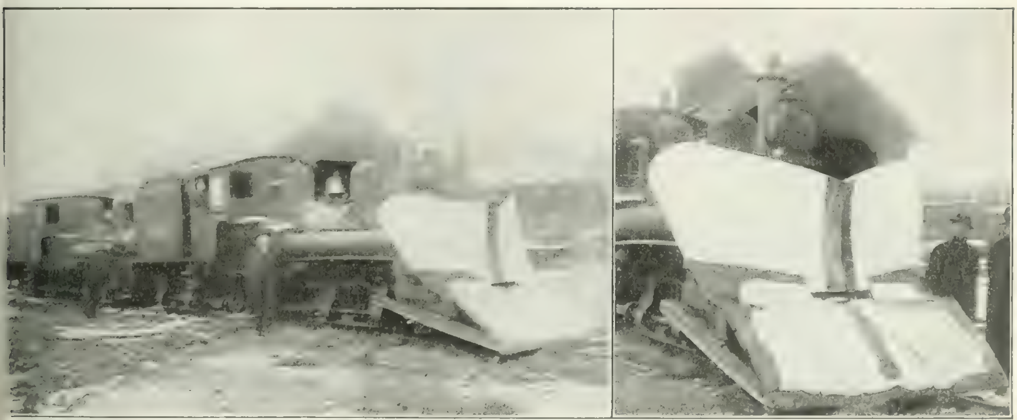
Operating Shay Locomotives

By Frank M. Leland*

SYNOPSIS—In operating geared locomotives of the Shay type a number of difficulties are encountered, particularly in winter, to surmount which requires some ingenuity. Clearing snow from the track, keeping it out of the gears and removing ice from the brake equipment are some of the points, the proper handling of which is indicated.

Since others may have a railroad resembling ours, and may be interested in hearing of the difficulties encountered in operating in wintertime, there may be some point in telling the way we overcame many of them.

This road is 7 miles long, starting from our smeltery, where it connects with the Oregon Short Line tracks. The altitude is 5800 ft. Our mine is 4¼ miles in an air line from the smelting works, but requires 7 miles of railroad to reach it. The altitude at the mine is 7700 ft., and our heaviest grade is 9%; but most of our grades are about 6%. Our curves are mostly level, and the sharpest one has a radius of about 130 ft.



Two Shay Locomotives, the Front One Equipped with the "Butterfly" Snow Shovel, Designed and Built at the Empire Copper Co.'s Plant, Mackay, Idaho

We have two Shay locomotives weighing 31 tons each hen ready for the road. The gage of the track is 36 in. he lower four miles is laid with 60-lb. rail, but I suppose ie old company ran short of money when building, for laid the upper three miles with 25-lb. rail.

One of our many troubles is the crawling of the rails wn hill; and no matter how hard we try to hold them, out every three months we must go over our various vitches and saw out a piece and put in "dutchmen" ove. We find that the 25-lb. rail is a little light, but by itting heavy ties with 2-ft. centers it answers very well. I were to build a road for engines of this size I would e not less than 35-lb. rail; but this, I think, would be nply heavy.

We have a great deal of trouble with drifting snow; in fact in some places after we have cleared the road we can step from the top of the cab to the snowbank. We have cured this drifting in some places, and materially lessened it in others, by putting in snow fences, using the slabs from our sawmill for that purpose. It is wonderful to see how they will check the piling up of snow on the track.

In the Journal of May 3, 1913, p. 895, there are four illustrations showing some of our operations in winter. The snow plow we had at that time was a home-made affair, consisting of an old boiler plate straightened out and mounted on a flat car, with a shelter built over it for the protection of the men. We had under this car a V-shaped flanger which we handled with levers operated by two men inside, and to make the car stay on the track we loaded it down with 4 or 5 tons of old car wheels. It was a crude affair, and while we managed to clear the track with it several times during each winter, it was expensive to operate and had a habit of getting off the track and folding up like a jack-knife, and we had to keep three men on the plow with a stove to keep them from freezing. Sometimes, when the engineer hit the snow a little too hard, the stove would break loose and the car wheels would start ahead, and it kept the men busy getting out of harm's way.

We conceived the idea of building a plow and fastening it to the front of one of the engines. We tried this; but not having a flanger, the snow would pack on the rails and cause us a lot of trouble. We then designed a V-shaped flanger which we put immediately behind the plow, and to save labor we took an old brake cylinder from a car and put a head in it so as to apply the air on either side of the piston. We then connected it up with some valves in the cab. The engineer could then apply pressure to the flanger with compressed air, and when it was necessary to pick it up going over frogs, switches or any obstruction, he applied air to the other end, lifting it. With these improved methods we can plow with the regular crew, and when the snow is especially heavy we couple the other engine on behind, and it is a mighty big snowbank that we cannot go through. Of the accompanying photographs, one shows the two engines and the other a front view of the plow. Our boys call it the "butterfly." It was devised by our master mechanic, E. L. Thornton, and except for a rotary, it is the best arrangement I have ever seen for bucking snow. Some years ago I thought we might afford a rotary, which would, no doubt, be a fine thing for our purpose, but upon getting prices and finding that we would be set back about $18,000 I concluded that we would struggle along for a few years longer with our home-made devices.

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*President, Empire Copper Co., Mackay, Idaho.

Clearing the Brakeshoes

I will give a few little kinks that we have figured out for ourselves. Often when a train stands over night at the mine the snow will blow on the cars when the wheels are warm and keep thawing and then freezing until the brakeshoes and wheels are a mass of ice. It would be impossible to start down the hill with a train in this condition, and to pick away the ice would take all day for half a dozen men, so we obtained about 40 ft. of ½-in. flexible, metallic tubing. It may be seen in the illustration coiled around the sand box. We run the engine alongside the train, and in half an hour, by using steam, we have the ice and snow thawed away from the brakeshoes. It is an inexpensive process, and without it we could hardly operate in winter. Another thing we found—and no doubt some of your readers have had the same trouble—is that the snow packs in the gears of the engine. Grease seems to have no effect, as the snow will fly in and soon the gears become so full that the pinion is crowded away from the gears and the result is a broken shaft. We studied this condition a long while and almost made up our minds that we could not run in winter. I then thought that possibly other people might have a solution for the trouble, so I paid a visit to the Bingham & Garfield R.R., and took the matter up with John Hughes, who was the master mechanic. His solution was to use on the gears common coal tar instead of oil. He also told me—and I have verified the the truth of the statement—that the gears so lubricated would last about three times as long as when oil or grease is used. It puts a gloss on the metal, and it is surprising how long they will run. In wintertime the snow will positively fall out of the gears. We have run through snowbanks in which the gears were actually buried, and when we came out the packed snow would fall right out of the teeth. This leads me to say that were I running open gears at any place or for any purpose where they required lubrication, I should use coal tar.

During our first year we had much trouble with our eccentric straps, which run at high speed. Those furnished by the manufacturers were cast iron lined with babbitt, and about every two months we would have the engine in the shop rebabbitting the straps. If we used a babbitt hard enough to wear any length of time it would break and work out. If we used it soft enough so that it would not break, it was a case of frequent rebabbitting and reboring. One day I sent an eccentric strap to Salt Lake City and had a pattern made and six straps cast in phosphor bronze. I think the initial expense was about $30. We bored them out, leaving four Russian-iron shims in the flanges, and tried them out. They did so well that we immediately ordered another set and put them on the other engine. The first set has now been on for about four years, and we have only taken out two of the shims from each strap. It is surprising how much time and money this investment has saved us, and I think any readers who are using the cast-iron ones lined with babbitt will find it greatly to their advantage to use the kind we do and exclude the babbitt.

Our road runs for its entire length through sagebrush or timber and in summer it gets very dry. During the first two years of operation we were continually starting fires in the timber and brush. Our worst fire lasted three days and we had as many as 40 men working to put it out. We tired of this and purchased the Hunter stacks, made by the Lima people, and since that time have never had a fire. We use them only in the summer, because the engines do not steam quite as well with them as they do with a straight stack.

Removing Weeds from the Track

The weeds on our track give us a great deal of trouble. The sun shines from four o'clock in the morning until eight o'clock at night, and the weeds grow fast. We formerly kept four men employed almost continuously for about four months during the summer to keep the weeds under control, otherwise the brake beams would throw them over on the rails, and then it meant a runaway. When you have 100 tons of train pushing on your engine it is hard to hold unless you have a good rail. The writer thought there might be something cheaper than this and wrote John A. Hill, President of the Hill Publishing Co., who put us wise to a patent liquid weed killer. We buy every spring two 100-gal. tanks of this, dilute it with 20 times its volume of water and put it on the track with a sprinkler which we made ourselves. The weeds come up very little. About 60 days later we go over it again, and that is the end of it for that year. We save between $900 and $1000 a year by using this weed killer.

Should anyone desire to know anything about the various things I have mentioned or anything pertaining to the operation of a Shay road we would be very glad to impart what little information we have gathered and should anyone desire to copy any of our improvements we should be glad to have him come here and we will afford every facility for him to acquire information.

Mercury in the Kuskokwim Region of Alaska

The mineralization by which quicksilver was introduced in the deposits of the Kuskokwim region of Alaska clearly seems to have accompanied the intrusion of th igneous dikes, which have a rather widespread distributio in the areas of Cretaceous rocks, according to the U. S Geological Survey. The deposition of the quicksilve minerals took place in the shattered zone adjacent to thes intrusives. None of these areas has yet been adequatel prospected. The geologic indications point to the conclusion that workable deposits of quicksilver may occu in this region, but whether the development of a specifi deposit promises adequate financial returns can be ascertained only by a critical investigation. In order to establish these facts, capital for adequate prospecting i needed, and its employment for this purpose is fully justified.

The Shushana Mining District

By Hubert I. Ellis*

SYNOPSIS—District of interesting possibilities 275 miles from Dawson. Not only shows good pay in placer, but quartz mining promises much. Steep narrow cañons neglected by old-timers yielding to persistent prospectors.

The discovery of gold in paying quantities on Little Eldorado Creek in the summer of 1913 precipitated a stampede that led several thousand prospectors into the headwater regions of the Tanana and White Rivers. When t was found that the showing was not all that was expected from the ultra-optimistic reports of the "Second Klondike," most of the stampeders left the district, but everal hundred scattered into the surrounding hills and ontinued their prospecting, with varied results. Bonanza and its right-limit tributary, Little Eldorado, produced most of the $240,000 credited to the new camp in 1914. Bonanza is a tributary of Chathenda, or Johnson Creek, s it is more commonly called by the miners. Johnson reek flows into the Chisana, or Shushana, about five miles north of the source of that river in Chisana Glar. Farther to the north the Chisana unites with the besna to form the Tanana.

As is usually the case, the pioneers have named the riv- and creeks to suit themselves, with scant regard for viously accepted nomenclature. Thus the river from ich the district takes its name is variously called Chia, Shusana, and Shushana, the pronunciation differing n more than the spelling. Shushana is probably the old lian name for the river, and is, therefore, the one that uld properly be used. On the Government maps, however, Chisana is preferred, and there is little likelihood an official change to the aboriginal name; so it seems ferable to call the river by its official title and to reserve name Shushana for the district as a whole. A similar fusion exists in regard to Chathenda Creek, usually called Johnson, and Chavolda Creek, renamed Wilson. In the present description the names preferred by the [illegible] in the district will be used. A reference to the accompanying sketch map will make clear the relationships between the old names and the new.

Opencut Mining in Shushana

The Winter Trail, Dawson Stampede

Routes of Access and Freight Rates

Access to the Shushana may be had from several sources, but the two trails most used are one up White River, through Canadian territory, and another from Cordova by way of McCarthy and the Shushana glacier. The town of McCarthy is at the end of transportation on the Copper River & Northwestern R.R. and is about 100 miles by trail from Shushana City. This is the shortest of all routes, but it is also the most difficult and the most dangerous. For many miles the trail leads over the glaciers and over the moraines, the latter a continuous series of mounds and hummocks. Constant movement of the glacial ice leads to the sudden opening of fissures and crevasses extending in all directions and permits huge blocks of ice to drop without warning. At one place on the trail last winter a block dropped 40 ft. This makes the glaciers dangerous routes for travel, especially in the short winter days, when the light is poor and the weather uncertain. Snowstorms and blizzards are frequent, and the absence of timber or other shelter leaves the man caught without sleeping bag or robe in a precarious position.

The camp is 275 miles from Dawson by winter trail, but the route is an easy one, on which horses can be used to advantage. In summer small boats and launches proceed up White River to Donjek Landing or Snag Creek, which greatly decreases the overland journey. During the winter of 1913-14 about half the supplies entered from McCarthy and half from Dawson. Dogs are used in preference to horses on the glacier trail, since they are tougher and can accommodate themselves better to the rough trail and the frequent emergencies arising on account of [illegible] weather and sudden storms. Freight rates from McCarthy are about 15c. a pound in winter and from 25 to 50c. in summer. It is intended to take in sufficient supplies over the snow to last through the following summer; but such as are required to make up any deficiency are brought by launches to Donjek Landing and packed by horses to the mines. There is an abundance of native grass along the White River and the experiment was tried of wintering horses at Hosfeld, on Beaver Creek, a tributary of the White, by turning them out and allowing them to forage for themselves. As has been found elsewhere under similar conditions, the grass native to the Tanana and the Yukon makes poor fodder for a sustained diet in winter, and many of the horses died before spring. This may have been due in part to an unusually heavy fall of snow and continued cold weather.

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The price of provisions, being determined largely by the cost of transporting to the point of consumption, is inevitably high. Flour last summer sold at from $20 to $35 a hundred, and sugar for about the same. Butter brought $1 a pound; ham and bacon, 60 to 75c. a pound, and rice and beans cost the miner from 25 to 45 cents.

Wood and Timber

There are two small sawmills in the district, but owing largely to the high price—about $200 per 1000 ft.—necessarily charged for sluice-box lumber and the insufficiency of the supply of the sawmill product during the first winter, many operators whipsawed their own lumber. There is no timber on Bonanza and Little Eldorado creeks, and all wood for fuel or timbering must be hauled from lower Wilson or lower Johnson.

Fortunately, the ground is shallow and opencut methods of mining are used almost exclusively, except for some winter mining on the benches. Should pay be found in deeper ground, however, or should lode mines be developed, the power question will be a serious one. There is a 30-ft. waterfall on Johnson Creek which may be a possible source of hydro-electric power, but this would not be available in winter and would not solve the problem of thawing frozen ground.

Bonanza and Little Eldorado Creeks Producers

Good prospects were found on Bonanza Creek, but no production was made last summer except from the claim known as 3 Fraction, from which probably $30,000 or more was taken for the season. Wiley, McClellan & Taylor had good pay on 4 Fraction and expect to work again next season. Hamshaw, who had a lease on all the ground from 4 Fraction to 6 Above, worked several sets of boxes.

Except near where it joins Johnson Creek, Bonanza runs through a cañon from the mouth of Coarse Money Creek down; above No. 10 Above Discovery the valley widens into a small flat. Pay has been found on Bonanza as far up as 12 Above. Considerable prospecting has been done above this; but so far as known no defined paystreak has been found. Good prospects have also been found on the benches all the way up the creek.

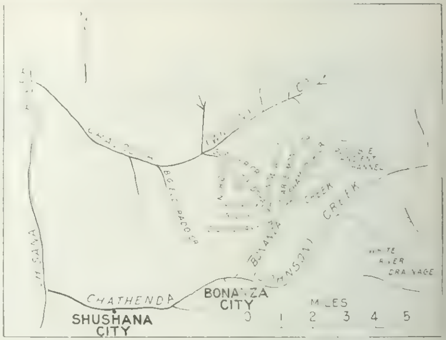
Little Eldorado, the most important tributary of Bonanza, shares with that creek the honor of producing nearly all the gold taken from the district. Skookum Gulch, a small right-limit tributary of Little Eldorado, had some of the richest ground in the entire section and last summer yielded about $10,000.

On Johnson Creek itself much prospecting has been done from the head down, but the gold is fine and no defined paystreak has been found. Placer ground was located and some sluicing was done about 1904, but the locations were allowed to lapse. Quartz locations have been made all along the creek, the earliest one dating back ten years. The formidable-looking cañon near the mouth of Bonanza served to keep the first prospectors in the district from finding the rich gravels discovered two years ago. The early prospectors came chiefly from Dawson, with its rolling hills and broad valleys, and had no faith in the possibility of finding pay in the vicinity of a steep-walled cañon such as that on Bonanza and decided that this was not a placer country.

Wilson Creek, which parallels Johnson and enters the Chisana about seven miles farther downstream, has been the scene of extensive prospecting; but the ground is deep and nobody had, at last advices, succeeded in reaching bedrock. Fine gold is found on the benches, and many of the left-limit tributaries that head in the divide between Wilson and Johnson show good prospects. On Big Eldorado coarse gold has been found, but not in paying quantities.

Mining Possibilities

It is the belief of many prospectors that there is an ancient channel of auriferous gravel extending, as indicated from the work done on it so far, from the head of Bonanza Creek across Shamrock, Coarse Money and Little Eldorado, as is shown roughly on the sketch map. There is a well-marked series of depressions in the ridges extending across country for several miles, and the distribution of the gold found by prospectors at several isolated places would seem to show that such a channel is at least a possibility.



Sketch Map of the Shushana District

Gold has been found on Solo Creek and other tributaries of Beaver Creek, which flows into White River, and pay is reported from Carl Creek, which heads against the ridge along the left limit of Johnson Creek. Good prospects have been found on many other creeks tributary to the headwaters of the White and Chisana Rivers, but the cost of mining and prospecting is so high that development will necessarily be slow, even if other workable deposits are discovered.

Quartz mining promises much, but transportation facilities must first be provided. So far the work of the Government has been confined chiefly to locating trails, and but little actual road-building has been attempted, except by private individuals. If the Government should construct a good trail that could be traveled in safety through out the year it would be of inestimable benefit to the district.

Owing to the shallowness of the ground all mining has been done by opencut methods; but persistent prospecting of the benches may discover deposits suitable for drift-mining in winter. Drift mining, however, will necessarily be on a small scale for some time, because practically all the mining machinery in the district consists of a few prospecting boilers. The sluicing season commences in the latter part of June and extends to the latter part of August.

Coarse Gold and Narrow Pay Streaks

Mining is simplified by the fact that all the gold in the paystreaks is coarse and the paystreaks are narrow. In any places a width of six feet covers the cream of the posit, and the rest might profitably be left were it not cessary to work a wider cut than this for the sake of om. The deposits are shallow, anything over 12 ft. beg considered deep ground. The gravel is coarse at the ads of the streams and becomes finer downstream, expt that there are numerous large boulders in that porn of Bonanza where the cañon walls rise abruptly; the ulders spall off from the precipitous walls and become ixed with the regular stream gravel, but are not transrted far. Contrary to the rule at Dawson and Fairbanks, the paystreaks do not contain much clayey material or sediment. As noted previously, the gold [illegible] on bedrock, and coarse gold may extend down into bedrock two feet or more. The bedrock on Bonanza is described by miners as consisting of pieces of uniform [illegible] well developed concentric structure. These are [illegible] or larger, and the layers come off like the peeling from an orange. On Little Eldorado the bedrock appears to be of volcanic origin.

luicing in Rugged Section of Shushana District

When there is any quantity of barren overburden it is removed by ground-sluicing, by horses and scrapers, by wheelbarrows or by direct shoveling. The grade of the bedrock averages about eight feet to the claim length, so the disposal of tailing gives little trouble. The number of sluice-boxes varies, but is usually six to eight. The barren overburden having been removed, the pay-dirt is shoveled into the boxes.

The writer is under obligation to A. T. Wright, a pioneer operator in the Shushana, for much of the information given in the foregoing.

The method of opencut mining in the Shushana district is shown in the illustration, although it is generally customary to use more sluice-boxes than are shown. The other cut shows the winter conditions along the trail from McCarthy to Shushana. This particular photograph was taken during the Dawson stampede, but conditions now are much the same. The rugged topography of the district is shown in the illustration, which also shows a canvas flume-hose supplying water to the sluice-boxes.

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Coal and Iron in Russia

The production of coal in Russia was about the same in 1914 as in 1913. There was an increase in South Russia, which counterbalanced the decrease in the Dombrova district in Poland. The output by districts was as follows, in metric tons:

	1913	1914
South Russia (Donetz)	24,900,000	27,600,000
Poland (Dombrova)	6,880,000	3,870,000
Moscow district. . .	300,000	300,000
Urals	1,185,000	1,480,000
Caucasus	70,000	80,000
Total	33,335,000	33,330,000

Imports of coal in 1914 were 5,020,000 tons and exports 40,000 tons, showing an approximate consumption of 38,310,000 tons. Both imports and exports decreased from those of the previous year.

Iron and Steel

The production of pig iron and of wrought iron and steel showed some decrease in 1914. The totals are estimated as follows, in metric tons:

	1913	1914
Pig iron	4,555,000	4,270,000
Finished iron and steel. .	4,110,000	3,860,000

The decreases were due chiefly to the war, which forced the suspension of work in Poland for nearly five months of the year.

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An Effective Treatment by which the porosity of cement used in constructional work can be stopped and the free lime neutralized is said to be the painting of the surface with a solution of 8¼ lb. of zinc sulphate ($ZnSO_4$, 7 H_2O) in a [illegible] of water, reports "Engineering News." A reaction between the zinc sulphate and the free lime occurs as deeply as the solution penetrates, and by it the insoluble neutral salts, calcium sulphate and zinc hydroxide are precipitated into the pores. This priming coat should be given some time to dry, the surface then being brushed and painted with two coats of a good cement paint.

Zinc Deposits of Eastern Tennessee

By Frank L. Nason*

SYNOPSIS—System of mineralization and origin of ore deposits discussed and theory in opposition to the usually accepted one advanced. Series of zinkiferous strike veins reaching from Alabama to Newfoundland offers promising field for geological study.

In discussing the zinc deposits of Tennessee, two questions have been put to me: What is the system of mineralization? What determined it?

The results of a careful field study extending over one year may give weight to my opinion. My work having been private, only such results as are of general interest can be published. In discussing the question: What is the system of it? one must choose from one of the four accepted hypotheses relative to the character of ore deposits. These four are briefly: (1) Contemporaneous origin; (2) magmatic segregation; (3) downward flowing of meteoric waters; (4) secondary or vein origin.

The State Geologist of Tennessee[1] seems to advocate the contemporaneous origin of the zinc ores in the Knox dolomite and their subsequent assemblage into economic deposits by lateral and down-flowing waters. The results of my studies lead me to the opposite conclusion; that is, to deep-seated vein origin with upward flowing waters. This to my mind is *the system*; the support of it follows.

Extent of Formation

The zinc-bearing limestones of Tennessee, known locally as the Knox dolomites, reach, under various names, from northern Alabama to Maine. The main structural feature of these dolomites and the underlying paleozoics is a series of six compressed folds striking N 45 to 65° E. In places these compressions are so intense as to end in long and deep strike faults. In addition, along these strike faults there are places where the eastern faulted section is thrust for miles over the western section. In the process of folding and faulting, successive beds of dolomite, slipping over each other, have given rise to extensive beds of brecciation. These beds of breccia, at their outcrops, are strictly conformable to foot- and hanging-wall beds. Whether this conformity continues, as is possible, to the limits of the series, or, at some unknown depth, cuts across the formation, ending in a strike fault, has not so far been demonstrated. That this latter is the case, I have no doubt. The very fact of the existence of strike faults at least supports this assumption. It is agreed among observers that there are two distinct belts of brecciation—the White Pine and the Mascot. These are supposed to occur respectively at the upper and middle series of the Knox.

These long strike folds, faults and over-thrust faults, are the most striking features of the Tennessee zinc fields. In addition to these should be mentioned the fact that, although the Chickamauga limestones are found close to the zinc outcrops in many localities, the zinc has been found only in the well recognized Knox. These limestones thus seem to have fixed a definite upper limit to the circulating zinkiferous solutions. Important, but less noticeable, is the series of cross folds and fractures that occur along what is known as the Powell River anticline, which are observed from the southern end of Union County, Tenn., into Virginia. These cross folds and fractures are all approximately parallel and strike E 6 to 15° S. These cross folds are evidenced by the underlying conasauga shale series. Taking the Powell River (1000 ft.) as the datum level, a strike section for 10 miles shows relative elevation of the shale series to be as follows: Two miles southwest of New Prospect, elevation of the shales, —400 ft.; New Prospect, +150 ft.; two miles northeast of New Prospect, —1000 ft.; eight miles northeast of New Prospect, —500 ft.

Given as isolated localities, these would not of necessity connote folds, but the fact that the shale series, flanked on the north and south by unmistakable Knox, can be followed continuously for ten miles, from New Prospect to the Straight Creek mines, lends support, even if it does not positively demonstrate the theory of east and west cross folds, and, as a matter of fact, a fold can actually be seen at Straight Creek.

Rock Preparation for Mineralization

It is axiomatic that rock preparation in some form must in all cases precede secondary mineral deposition In the White Pine, Mascot and Powell River belts, thi rock preparation is evident. But while the rock preparation in the first two belts is almost, if not quite, exclusively brecciation, the rock preparation in the Powel River belt is individual in character. In the first two belt there are strike beds of brecciation with no sharply defined limits; in the Powell River belt the brecciation i east and west and is vertical, passes through the Kno and into the shale series, and is confined between vertica fissures. At New Prospect the vertical fissures are 9 ft. apart. These fissures have been proved to be persistent 1200 ft. below the bed of the Powell River an have zinc and lead to the bottom, 200 ft. below sea level. At the Mascot and White Pine belts the zin and lead are confined strictly to the breccia, whil at Straight Creek and New Prospect beds of unbrecciate limestone 12 in. thick have been mineralized up to 50 zinc. This replacement has been found to a depth of 110 ft. below the Powell.

In the Maynardsville Folio of the U. S. Geological Survey it is estimated that the thickness of the Knox is fro 2600 to 3500 ft. It follows, then, in accord with the ide that the White Pine breccia is in the upper Knox, th Mascot in the middle, and the Straight Creek and Powe zinc in the basal or lower Knox, that the Mascot zinc from 1300 to 1750 ft. above the shale series and that th White Pine is from 2600 to 3500 ft. above.

In Scott, Russell and Washington Counties, Virgini zinc and lead occur in or close to the shale series. At Iva hoe, Austinville, Bertha and Delton, Wythe County, Va the same is true. Throughout a large area of the zinkife ous beds of Tennessee and Virginia, the zinc-lead ores fissures and breccias both have a vertical range of not le than 4600 ft. Of this, no less than 3600 ft. is exposed at various localities. This is an important point to bear in mind in estimating the future of the zinc industry in Tennessee. In answer, then, to the question: "What is the system of it?" the theory of a profound vein origin seems to be inevitable. It is also evident that in the Powell River anticline the mineralization is due to east and west veins in sharp distinction to the northeast-southwest strike of the Holston River zinc breccias.

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[1] "Bulletin 11, Geological Survey of Tennessee," pp. 15 and 16.

Perhaps the following is overworking the vein theory, but these facts are too striking to be allowed to pass without comment. From the top of the Knox to the bottom of the underlying Paleozoics the vertical distance is not less than 6325 ft. Immediately flanking these Paleozoics on the east are the Pre-cambrian schists and gneisses. It is certain that these underlie the Paleozoics. In the schists and gneisses are numerous deposits of pyrrhotites. These pyrrhotite lenses have, as accessory minerals, chalcopyrite, galena and blende. Whatever the origin of these lenses of pyrrhotite, there seems to be no opinion hostile to the theory that the secondary minerals have an independent vein origin. Without regard to the economic size of the various lenses of pyrrhotite, vein lead and zinc is found at Ducktown, Tenn.; Swain and Ashe Counties, North Carolina; Spottsylvania and other localities in Virginia; Wheatley, Penn.; in Cambrian and Pre-cambrian rocks in New Jersey; in New Hampshire, Maine, New Brunswick and Newfoundland.

ZINKIFEROUS VEINS 1850 MILES LONG

It is therefore certain that in the Appalachian Pre-cambrian there is a series of zinkiferous strike veins paralleling the dolomites from Alabama to Newfoundland, a distance of 1850 miles. We are under no necessity of assuming that zinkiferous veins cut the Pre-cambrian underying the Paleozoics, because at several localities this is an observable fact. At Franklin Furnace, N. J., a large vein of blende has actually been followed from the Cambrian blue limestone into the Pre-cambrian gneiss. In Maine one deposit of mixed copper, lead and zinc sulphides occurs in a limestone formation, but in other localities are similar mixed sulphides, with zinc sometimes predominating, in fissures in Cambrian or Pre-cambrian eruptives. In New Hampshire, New Brunswick and Newfoundland, blende again occurs in Pre-cambrian rock fisures. In Maine, especially, isolated patches of limestone are surrounded by Pre-cambrian rocks, from which I assume that here erosion has scoured off the Paleozoic series, howing zinc-bearing fissures in the underlying Pre-cambrian. By these means the Tennessee zinc deposit is raced to its origin in the underlying Pre-cambrian. If his assumption is tenable, the zinc deposits of the Appaachian limestones have a visible vertical exposure of at east 6325 ft.

ORIGIN OF ORE

It has been remarked for years that the zinc ores of the Appalachian field are nowhere accompanied by igneous rocks which could account for their origin. But old, metamorphosed eruptives are known in the flanking Pre-ambrian of Tennessee and Virginia, and in Maine they re to be seen underlying the limestones, presumably belonging to the Tennessee horizon. If this is tenable, the deep-seated origin of the veins of Tennessee is completely demonstrated. Post-cambrian eruptives are very near the ulphide veins in Sussex County, N. J., and at Friedensville, Penn., the well known zinc deposits are within a few hundred feet of the Pre-cambrian rocks. Fluorite is occasionally found at Austinville, Va., and is a[illegible] in the shale series in several zinc localities between Austinville and Crocket.

It may well happen, then, that there are intrusions in the lower Knox which do not show on the surface, and it may be that through these channels the dike-free upper Knox has been mineralized. Certainly in some of the New England states Post-cambrian eruptives occur and many of these are accompanied by zinc, lead and copper sulphides.

In conclusion, then, in answering the question: "What is the system of it?" the facts stated seem to point conclusively to the veins having originated in the Pre-cambrian.

Taking up the question: "What determined it?" All vein deposits and their modified forms depend absolutely on previous rock preparation, but in none of these localities is economic mineralization co-extensive with rock preparation. My observation seems to contradict the very common explanation that mineral loci are determined by the presence of reducing or precipitating agents present in the rocks. Rather, to me, the prepared rock is an alluvium through which flowed mineralizing solutions subject to retardation and deflection by obstructions in their channels as, by analogy, the meander of rivers through alluvial plains.

For 50 miles northeast of Knoxville and an equal distance southwest, the Mascot breccias can be traced in an almost unbroken line. Along this line only about eight localities are known to be mineralized, and only one has been proved to be economic. In one locality northeast of Knoxville a great exposure of breccia occurs where considerable pit and cut work has been done, but this has failed to show a single trace of either lead or zinc. There is no change in chemical composition of the rocks; zinc is simply absent. The same facts obtain in the east and west fractures of the Powell anticline. Some are mineralized, some are not. The answer to the question: "What determined it?" is, simply: Flows along the line of least resistance resulting in shoots and chimneys.

INDICATIONS OF FURTHER ZINC ORES

These facts and deductions will immediately suggest the question: Do they indicate that there are great reservoirs of ore in this field? In the comprehensive line mentioned, 1850 miles long, there are only eight zinc properties that have risen to the dignity of mines, with only three that are active at present. If there is a vertical exposure of 6325 ft. of the vein system, in which there has been found only one operating mine in the middle section of the Knox and two at or near the base, what are the chances of developing other productive mines either on the strike or in depth? There are hundreds of prospects on this line located at all horizons in the thickness of the formation. My opinion is that it is a most promising field for study by geologists.

Are there any phenomena which will lead to the conclusion that the present outcrops received their mineralization from spent solutions which had left the most of their mineral burden lower down? Pure limestone is the most favorable locus for mineral deposition. Of the 6325 ft. of possible thickness, only about 3500 ft. belongs to the Knox. If, as is possible, the breccia passes into strike faults with depth, the distance traveled by mineral solutions on their way to the known outcrops may be as great as 7000 ft., or even more, depending on the dip. The 2825 ft. of underlying Paleozoics are mainly shales, sandstones and impure limestones. These would take little or no toll from the traveling mineral solutions rising from the Pre-cambrian, leaving them to pass nearly full strength into the Knox formation. In a possible 7000-ft. width of strike fault plane, or even limiting the distance to the vertical thickness of the Knox, there is abundance of space within which even the richest solution could be quite exhausted, forming large and rich deposits, while the spent solution would pass to the surface, leaving there only a trace of its former burden. In this line, by far the richest zinc and lead ores have been found in the New Prospect and Straight Creek mines, and these are at or below the base of the Knox, just where, on this hypothesis, they should be found.

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Conflicts between Placer Patents and Lode Claims

By A. L. H. Street*

In the recent case of Clark Montana Realty Co. *vs.* Ferguson, 218 *Federal Reporter* 959, the United States District Court for the District of Montana decided the following matters pertaining to lodes within placer claims:

"When a placer patent is applied for, the Land Department requires evidence in relation to the character of the land. Affidavits are presented by the applicant. If the proof is that lodes are known to exist within the placer claim, the applicant is required to survey them, and if not claimed, and as known lodes included in his application he is required to exclude them, whereupon he enters and pays for only the net area of his placer claim and patent issues to him, conveying said net area alone. If the proof is that lodes are not known to exist within the placer claim, the applicant enters and pays for the entire area of his placer claim and patent issues to him, conveying the whole thereof; but the Land Department inserts in the nature of an exception that, should any lode be known or claimed to exist when the patent was applied for, it is expressly excepted (though not defined) from the grant. There is no warrant in law for this insertion and it is broader than the law implies, if the statute implies any exception. Perhaps the reason that it is held that the law does imply an exception of known lodes, contrary to the holding in the matter of patents by virtue of analogous laws and inappropriate lodes and mineral lands, is that this Land Department practice confronted in the first case involving this question, if not given undue weight, at least suggested the exception more suggested it than did settled principles of construction. Since lodes known to exist are excepted from a placer grant, title to them continues in the United States and they are open to location as lodes in public land and by any one at any time.

"If located, in any controversy involving the respective rights of the lode claimant and the placer patentee, the burden is on the lode claimant to prove the lode was known to exist when the placer patent was applied for. And the proof in effect impeaching the patent proceedings, if not the patent, for fraud, seeking to withdraw from a solemn grant over the seal of the United States premises *prima facie* conveyed by it, must be clear and convincing, in quality and quantity that inspires confidence and produces conviction.

"To establish that a lode was known to exist when the placer patent was applied for, it must appear that at that time the lode was clearly ascertained and defined, and of such known extent and content that in view of all circumstances and conditions affecting its worth, such as the importance attached locally to like lodes under similar conditions, ease or difficulty of development, facilities for ore treatment, cost of mining and reducing ores, reasonable probabilities of development, and the like, it then would have justified location, development, and exploitation, and because of which it and the area attaching to or excluded with it then were valuable, and more valuable than for placer mining purposes.

"Float, outcrop, lodes and abandoned lode locations, separately or combined, are not sufficient to constitute a lode 'known to exist' within the exception of a placer patent. In addition must be the known quality above defined. And the reason is that lodes exist throughout the mining country. Not one in hundreds justifies development and proves of value. No reason exists to except the valueless from placer patents or grants, and such patents issued or grants made without excluding them *prima facie* lodes of value do not exist. The issue is determined now by conditions as they were when the placer patent was applied for, even as though tried and determined then. Subsequent development and results however marvelous, are immaterial."

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Iron and Gold in the Philippines

The Bureau of Science has sent a party of engineer to Surigao, Mindanao, according to the *Daily Consula and Trade Reports*, issued by the Department of Commerce, to investigate the reported iron-ore deposits o that region. It has been said on good authority tha there is a large body of iron ore in that region comparable with some of the world's greatest deposits. general reconnaissance of northern Surigao and of th country about Iligan, where gold deposits were recentl found, will be made. The 1914 output of gold in th Philippine Islands shows a gain of 39% over that o 1913. The value of the year's yield is $1,203,133, little over half of which is from lode mining, the remainder being the output of dredges. In mining th gold ore about $8000 worth of silver was produced. Th prospects are good for a large increase this year in th mineral production of the islands.

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Cryolite Production

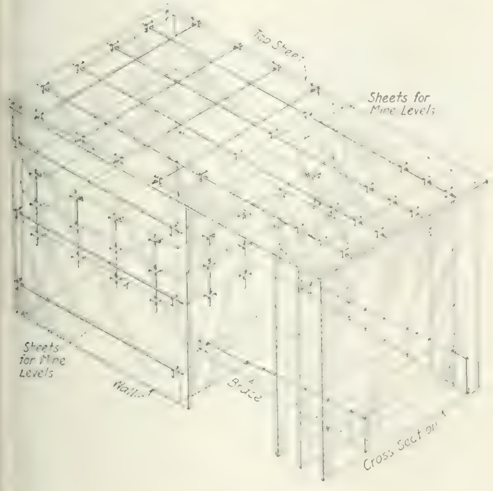
Cryolite is quarried from the mines in Greenland b the Kryolith-Mine og Handelsselskab (the Cryolite Mining & Trading Co., Ltd.) under a state concession, say Consul General E. D. Winslow at Copenhagen. In clo connection with this company is the Oresund works Copenhagen, which has been given the technical use this valuable mineral. During the last two years fro 5000 to 6000 cu.m. (6500 to 7800 cu.yd.) of cryolite ha been quarried. The exports of cleaned cryolite to Denmark in 1913 amounted to $700,000; besides, there is considerable direct export trade to America which do not come under Danish trade statistics.

Details of Practical Mining

Mine Models Made of Celluloid Sheets

By Mack C. Lake

Models made from transparent celluloid have many dvantages over other types for showing mine levels, vertical sections, drill holes in any position, or any com ination of them. In fact, all available information can e brought together in such a model and placed in its roper position for correlation. The model is adaptale to any sort of geologic problem. It is better than those made of glass, for it requires no framework to support it, neither is it breakable. It is easy to construct, can be made accurate in detail and adds surrisingly to the simplification of the problem. By the se of this model it is easy to explain the geology to layman, a task which would be difficult if only crossections and plans were utilized. Another advantage is hat they can be easily taken apart for mailing or filing.



Celluloid Mine Model

Sheets of celluloid 20x50x30/1000 in. have been found o be most serviceable. A thickness of 30/1000 in. is best suited to the purpose, since celluloid has a tendency to warp and is too flimsy if used thinner. The various nine-level maps, cross-sections, drill-hole data, etc., are irst reduced to a convenient scale—say 100 ft. to the nch—transferred to paper and the formations colored with pencils. The sheets of celluloid are then painted, sing the crayon maps underneath as guides. The model may be composed of four walls, a top sheet and various nterior parts which exhibit the formation. The four walls, which should be a little higher than the depth of the deepest drill hole shown, and the top sheet together limit the size of the model, and when fitted together form a support for the inner sheets and lend stability. The top sheet presents the topography, positions of shafts, drill holes, etc., and serves as a convenient datum plane. Within this box-like structure data are placed in their correct relative positions. As a simple example: To show a mine of six levels, each level is represented by one sheet of celluloid containing all data relative to that level and placed at a proper depth below the surface.

The sheets of celluloid are made with little tabs on the ends which fit into slots in the walls. The sheets are cut to fit into the box, and an allowance of ½ in. is made on all edges for the tabs. The edges of the sheet are then cut away, leaving the tabs projecting, one every 4 in., the slots in the walls being cut to receive them. As celluloid, like glass, breaks readily along a scratched line, it can be easily worked into the desired shape. To make the slots, two small holes are bored at the ends of the slot position and the strip between them cut with a carpenter's chisel. This method facilitates the mechanical part of the work. The walls and top sheet are fitted together in the same way. If the small tabs are crimped about ⅛ in. from the bottom they will snap into place when inserted into the slot and will be kept from slipping out. This crimping is done by placing a dull-pointed instrument against the celluloid as it rests on a soft pine board and striking it a sharp blow with a hammer. The celluloid is bent out and does not spring back into place. These crimps are so placed as to hold the sheet in which they are made against the sheet in which the slot is made. In this way a rigid structure is formed, reproducing the given information in three dimensions.

Often the side walls are not needed. For instance, if it is desired to show a series of cross-sections of drill holes across a property, or sections of a mine along the strike of the formation or vein, the vertical sheets will fit into the top sheet, and to support them, two braces can be inserted through slots in the bottom of the sections. Beginning at one end of the model the first section would have a longer slot than the next succeeding section, and so on. The brace is cut in steps to fit these slots. The large end is caught at the largest slot. The next slot being smaller has a shoulder equal to the difference between its length and that of the preceding one. The brace is crimped close to each shoulder so that it will snap into place and remain there. This shoulder arrangement is an extremely simple manner of support, but it serves well.

Where it is desired to show drill holes or sections of a mine, as well as the levels, vertical sheets will be inserted through slots cut into these sheets, and where possible the walls will be used to advantage. If a drill hole is inclined, the section is placed in the vertical

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*Assistant to C. K. Leith, Madison, Wis.

plane of the hole. Many variations of construction can be used to suit the problem presented.

Tube oil colors mixed with turpentine, varnish or Jap-a-Lac give transparent colors which are distinct, dry quickly and neither rub off nor fade with age.

Types of Chutes and Chute Gates

By Albert E. Hall*

The chutes here illustrated were tried out at Creighton Mine, Ont., where the ore is a mixture of pyrrhotite and chalcopyrite with a little pentlandite, and is consequently heavy material to handle. Besides being heavy, the ore comes to the chutes in large pieces because the ground has many slips in certain sections and because of the presence of a large amount of rock from a caved section of the mine. These large pieces often have to be blasted in the chutes, so that the latter have to stand hard usage both from the hammering of the ore and from blasting.

Mining at Creighton is carried on by the shrinkage method. The ordinary system of developing a level has been changed, however. On the older levels drywalls were used, while on the new levels rock drifts replace the drywalls. In the drywall method when the point is reached where the chute is desired, the wall is stopped and the chute built and then the masons start the wall on the other side of the chute. In the rock-drift method a raise is put up to a height of from 8 to 10 ft. and the chute built under this. These raises are known as box-holes, and the stope is started from the top of them.

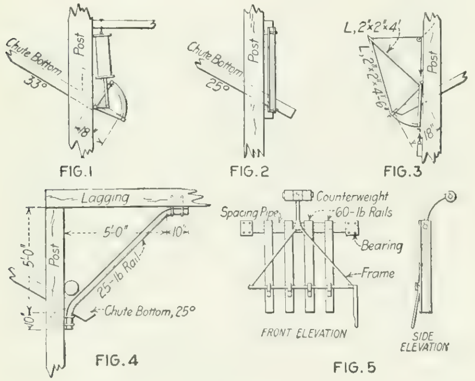

FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

Types of Gates

Drywall Method

The first chute considered in this method was the Lawson, which has an underswing arc gate, with the concave side of the arc toward the muck.

In Fig. 1 is shown the general design of the gate. The construction of the chute itself is similar to the Henrotin chute shown in Fig. 6, the only difference being that the pieces marked *A* are made longer in the Lawson chute to support the lip. There is no lip on the Henrotin, so that these pieces can be short. The gate is operated by an air-lift suspended from above and operated by means of a three-way valve. When the car is nearly filled with ore from the chute, the air is turned on, closing the gate in time to keep the car from becoming too full and spilling on the track. It frequently happened that small pieces would get between the gate and the lip or between the gate arms and the lip, thus either making it hard to open the gate or harder to close it, causing a spill in the drift which took a long time to clean up. A remedy was therefore sought, and the result was the Henrotin chute, shown in Fig. 6, which was practically the same as the Lawson, except that the pieces *A* were shorter. The gate instead of having the concave side of the arc toward the muck has the convex side toward it and is underswung. No lip was needed on the chute because the gate was supported in the side plates, and the front of the gate became the bottom of the chute when it was opened. The air lift was located below the chute. Putting the convex side of the gate toward the ore relieved the pressure against it and thus made it easier to operate and control. The arc of the gate must be a part of a circle or it will not operate and one of the difficulties was to get it made true to radius. Trouble similar to that experienced with the Lawson chute was encountered with this one. Fine material got between the chute and the gate and interfered with its operation; also fine material went through onto the air lift below and sometimes stopped its operation.

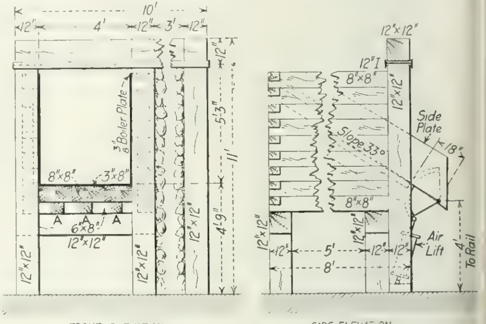

Fig. 6. The Henrotin Chute

Both chutes had an opening too small for the size of muck that was being handled from the stope, and too much blasting was necessary near the gates, which did not stand up under the heavy duty. This made the cost of repairs high. The air lifts consumed a large quantity of air, making the operating cost high and reducing the amount of air available for the drills. In winter there was trouble with the air lifts because of freezing. These facts led to the construction of a chute with a larger opening and without a mechanical gate.

The Keating Chute

A chute called the Keating (Fig. 7) was then tried. This was a long wide box, which was quickly built and required comparatively little timber. The first of these chutes was constructed with a slope of 15°, which proved too flat; but one of 25° with an iron plate on the bottom was satisfactory. For a gate, a 25-lb. rail was fastened to each post and set out from it, as shown in Fig. 4, so that an iron-bound plank could be run across the front of the chute. This plank was extremely hard to raise on account of the muck behind it and soon became badly bent, when it was impossible to move it. The trammers and chutemen replaced the planks with long drill steel, which worked well, except when fine material ran in the chute, when there would be spills which would bury the car and require much time to clear up. When the steel replaced the planks, staples were used in place of the rails. To overcome the difficulty of the fine material running over the steel, a gate, known locally as the Minnesota gate, was tried and has become the regular gate throughout the mine. It is so satisfactory that it leaves little to be desired. As shown in Fig. 4, two 25-lb. rails with ends 8 to 10 in. long, bent at 45°, are spiked to the chute post and to the lagging over the drift. Across these is placed a round timber, which can be raised and dropped easily to control the run of the ore from the chute. The timber becomes worn, but can be replaced with no trouble when the chute hangs up a little. These chutes were built with two I-beams, as shown, to protect the chute blaster when trying to bring down a hang-up. This was found not altogether desirable, for when the chute blocked but could be started with a bar it was difficult to bar that far back in the chute. When these I-beams became broken, they were never replaced, and the chutes constructed later have only the front one. The lagging, however, was allowed to project over the front I-beam to give a little protection when working the chute.

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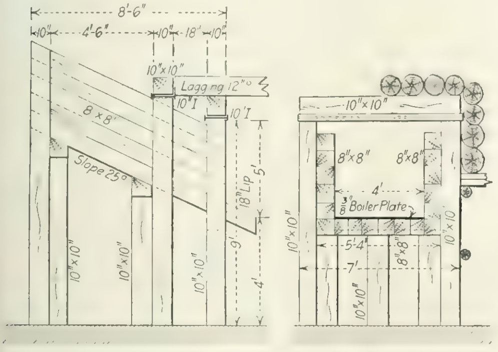
*Creighton Mine, Ontario



SIDE ELEVATION FRONT ELEVATION

FIG. 7. THE KEATING CHUTE

ROCK-DRIFT METHOD

When the rock-drift method was started the chutes had to be adapted to the box holes. At first a long flat chute was tried which was a cross between a chute and a shoveling platform. It had low sides and the raise was a long distance in from the chute. The chuteman stood up on the rock at the side and reached over the timber to pull the material down into the car. The loading was slow and when the chute blocked it was too far back to blast it down quickly. The chute was then made steeper and a counterbalanced gate of the underswung type, shown in Fig. 3, was tried. The gate was swung in two bearings, one on either post, and had its concave side toward the muck. Two angle-iron arms, as shown, were fastened on each side of the gate, one near the bearing and the other near the front of the gate. From the point of each angle-iron arm, a wire ran over a pulley, fastened to each post, to a counterbalance weight for the gate. Although this gate never [illegible] a fair tryout, it was, to all appearances, too ligh[illegible]nd the wear, and if made heavier would have been too cumbersome.

An adaptation of the finger chute (Fig. 5) used [illegible] other districts was then tried. A shaft running through a bearing on each post supported four 60-lb. rails which formed the fingers. The rails were held apart by short pieces of pipe. A triangular frame with a handle served to operate the gate, and at the top of the frame were three weights on a short cross-piece which acted as a counterweight. This chute was not successful due to the material handled. It was too heavy for one man to work at times, even with the counterweight, and at other times the material could not be held in check.

The finger chute was therefore discarded and the Keating chute, with the Minnesota gate, was changed, as shown in Fig. 8, to suit the rock-drift system of development. The lower ends of the rails are fastened to the posts and the upper ends are held by staples driven into wooden plugs, which are firmly wedged into holes drilled in the back of the drift.

This chute is now the standard for the mine and works well. The back over the chute marked *B* in the figure was at first made from 6 to 8 ft. long, but has been cut down to from 2 to 3 ft., which makes it much more convenient for the man barring or blasting. The lip, which is 18 in. long, sometimes catches on large pieces on the top of the cars; but owing to the type of cars used this cannot be remedied. A new type of car is to be introduced which will remove this trouble.

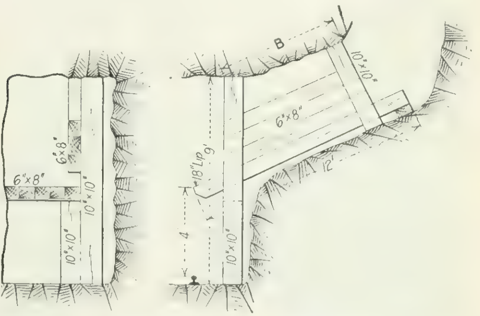


FIG. 8. KEATING CHUTE ADAPTED TO ROCK-DRIFT METHOD

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Failures of Concrete

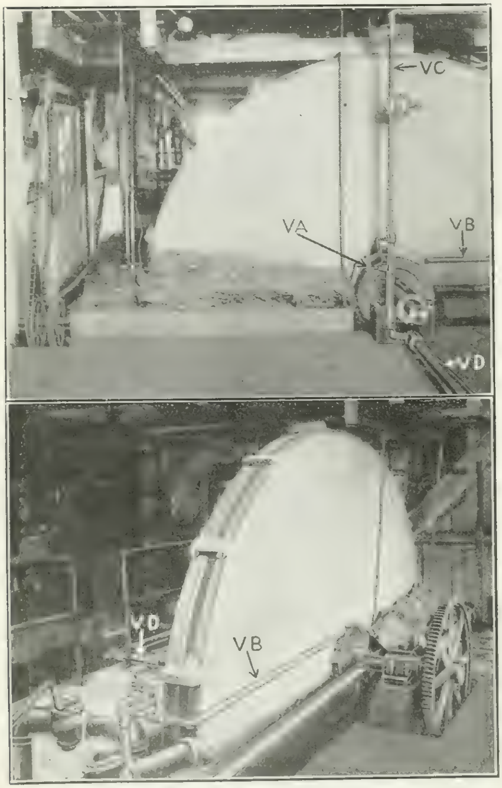
Some of the principal causes of failure of concrete structures are, according to the *Travelers Standard*, January, 1915, (1) the removal of the forms before the concrete has had time to set, (2) lack of care in preparing the foundations or in determining the nature of the soil upon which the foundations are to rest, (3) [illegible]able proportions for the mixture, (4) improper [illegible], and (5) insufficient precautions in cold w[illegible].

Premature removal of the forms is perh[illegible]sible for more failures than any other single cause

Details of Milling and Smelting

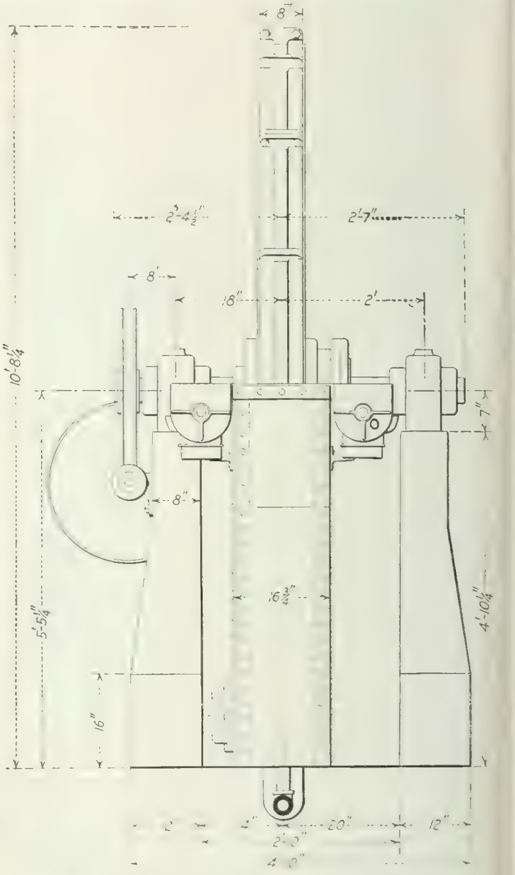
The Robacher Filter

Mention has already been made in the JOURNAL of the new mineral filtering medium, known as "filtros," a highly porous artificial stone, consisting largely of silica, and highly resistant to acids and alkali. A new development in the utilization of this material is in the manufacture of a filter for use in chemical and metallurgical plants. The new machine is known as the Robacher filter and is manufactured at the General Filtration Co.'s plant in Rochester. The accompanying photographs show the filter, the drawing particularly illustrating its method of operation.



THE ROBACHER FILTER, USING FILTROS AS A SEPARATING MEDIUM

The principal variation of this filter from other machines of the revolving type—aside from the use of filtros instead of canvas as a filtering medium—is that the filtering surface is carried upon the flat side of the wheel instead of upon the face of the drum, as is the case with the Oliver and Portland types. The advantages claimed for this filter are, first, the indestructible nature of the filtering medium, and, second, the possibility of installing it in small sections or units, so that should anything go wrong with one block, it would be easy to remove it and to replace it by a new one without the necessity of renewing the entire filtering face, as would be the case with a canvas filter. Should a hole appear in the canvas, it must be sewn up, and thus part of the filtering efficiency removed, or the entire piece of canvas must be removed and replaced by a new one. A larger filtering area is presented with this machine in a small space than with other machines of the type, and of course the chemically inert nature of the filtering medium is a great advantage.



END ELEVATION OF THE ROBACHER FILTER

Low-power consumption is claimed by the manufacturer of this filter, and it is also claimed that the pores are so fine that they will not plug up easily, and that if they do fill it is rather easy to get rid of the filling either by blowing or by acid treatment.

Filtros was developed by J. E. Porter after observing the shortcomings of other porous plates, and was intended to fill the gap left by them with respect to their use for agitating and filtering acid liquids, and also to produce a uniformly porous plate of strength and permanence for use wherever porous mediums are required.

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Preparation of Beryllium Compounds

The preparation of beryllium compounds is given at some length in the *Bulletin* of the Imperial Institute, October to December, 1914. Finely powdered beryl is mixed with twice its weight of dry potassium carbonate and fused for 3 hr. The melt is treated with a slight excess of dilute sulphuric acid and the whole evaporated until the excess of acid is removed. Water is then added, the insoluble silica removed by filtration and the solution concentrated so that on cooling the greater part of the aluminum crystallizes out as potash alum.

The mother liquor, which now contains sulphates of beryllium and iron, together with a small amount of alum, is poured into a saturated solution of ammonium carbonate and allowed to stand for several days. By this means most of the iron and aluminum separate and are removed by filtration. The solution in ammonium carbonate is next treated with superheated steam, which causes the beryllium to be precipitated as a basic carbonate. By repeating the solution in ammonium carbonate and the precipitation with steam several times, a fairly pure product can be obtained.

The preliminary fusion with potassium carbonate may be replaced by one using six parts of ammonium fluoride to one part of beryl and continuing the heating for from 10 to 12 hr. On extracting the mass with water, most of the aluminum remains as insoluble fluoride. The filtrate is evaporated with sulphuric acid to remove the silica and hydrochloric acid and the solution is diluted and treated with ammonium carbonate as described in the foregoing. From the carbonate, the other salts can be readily prepared.

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Nonpareil Insulating Brick

A novelty in insulating material has been introduced by the Armstrong Cork & Insulation Co., of Pittsburgh, Penn. Diatomaceous earth is mixed with finely ground cork, molded to proper form and the bricks thus produced are fired. The cork is burned out, leaving a brick extremely porous in structure, both from the cellular formation of the infusorial earth and the larger spaces left by the consumed cork. These bricks weigh about 27 lb. per cu.ft., as compared with 150 lb. per cu.ft. for firebrick.

It is claimed they conduct heat only $\frac{1}{10}$ as rapidly as does the ordinary firebrick and sustain a crushing load of 140 lb. per sq.in., or 10 tons per sq.ft. They are said to withstand temperatures up to 1800° F. without shrinkage or change of form. They are not a refractory in the ordinary sense of the term, but are rather to back up the ordinary firebrick where it is desired to prevent the conduction of heat.

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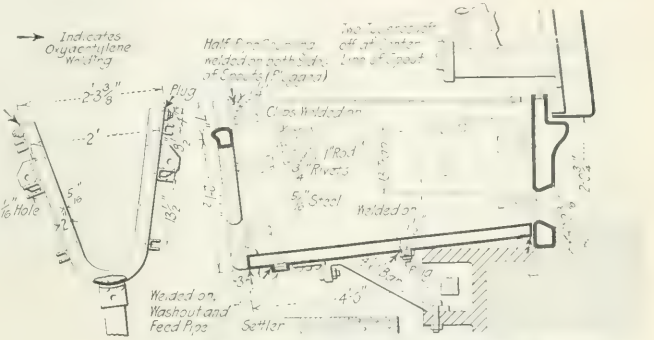
Blast-Furnace Spout at Great Falls, Mont.

The application of oxyacetylene welding at the Great Falls reduction works of the Anaconda Copper Mining Co. was referred to in the JOURNAL of Feb. 27 and Mar. 20, 1915. Besides the applications shown, autogenous welding is used in the construction of the blast-furnace spout illustrated in the accompanying drawing. This is a water-jacketed trough-shaped spout having a water space of 2 in. The inner plate, $\frac{5}{16}$ in. thick, is rolled and then flanged at both ends and on the top. The outer plate, also $\frac{5}{16}$ in. thick, is rolled and then welded to the inner plate. This makes a water jacket without a riveted joint and leaves the spout smooth on the outside as well as the inside. The pipe connections for the spout, consisting of half-couplings, are also welded in place with the oxyacetylene torch. If good circulation is maintained, such a spout should last indefinitely.


→ Indicates Oxyacetylene Welding
2'-3 3/8"
Plug
2'
1 1/16" Hole
5/16"
13 1/2"
Half Pipe Couplings welded on both Sides of Spouts (Plugged)
Clips Welded on
1" Rod
3/4" Rivets
5/16" Steel
Welded on
4'-5"
Welded on, Washout and Feed Pipe
Settler
2'-0 3/4"

OXYACETYLENE-WELDED FURNACE SPOUT AT GREAT FALLS

It is interesting to note the shape of this spout, which is different from many of the trough spouts used elsewhere. No mud dam, such as is common in the Southwest, is used at the front of the spout. In its place is a cast-iron block and a water-cooled lip. This block has a hole near the bottom, which is presumably plugged during ordinary operations, when the blast is trapped 13 in. by the block and water-cooled lip. When it is desired to drain the furnace the plug in the bottom of the block is evidently pierced and the spout and furnace are permitted to drain.

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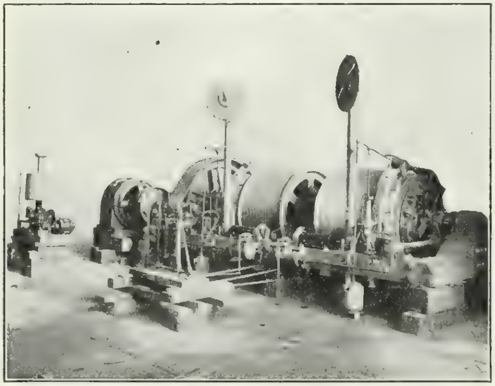
Semi-pyritic Smelting, with 5% of Coke, is performed at Anyox, B. C., by the Granby Consolidated Mining, [illegible] & Power Co., Ltd. The company has three blast fu[illegible] wide by 30 ft. long, and a fourth furnace, 5 ft. [illegible] to be ready by spring, giving a capacity of abo[illegible] per day. The matte, which averages about 1[illegible] verted, without resmelting, in basic-lined, upright [illegible]. This is probably the lowest grade of matte that [illegible] continuously handled on a large scale at any copper wor[illegible] North America.

Mining & Metallurgical Machinery

Electric Hoists for the Michigan Iron Country

The Wakefield Iron Co., a subsidiary of M. A. Hanna & Co., is installing four electric hoists at its properties at Wakefield, Mich. In the design and construction of these machines particular attention was given to safety appliances controlling the operation of the drums. In addition to these there are a number of other interesting features about the hoists. The drums are cylindrical, each 6 ft. diameter and 42 in. face, grooved for 1¼-in. rope, are mounted loose on the shaft and driven by axial plate clutches. The brakes are of the parallel-motion, post type, and the drum shaft is geared to the motor and pinion shaft by single-reduction Wuest steel gears.

Each hoist will be able to lift a net load of 3 gross tons of ore in skips weighing 3400 lb., with a rope speed of 750 ft. per min. A G. E. motor equipped with contactor control and using 2200-volt, 3-phase, 60-cycle current drives the drums through the gears and a flexible coupling.


Electric Hoist for the Wakefield Iron Co.

Both the clutches and brakes are hydraulically operated by oil supplied from an accumulator, and the valves of the cylinders which work these brakes and clutches have a floating-lever control. In this way the operator can move the clutches and brakes as much or as little as desired, and since the motion of the pistons is the same as the motion of the operating lever, the effect on the operator is that of having direct control of the parts to be moved. The accumulator is supplied with oil by two motor-driven, geared, triplex pumps mounted on a base, which forms a reservoir for the pumps to draw upon. From the accumulator the oil flows either to the brake or clutch cylinders as they are moved, these cylinders in turn exhausting back into the suction supply for the pumps. In electrically operated hoists the brakes and clutches are frequently operated by compressed air from some other source at the mine. One trouble with such an arrangement is the difficulty encountered when for some reason it is inexpedient to operate the compressor at a time when it is desired to continue the operation of the hoist. Of the two pumps for the accumulator in connection with the hoists in question, only one is actually needed for the usual work, the other being merely a standby unit. One horsepower is required to drive this pump, and if current is available to drive the main-hoist motor it will surely be available for the small-pump motor.

Three separate and distinct safety appliances control the operation of each drum. First, the miniatures of the hoist are driven by roller chains from each drum back to a lay-shaft. This is shown in the illustration. Geared to this shaft are two limit switches, which are virtually power-driven drum controllers. As the load approaches the top of the run these switches, being geared to the miniature drive, shut off the current as the operator should, provided he does not anticipate this automatic feature. Second, each brake engine is supplied with a solenoid valve, which is normally energized and closed. The brakes are set by dead weight—that is, oil under pressure must be present in the brake-engine cylinder in order to release the brakes when the hoist is in motion. The solenoid valve is directly attached to the brake-engine cylinder, and if for any reason it becomes de-energized, it opens the valve, exhausts the oil and applies the brake. If the limit switch is allowed to shut down the hoist, it will first slow down the motor in successive steps, and finally, when it breaks the motor circuit, these solenoid valves will become de-energized and the brakes applied. Third, a track switch is used and is placed in the runway of the skip in the headframe. This track switch is inserted directly in the circuit which energizes the solenoid valve on the brake engine. If the skip travels beyond its dumping point in the headframe, it will engage this track switch and open the circuit, thus de-energizing the solenoids and instantly applying the brakes. These hoists were designed and built by the Nordberg Manufacturing Co., Milwaukee, Wis.

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Adjustable Arc Ruler

A new drafting instrument, an adjustable arc ruler, is now being manufactured, and can be used for all purposes for which sets of curved templates are used. The instrument is designed to draw arcs of circles having a radius of 3½ in. or greater. The scale is divided into degrees, permitting a curve of any known degree or radius to be drawn with accuracy. The instrument can be used with either the concave or convex ruler edge and is equipped with two scales, one for each form.

The main parts of the ruler are German silver and the edge and scale members are celluloid, the scale being mounted on a suitable scale bar of German silver. The ruler is for sale by the William S. Weston Co., 6617 Greenwood Ave., Chicago.

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Portable Electric Sawing Outfit

A new electrically driven combination swing-and-rip saw has been put on the market by the Reno-Kaetker Electric Co., of Cincinnati. This outfit is self-contained, and is portable, and can be utilized by mining companies which have an electric plant—[illegible] most mining companies nowadays have—either for [illegible] around the mine plants or in isolated cases for use in the standing timber, where by running wires to this new device the old sawmill boiler and engine are eliminated.

⁂

An Oil-Burning Assay Furnace has recently been [illegible] on the market by the Mine & Smelter Supply Co. It has a hood with clay-lined exhaust pipe to prevent undue heating of the assay office, and has the burner so constructed as to cut out most of the noise from it.

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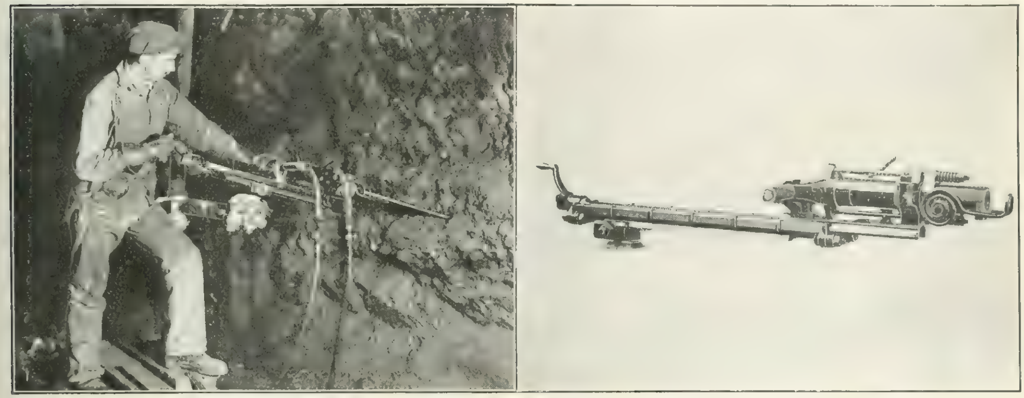
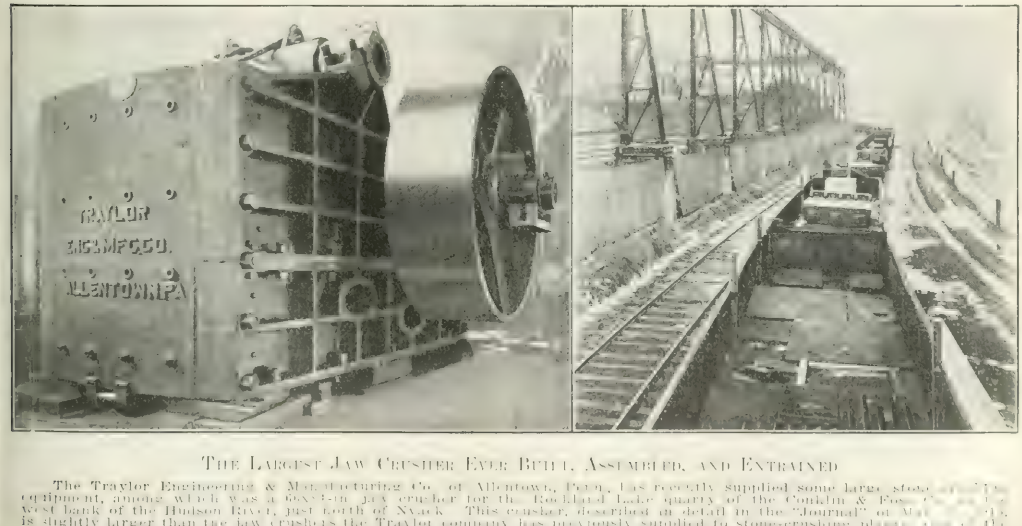
Some Useful Adjuncts to Mining



Ingersoll-Rand Mounted Jackhamer for Flat-Hole Drilling

The jackhamer for drilling flat holes continuously becomes tiresome to the workman, so that the Ingersoll-Rand Co. has developed a carriage on which it can be mounted for drifting, underhand stoping, etc. A water-feed device of the Leyner type has also been added for use in dusty places. A total travel of over 43 in. may be obtained with this mounting, and the total weight is only 63 pounds.



The Largest Jaw Crusher Ever Built, Assembled, and Entrained

The Traylor Engineering & Manufacturing Co., of Allentown, Penn., has recently supplied some large stone [illegible] equipment, among which was a 60x84-in. jaw crusher for the Rockland Lake quarry of the Conklin & Foss Co. [illegible] west bank of the Hudson River, just north of Nyack. This crusher, described in detail in the "Journal" of Mar. [illegible], is slightly larger than the jaw crushers the Traylor company has previously supplied to stone-crushing plants. [illegible] accompanying photographs shows the crusher erected in the shop of the manufacturer. The crusher weighs [illegible] lb. and is approximately 18 ft. high, 26 ft. long and 20 ft. wide. The driving pulley is 12 ft. in diameter [illegible] hp. Westinghouse MS motor will be used to drive the crusher. Fourteen railroad cars were required to [illegible] the crusher from the shops to the quarry, where blockholing and bulldozing will be practically eliminated by [illegible] this large crushing unit.

Correspondence and Discussion

Spitting Fuses

We all know that spitting fuses by the use of matches is poor practice and seldom used except by foolhardy prospectors. Spitting with a candle is very common, and an extra candle is always kept handy because the one used is sure to be blown out once or twice during the process of spitting. But spitting with a candle is also [illegible] practice and unsatisfactory, and is the reason for many short-reports at the end of a round. In mines where acetylene lamps are used, the acetylene flame is fairly satisfactory for spitting, but a second lamp is always necessary, because the one used is also liable to be blown out by the fuse when it spits. Having seen this method depicted on a safety-first movie recently, I am wondering what has become of the good old-fashioned way of spitting with a piece of notched fuse, and why, this being absolutely the surest method of spitting, it is not shown in these safety movies, which are now becoming such a common method for educating the underground man. A notched fuse for this purpose has a flame which is self-perpetuating, and when it spits through one of these notches it makes a flame which will penetrate the powder train of the fuse being spit with almost never-failing results. Why is not this the best method of spitting a fuse?

SOURDOUGH.

Goldfield, Nev., Apr. 5, 1915.

What Is the Matter with Mining?

What is the matter with mining? There is something the matter with it in this district.

A number of times around the first of the year I have been in different parts of this district to investigate properties and have noticed men patrolling the neighborhood with Winchester rifles on their shoulders. In answer to my inquiries I was told that those men owned 10 or 20 claims (60 in one case, I remember) in the principal part of the district which they made little effort to develop, but held by relocation year after year and enforced title and ownership at the muzzles of shotguns and Winchesters.

This is not only true but is so notoriously common that I often wonder why the United States Government does not prosecute such men as intimidators and trespassers on the public domain.

Our Government is making a show of ending unfair, improper monopoly and restraint of business endeavor; but here is one of the most oppressive, hoggish, dog-in-the-manger and inexcusable kind of monopolies and restraints existing year after year without correction, and it is a serious detriment to the whole mining industry hereabout.

Life after life has been sacrificed by men who persisted in prospecting on ground they knew was being held in these ways with totally insufficient work to comply with the laws. Justice and adequate punishment by local courts and juries have been impossible, and for obvious reasons. There are too many whose garments are not clean. In other words, to put the truth bluntly, you cannot expect a thief or two on a jury to convict the one on trial. The friends of a dead—murdered—prospector are seldom financially able to employ competent legal talent and to subscribe the large necessary expense fund to secure justice. The county supervisors are loth to stand such expense against the slim chance for conviction, even where the district attorney is competent and honest.

But the power of the Federal Government behind a prosecution has a wonderful influence in stiffening the backbone of important witnesses, who otherwise fear to tell the whole straight truth. Only the strong arm of the National Government can put a check to this condition and break it up. A few shrewd, fearless detectives who can be implicitly trusted and some prosecuting attorneys like Francis J. Heney can benefit the country some millions of dollars in a little while, if set to work with the proper backing. There should be means taken to put a stop to activities of men who threaten the lives of witnesses and to secure public officials who will not be bribed.

A. D. BOYD.

Searchlight, Nev., Mar. 22, 1915.

Why Is the Patent Mania?

I am surprised at Mr. Greenawalt's defense of our present patent system, which he seems to think cannot be greatly improved. In this he is at variance with nearly every engineer and layman with whom I have discussed the subject.

Since the concentration of ores by flotation is in the spotlight of the metallurgical stage at the present time, both in the practice of the art and in patent litigation, I trust I may be permitted to make a few quotations from both sides of the controversy which are much to the point, and most of which I did not have an opportunity to read until some time after my previous article was sent to the JOURNAL.

As is now well known, the basic patent for oil flotation was taken out by Miss Carrie J. Everson in 1885, and of course has expired. Mr. Hoover, who for four years was general manager and consulting engineer for Minerals Separation, says:[1]

> All the salient points of the flotation method as it is used today are accurately described in Everson's patent, and with such clearness and distinctness that anyone of ordinary skill in the treatment of ores can, by following the instructions in Miss Everson's patent, easily produce the results being secured at Broken Hill and elsewhere. That her invention was quiescent for a number of years does not argue any lack of completeness or perfection. The real reason for its lack of commercial application was its startling departure from previously known methods.

In the preceding chapter of his book he summarizes 110 patents on flotation; "but out of them it would not be possible to cull 110 new ideas." I do not know how many patents have been issued on this subject since the book went to press—Apr. 11, 1914—and yet Minerals Separation is making a desperate fight in this country to control the process.

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[1] "Concentrating Ores by Flotation," 1914 edition, p. 67.

With the light of the above-cited experience Mr. Hoover thus summarizes the patent system in both United States and Great Britain:[2]

> The patent law has been one of the greatest accelerating factors in our modern civilization, because it has offered an adequate potential reward to individual effort. When inventions were few and widely differentiated, governments were able to give adequate protection to the inventive class, there being in the nature of things little interference or clash of interests. However, after a hundred years of highly accelerated development, we have arrived at a point where it is obvious that either the patent idea or its method of operation has completely broken down.
>
> Leaving out of account the victims of patent "pirates"—unfortunately a large class—there are numerous well-intentioned people who have been deceived as to the value of the contract and covenant issued by the Government purporting to guarantee to them, their heirs and assigns certain definite benefits and profits. The industrial world is alive to this breakdown and a discussion of remedies has occupied the attention of serious reformers. . . . Sooner or later governments must undertake to make their guarantees good. . . . The men who are most competent to judge in these cases (the validity of a patent) are not called until the matter is before the courts, technical and scientific men of ability and training generally being conspicuous by their absence. The patent commissioner or chief is generally a politician, whose chief ambition is to draw his salary with a minimum of effort. Examination by the Patent Office should be thoroughly scientific. As no expert examiner has perfect knowledge, the specification, as determined by the official examiner, before final sealing should be published in the recognized technical press covering the particular subject of the patent, announcing that unless valid objections are submitted within six months the patent shall hold good from date of publication and be a perfect protection against any possibility of the patent ever being the subject of a lawsuit.

On the other side of this controversy I quote from the remarks of Mr. Hyde before the San Francisco section of the A. I. M. E. last October.[3] Mr. Hyde suggested

> that the Patent Office be re-housed and given a good library; that proper laboratories be available in which inventors should be required to demonstrate that they have really an invention; minute variations should be cast out; salaries of Patent Office officials should be made worth while; publication of all applications for patents should be required; much discretion should be left with the patent examiner, as is done in this department in Germany; the whole system of patents in the United States requires investigation and overhauling; and there should be one court in Washington presided over by technical men, for patent business only.

To which the editor says that Mr. Hyde

> is in accord with virtually all who have come in contact with the patent law. No one doubts the value of a patent system, but the present cumbersome and expensive method of determining the validity of a patent places a heavy tax on the industry, and certainly does not operate to reward inventors.

Both of these gentlemen advocate the publication of applications in the technical press, which will probably suggest an answer to Mr. Greenawalt's analogy to a patent on a mining claim. The advertising revenue from such a system would boom the stocks of the technical press, but I can foresee the flood of objections that would come into the Patent Office, which would surely eliminate all patents on trifling details.

Mr. Greenawalt seems to confuse improvements with patents, and intimates that without patents there would be no improvement in the arts. The value of anything is measured by results, pecuniary or otherwise. The value of a high percentage of patents as now obtained must be purely one of pleasure and satisfaction, for it cannot be one of financial reward, aside from possibly two sets of patentees—first, manufacturing companies which strengthen their basic patents by a long string of detail patents on improvements, and second, other large companies which reap a negative reward by patenting everything obtainable relating to their operations, as a defensive movement against litigation. Where, then, lies the incentive for improvement, pleasure or profit? If the former, would not the real reward be greater in publication of the improvement in some society proceedings or the technical press, rather than in the Patent Office *Gazette*?

It is an unfortunate fact that even real inventions are often born a generation before their time, and the patent expires before the common run of humanity is able to appreciate its value, so that the original patentee does not receive a commensurate reward. This was the case with the cyanide patents, the Everson patent and a host of others that might be mentioned.

The present bill before Congress to change the patent law seems to be a sudden alarm brought about by the European war and relates only to the dyestuff industry. Concerning this Dr. Baekland has testified before the Committee on Patents that "the trade in [illegible] for tanning and other purposes is about equivalent in value to the value of aniline dyes imported into this country."[4] The particular features of this bill seem to be a two-year working clause and allowing a patent only on a process and not on a product, neither of which seems to meet the approval of those best posted. The two-year working clause has been pronounced a failure, although it has been adopted by many countries—as a retaliatory measure if nothing else.

Chemical industries have resorted to secrecy rather than take chances with the publicity and infringements connected with the patent system, and their operations are such that they can easily do this. The general theory is that any improvement can be kept reasonably secret for two or three years at least, during which time any company will have made such an advance over its competitors that if it cannot maintain that advance by continued improvement it deserves to fall by the wayside.

The idea of one court for the patent business, presided over by technical experts instead of lawyers, seems to meet with favor on all sides. But why put it on the rear end of the system? It is generally admitted that the Government grants are of no protection to a patent. They simply open the gates to determine its validity through the courts in every country in which the patent is issued, which is a prohibitive process to most inventors. Then why not simplify matters by putting the technical court on the front end of the system in the form of well-paid expert examiners in each art represented? Let them have ample assistance and have them properly index all patents issued. Let the heads of each department form a final board to pass on the validity of an application before the patent is issued. This would greatly relieve the burden on a final, technical, patent court, if established, and secure more rapid and more satisfactory results. Such a final court could be kept busy for a number of years on the "accumulated tailings" from the Patent Office without much new business.

It may be that the patent law needs much less attention than its method of operation, and if so, the whole reorganization ought to be comparatively simple.

Denver, Colo., Mar. 20, 1915. STUART CROASDALE.

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[2] Ibid., pp. 12 and 13

[3] Editorial, "Mining and Scientific Press," Oct. 17, 1914

[4] "Met. and Chem. Ind.," February, 1915.

Two Old Appalachian Copper Mines

By John W. Mason

The accompanying illustration is a reminder of the early days of the copper industry. The view at the left shows part of the plant of the old Perkiomen copper mine not far from historic Valley Forge, on the outskirts of the village of Audubon, where once lived the great naturalist of that name.

This mine and the neighboring Ecton mine were worked during the early '50s; but there is now little to suggest former activity, save the wrecks of the old buildings and the caved shafts. In the dumps one can still find a few pieces of copper-stained quartz, and the portals of two old adits are still visible, one of which serves as a spring.

Whitney, in his "Metallic Wealth of the United States," says of these old mines: "They occur in a metalliferous zone that ranges in a general east-and-west direction across the Schuylkill River and is six or seven miles in length. Ten or 12 holes occur not far from the boundary of the metamorphic rocks and new red sandstone, in either or both formations.

"From the manager's report, Apr. 1, 1852, the Perkiomen Consolidated engine shaft was below the 50-fathom level, and the vein, 4 to 9 ft. wide, was made up of quartz, gossan and sulphate of baryta, with green copper carbonate and copper pyrite. On May 1, 1853, the engine shaft was 62 fathoms deep. In the 50-fathom level the lode is reported as not productive. In the nearby Ecton mine the engine shaft was 66 fathoms, and a level had been driven a few fathoms each way on a lode 3 to 8 ft. in width, but poor in copper. From August, 1851, to April, 1852, 524 tons of ore was sold by this company for $30,573, and varied from 7 to 23% Cu. In the year ended April, 1853, 143 tons of ore was sold for $9989. The Ecton and Perkiomen shafts are 1800 ft. apart."

Old Stone Power House of Perkiomen Copper Mine, Near Audubon, Penn.

Dumps of Old Copper Mine in the Bare Hills, Near Baltimore, Md.

The view at the right shows the dumps of a copper mine in the Bare Hills, just outside of Mount Washington, a suburb of Baltimore. This is evidently a deposit in metamorphic schist, typical of the southern Appalachian region. One of the deepest shafts in this region was sunk here on the vein. One statement claims that it is 832 ft. deep and another 950 ft. Work was commenced before the war and kept up intermittently until 1903. From various authorities, it is estimated that from 1866 to 1886 there was mined and shipped to the Baltimore Copper Works, for treatment, upward of 30,000 tons of 18% ore. For a number of years there has been nothing done here. Pieces of high-grade ore are visible in the dump, which evidently contains considerable copper and may be of economic value.

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Lost Mines

By G. L. Sheldon*

Lost mines! Who has not felt the lure of the mystic combination of these two simple words?

The gambling spirit is inherent in the human race; and in the search for lost mines and buried treasure the prospector and the average man may find a fascinating field for indulging this propensity, each in the hope that fortune will smile upon him. It is a legitimate sport, however, and the fellow who outfits a prospector for such a venture should bear in mind that the latter frequently risks that which is more precious than a few hundred dollars in cash—sometimes his very life.

In the United States the lost-mine industry appears to offer less chance of reward than in Mexico and South America. In Mexico, practically every mining district can boast of its lost mine. Many of these, no doubt, actually exist, for the reason that about 100 years ago the Indians, fired by the enthusiasm of the priest Hidalgo, either massacred their Spanish taskmasters or drove them from the country.

The Indians, attributing their enslavement to the Spaniards' lust for gold and silver, covered up, caved or destroyed the entrances to many of the mines. Assisted by nature in a country where torrential rains abound at certain seasons, it is not surprising if the Indians in many cases succeeded in obliterating all local clues to the location of mines which once sent their Royal Fifth to enrich the King of Spain or his viceroys.

The records, however, remain in distant archives, telling, in many instances, the names of the mines, the district where located, the production at different times, etc., but rarely is the description of a character to enable the casual searcher to rediscover them.

One of the most noted—Topia—supposed to be in the southeastern part of Sonora or over the line in western Chihuahua, is said to have been fabulously rich and to have had a large production. It has been stated that the records describe a trail hewn out of perpendicular cliffs for several hundred feet, then a certain distance across a mesa, where there are two piles of rocks or monuments, with a cross between them. Thence, go in the direction which one of the arms of the cross indicates to a small circular valley in which is situated the town, and mine, Topia. Many Americans and Mexicans have spent much time and money hunting for this mine. Often has it been reported as found, but subsequently developments have proved that a mistake was made. It is even stated that President Diaz at one time had 40 to 50 soldiers out several months trying to find it.

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*Ely, Nevada.

One day my *mozo*, while hunting deer, found an old trail, cut out of the rocks in places and leading up into the mountains in the section where the Topia mine is supposed to be situated. It was in a wild, isolated country and must have been made to give access to a mine. But as we were scheduled to break camp in a day or two, it was not investigated.

An American of my acquaintance who once explored in this locality described to me what bears a close resemblance to the identical trail. He stated that he and his companions went over the line into Chihuahua, climbing a trail which in places was cut out of the solid rock. The trail must, indeed, have been an ancient one, for the drill-holes, cut in the rocks to receive the hard-wood pins which served to hold in place the logs forming the outer edge of the trail in the most dangerous places, were evidently made with a flint rock and not with iron or steel, as they were about 3 and 4 in. in diameter.

On the mesa above they found the two piles of rocks with a cross between them. Following the direction in which one of the arms of the cross pointed, they came to a circular valley. Here was abundant evidence of an old town, and a large one, some of the ruins indicating that the houses must have been at least 100 ft. square.

But a group of Indians resented the presence of the ntruders, directing a few shots at them and setting fire o the underbrush. As it was during the dry season, the ire spread so rapidly that my friend and his party sudden-y remembered a pressing engagement somewhere else and never returned. Nor have I ever investigated this erritory since, though my friend gave me the directions for finding the locality.

When operating in southwestern Chihuahua our *hacienda* was near the junction of two small creeks in an old mining district. In the early days it was the custom f the Government to coin silver slugs for use as money n each locality, these slugs weighing as high as 10, 20, 50 and 100 oz.

When we first went there in 1898, small pieces of silver bullion, from 1 to 10 oz., circulated as money at one peso per ounce; and, small change being scarce, the merchants would stamp the weight on each piece.

On a small creek which headed just below two old ilver mines the natives would at the close of the rainy season wash the gravel to recover native silver, using he wooden *batea* in the same manner as it is employed in placer mining for gold. When a few ounces of silver had been secured they would place it in a fragment of broken *olla* (the general utility article of culinary pottery employed throughout Spanish America) with some lead flux and smelt it crudely in the charcoal fire f a blacksmith's forge, scorifying the charge and recovering a single lump of silver bullion ranging from 975 pward in fineness.

On our *hacienda* there was a large boulder about 20 ft. high and flat on the top. Tradition had it that the Jesuit priests used it as a pulpit from which to preach to the Indians. One day, while setting out banana plants in the vicinity of this boulder, we found a cement floor about a foot below the surface. Not far from this we discovered the ruins of several old adobe *vasos*, or crude smelting plants, as well as pieces of ore. Several [illegible] were found in this immediate neighborhood, indicating the former activity of Indians and Spaniards—notably a stone measuring about 2x3x4 in. with a groove at each extremity (presumably employed by the Indians in the manufacture of arrows) and an old spur of the type used by the soldiers of Cortez and Coronado, with a rowel wheel about 7 in. in diameter.

Here were evidences of an old trail leading up into the mountains from our hacienda. In places the trail was cut out of the solid rock. There was no known pass leading out or across the mountains in this direction. Therefore it is probable that it led to a mine or something equally interesting.

Although tradition (whose alias in Spanish America is *se dice*, or "they say") speaks of an old lost mine in that section, neither Americans nor Mexicans are known to have found it. A few years before I went there a boy lost his way while hunting cattle and found an old mine dump. Some pieces of ore, said to be from the dump in question, were assayed by an American and found to be rich in silver. The American, with the boy and other Mexicans, spent several days trying to find the old dump again, but the search was fruitless.

In southwestern Chihuahua, a few miles from the state line, there is a small rolling mountain of limited extent concerning which it is said that the records in Spain show that the old Gloria Pan (either "heavenly bread," "communion bread" or "cream-cake") mine is located upon it, that it was rich in native silver and that it had a large production.

Many people (including a Mexican of my acquaintance, who with several men spent two months in the search) have tried to find it, but with the usual result.

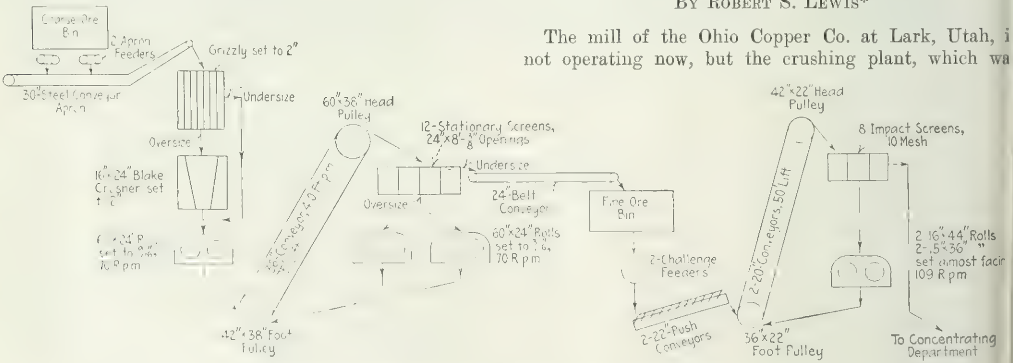
On a creek at the foot of the mountain are the ruins of an old hacienda, and pieces of ore showing native silver have been found there. Not far from these old ruins is a trail starting up the mountain; but a landslide or some other convulsion of nature has cut the trail off abruptly.

We were operating not far from this mountain, having located a zone with the exclusive right to prospect the mountain for 90 days. We had two Americans prospecting there for nearly two months. One doctored the sick child of an Indian who lived in the vicinity. The father of the child brought this American a piece of ore showing native silver, saying that it was from the Gloria Pan mine and that out of gratitude for the curing of the child he would show the location of the mine. But for some reason he failed to keep his promise.

The Jesuit priests in the early days of the conquest of the Americas (and ever since) have taught the Indians that all mines belonged to God, were only for his use and that if they showed the mines to anyone but the priests God would be angry and would strike them dead either immediately or soon thereafter. This grim and astute warning has so impressed the Indians for generations that it is almost a waste of time to attempt to induce an Indian to show a mine. Many an American has learned this to his cost.

However, I learned of one apparently authentic case. My *mozo* (who was afterward with me for 10 years, and whom I consider to be absolutely reliable) was once accosted by an Indian with a high-tension thirst. This Indian had been drinking for several days and was out of funds, but apparently still obsessed with a suicidal mania and quite indifferent as to any choice between the Jesuit route and the plain alcoholic route.

He said, or attempted to say, "*Yo tengo una mina, hombre, muy rico. Dame una botella de mezcal y yo la enseño a Ud.*" (I have a mine, mister, very rich. Give me a bottle of maguey brandy and I'll show it to you.) His request was granted, and the performance was repeated daily for six days, after which the Indian vanished. A month later he reappeared and said, "*Vamanos*" (Come, let us go). They went out of town several miles to a mountain where the Indian had been cutting wood. The Indian sat on the ground, saying "*Aqui está su mina, muy rica. Búscala.*" (Here is your mine, very rich. Search for it.) He hunted all around, while the Indian remained seated in the same place, repeating the formula and moving his outstretched hands in a circle around him. After a few hours the *mozo,* not finding any signs of a vein, became disgusted and left, cussing the Indian. Later, in thinking it over, he recalled that the Indian always had his thumbs pointed down toward the ground when moving his hands to and fro. He returned to the mountain, and in the spot where the Indian had been seated was a vein of rich silver ore covered with grass and leaves. He located it. His father was an expert millman and understood the "patio process," having worked many years for a rich Mexican, mining and milling ores. They worked the mine for a time, were doing well and had bought some cows and a small place with an orange grove.



Flow Sheet of Ohio Copper Co.'s Mill, Utah

One day the Mexican for whom his father had worked came to see the mine. He bought it, ostensibly for $21,000—$1000 cash and $20,000 in future payments. Neither my *mozo* nor his father could read or write. They signed the papers by making their mark, and later it transpired that they had sold the mine outright for the $1000. Up to a few years ago the mine was still working. The rich Mexicans have often treated the poor peons in this manner; and this fact, no doubt, is one of the direct causes of the present conditions in that unhappy republic. It has often been the case that the peons would show us, the Americans, mines or veins *because we have the reputation of playing fair.* We should strive to live up to our reputation.

In the near vicinity of the mountain where the Gloria Pan mine is supposed to be located is a creek cutting through a massive, dense, soft gray porphyry. The action of the waters has cut out this porphyry in such a way that in places, while the opening at the plateau level is but 50 to 100 ft. wide, at the creek level, 200 to 300 ft. below, there is a width of 200 to 300 ft., the ravine thus having overhanging smooth walls. There are places where these walls, well protected from the action of the elements, are painted in various bright colors. The designs depict many kinds of animals and birds, some of which can hardly be said to represent any types known to modern naturalists. A trained archæologist, however, might construct some interesting theories to account for the origin of these pictures, proving some of his points by comparison with some far-distant but exactly similar records undreamed of by the casual prowler.

In general it may be stated that when the Mexican—who is a close observer—cannot find a lost mine it is almost useless for a white-man-in-a-hurry to spend his time looking for it. His feverish haste to get rich operates against him and blinds him to many things which might aid him in his search. Apparently, success in the quest for lost mines may be attained by but two classes of persons—the trained expert who is willing to devot his time to the systematic analysis of fascinating facts and the natural-born lucky fellow who is watched ove by a divine Providence.

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The Crushing Plant of the Ohic Copper Co.'s Mill

By Robert S. Lewis*

The mill of the Ohio Copper Co. at Lark, Utah, i not operating now, but the crushing plant, which wa installed and operated under the management of G. Waddell, embodies some interesting features of desig The flow sheet is simple, so that no detailed explanati is required aside from the accompanying illustratio This article, therefore, will be devoted principally to simple mention of the unusual points of design. All t machinery is heavy and strong, since it is subjected severe strain when crushing a large tonnage of such ha ore as is encountered at the Ohio Copper Co.'s property.

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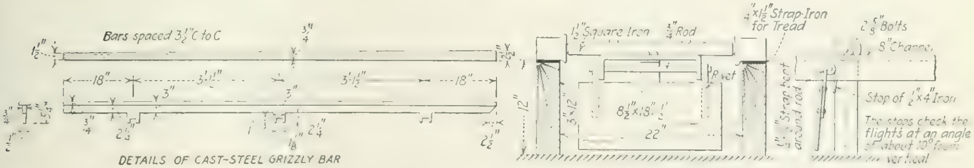
*Associate professor of mining, University of Utah. Sa Lake City, Utah.

There are two apron feeders, which supply the 30-in. steel conveyor. These feeders work fairly well, but their plates have a tendency to bend in time. The bars of the grizzly are of cast steel, T-shaped in section, and each has three lugs to fit over the cross supports, which have suitable recesses cast in them. The recesses are spaced 3½ in. center to center. The bars taper in width, making the opening between them 1 in. at the top of the grizzly and 2 in. at the bottom, a construction which facilitates renewing the bars and prevents clogging.

Discharge end of 30-in. apron conveyor

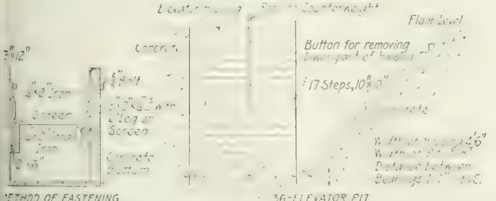
Bumpers at head of 36-in. elevator

MACHINERY ARRANGEMENT AT OHIO COPPER CO.'S MILL



DETAILS OF CAST-STEEL GRIZZLY BAR

PUSH-CONVEYOR DETAILS



ETHOD OF FASTENING
TATIONARY SCREENS
IN PLACE

36-ELEVATOR PIT

ARIOUS DETAILS OF MACHINERY IN OHIO COPPER CO.'S MILL

There are three sets of 60x24-in. rolls, of the Garfield type, for heavy duty. The shells, 6 in. thick, are shrunk on the core; but on account of the width of the face they e put on in two sections—one 10 in. wide and the other in. wide. The shells are heated for shrinking on the res by means of a gasoline burner. As the ore is ushed dry, considerable heat is developed in crushing, d this is sufficient to loosen the shells unless they are refully put on.

The roll springs are kept so tight that the result is actically the same as a rigid roll, the spring bolts being tightened with a wrench to which is hitched a 10-ton chain-block. The springs are so tight that they will flatten a bolt to the width of the roll opening.

The elevator pits were designed to avoid the difficulty usually encountered in mills where sufficient space is not allowed for proper working. In this mill a broad flight of stairs leads to the bottom of each pit; the lower part of the elevator housing is removable and counterweighted so that it can be pushed up out of the way, giving free room for repairmen to work. The elevator head-pulley is 60 in. in diameter by 38 in. face, and has a split hub of $5\frac{7}{16}$-in. bore. Two keyways, on quarters and running the full length, are cut in the hub, and each end of the hub is turned down to take an iron band ⅝ in. thick by 5 in. wide, which is shrunk on after the pulley has been put in place. Adjusted in this way, the pulleys do not loosen. They are easily taken off the shaft when the bands are cut with a cold chisel.

The elevator belt is 12 ply, 36 in. wide and has two rows of 9x9x18-in. buckets placed 30 in. apart. The rows are staggered. Two 3x6-in. timbers shod with ½x3-in. iron at one end are hung so that they can be lowered until the edges of the buckets strike against them. The object is to provide a jarring which will empty the buckets when the ore is a little sticky. The 20-in. elevators have 10-ply belts with a single row of 8x8x18-in. buckets placed 18 in. apart. A piece of belting is placed between the back of each bucket and the belt.

The 36-in. elevator discharges into a receiver from which 12 spouts lead to the screens, one of which is provided for each spout. These screens are 24 in. wide, 8 ft. long and are set at an angle of 45° with the horizontal. They are of heavy wire, with 1x⅜-in. openings, and are so arranged that they can be easily reversed end for end or turned over to equalize wear. Each screen is held down on its supports by two 3x2x¼-in. angles, which in turn are fastened in place by three lugs of ¼x2-in. iron spaced 3 in. apart. It is easy to loosen the lugs with a hammer, remove the angles and take out the screen. They do efficient work, and like the impact screens give trouble only when the ore is damp and sticky.

The push conveyors are simple and compact, but are not economical for conveying ore long distances. Supporting rollers are spaced 8 ft. apart and run on iron straps fastened to the edge of the trough. For a 24-in. stroke the straps should be spaced 18 in. apart, giving an overlap of 6 in. at each stroke. The drive is from crankarms on a countershaft. For smooth operation the feed should be introduced at a point 4 or 5 ft. from the end. The conveyors do good work, but are sensitive to overfeeding, which causes the driving belt to fly off its pulley, with consequent choking of the conveyor.

The coarse-crushing department, comprised of the Blake crusher, 36-in. elevator, stationary screens and three sets of 60x24-in. rolls, has a capacity of 3000 tons per day. The fine-crushing department, comprised of four sets of small rolls, eight impact screens and two 20-in. elevators, is designed for a capacity of 1000 tons per day. The plans call for two more fine crushing units. Ore will be supplied to these units by extending the 24-in. conveyor which runs under the stationary screen.

MOTOR EQUIPMENT

30-in. apron conveyor and two feeders	15-hp. motor
Blake crusher and coarse roll	150-hp. motor
Each fine 60x24-in. roll	75-hp. motor
36-in. elevator	50-hp. motor
24-in. belt conveyor	10-hp. motor
One 20-in. elevator, one push conveyor and feeder, four impact screens, two rolls	75-hp. motor

In concluding, the writer wishes to acknowledge his indebtedness to F. A. Dederichs, the superintendent, from whom much of the information was derived.

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Reported in New York

The New Keystone Copper Co. sold its property at Miami, Ariz., to the Inspiration Copper Co., taking Inspiration shares in exchange; but owing to a suit brought by Carl F. Pforzheimer no distribution of them has yet been made. The Keystone directors this week issued a circular to their stockholders reciting the circumstances of the case and asking them to express their wish as to what should be done.

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The stockholders of the Anaconda Copper Mining Co. are to hold a special meeting May 19 to act on a proposition to double the par value of the stock, which is now 25, and to cut the number of shares in half. Publication of the notice calling the meeting was made in Butte, Mont., on Apr. 20, 30 days' notice being required for the special meeting. The significance of the action the stockholders will be asked to take is the preparation it indicates for the dissolution of the Amalgamated Copper Company.

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The phenomenal rise in copper stocks during April is considered to be well founded, in view of the strong statistical position of the copper trade. Although there has been so huge a rise, many of the standard coppers are still selling at less than what is computed as their real value on the basis of an average price of 14½c. for copper. However, the crazy gyrations of the shares of the industrial companies, which are supposed to be benefiting from military contracts, are not relished. It is expected that there will be a reaction in the market on their account, which will naturally involve the rails and the coppers, although less severely.

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When the manufacturers of explosives began to take war orders they did not give much thought to sulphuric acid. When they began to look for the increased supply of acid that they needed they experienced trouble. In fact, the price of sulphuric acid on the Atlantic Coast has gone up extravagantly and is now about what anybody chooses to ask. The would-be buyer considers himself lucky if he can find any. This refers, of course, only to the concentrated acid, 93½% H_2SO_4 and upward, the explosive manufacturers being unable to use the lower grades. The increased profit accruing to acid manufacturers is reflected in the last quarterly statement of the General Chemical Co., which showed a profit of $1,007,920, compared to $652,271 in the corresponding quarter of 1914. The present prices for acid may induce some of the smelters who turn out acid of 60° Bé. as a byproduct to install concentrating plants.

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Safety Meets at the Panama-Pacific Exposition

It has been proposed by H. M. Wilson, the secretary-treasurer of the American Mine Safety Association, that the contestants at all state mine-rescue and first-aid meets pay an entrance fee of $25 or thereabout, the proceeds to be expended for the benefit of the winning team, enabling it thereby to represent the state at the mine safety demonstration and third annual joint field meet of the Bureau of Mines and the American Mine Safety Association, Sept. 23-24, 1915, at San Francisco, Calif.

It is anticipated that this meet may be even larger than that held in Pittsburgh in 1911, in which a team from the state of Washington participated. State meets ar already arranged to be held in May at Pineville, Ky. McAlester, Okla.; Huntington, W. Va.; Billings, Mont. Moberly, Mo.; Pittsburg, Kan.; Canton, Ill.; Birmingham, Ala.; Fort Smith, Ark., and Des Moines, Iowa The preliminary program follows:

Sept. 23—10 a.m., mine-rescue demonstration; 2 p.m., first aid demonstration; 4 p.m., coal-dust explosion.

Sept. 24—10 a.m., first-aid contest for interstate supremacy 2 p.m., rescue contest for interstate supremacy; 4 p.m., rock drilling contest; 8 p.m., award of prizes and souvenirs in th Convention Hall.

There will be music each day by the exposition bands.

The following organizations will hold indoor conference about the same time:

Sept. 17-18, American Institute of Mining Engineers; Sep 20-22, American Mining Congress; Sept. 20-25, Internationa Engineering Congress; Sept. 22, California state mine-rescu and first-aid contest; Sept. 27-30, National Safety Conferenc under joint auspices of the National Safety Council and th California Industrial Accidents Commission (Sept. 28 to b devoted to mine-safety conference); Oct. 6, the World's In surance Congress discussion on the relation of insurance t mine safety.

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Unreasonable Ore Rates to Douglas

The Arizona Corporation Commission on Apr. 20 com plained to the Interstate Commerce Commission tha rates on ore and concentrate from points in New Mexic to Douglas, Ariz., over the Santa Fé and the El Pas & Southwestern railroads are unreasonable compared wit the rates from the same points to El Paso, Tex.

Editorials

Treasury Department Needs a Mining Engineer

A good mining engineer out of a job might find an opening in the Treasury Department. At least there seems to be need of a mining guide for some of its officials. A recent incident will suffice, without going into the Gold Hill Consolidated case, which became the subject of a Senatorial "investigation" last year owing to the sending of a Treasury employee to the Gold Hill mine and the use of Senatorial stationery by Walter George Newman, its promoter. When it comes to a real mine, with millions of tons of developed ore and technical direcion of the highest sort, Comptroller of the Currency John Skelton Williams has consigned it to the wildcat list, without turning a hair or sending a Treasury employee o investigate. In his haste to reply to charges by the Riggs National Bank of Washington of unfair discrimnation the Comptroller of the Currency objected to some f the collateral which the bank accepted, and has listed as alleged wildcat stock the shares of the Inspiration Conolidated Copper Co.

Listing as a wildcat one of the big copper mines of the world, in which about $12,000,000 has been invested in plant, and sending a Treasury employee to one of the oldst and most obstreperous of mining wildcats probably epresent simply a difference in the personal point of iew; but we should not care to be under the dominance f that personal point of view and hence are inclined to ympathize with the officials of the Riggs bank.

A good many persons besides the Comptroller of the Currency have not yet awakened to the class of mining nvestments that we now have in such mines as the porphyry coppers, such gold mines as those of Lead, S. D., Treadwell Island and Juneau, Alaska, and the Witwatersrand, and perhaps some deposits of mixed sulphide res. Such mines have been developed to produce inividually at the rate of millions of tons of ore per annum, have had millions of money expended on their plants, ave proved ore reserves sufficient to maintain their prouction for 10, 20, or even 50 years, and are reckoned as quidating enterprises upon the basis of their assured fe. The accuracy of the estimates has been absolutely roved in principle, and in individual cases has been hecked and rechecked by independent engineers. More ıan that, dividends to the amount of millions and milons of money are being paid annually. In the case of ıe copper mines the investor is subject only to the vicissitudes of the market for copper, and even respecting that e takes no chance if he figures on a reasonable average. n the case of the gold mines even that chance is absent.

The investor who puts his money in such a mine knows ıat he is putting it in property that cannot vanish over ight. Panics may come, but his property is unharmed. ew York City real estate that is in a prosperous quarter oday may be worth but one-tenth as much a few years ence owing to a change in the course of trade. Standard railways may run down, like the New Haven. But an orebody of 100,000,000 tons is a solid thing. Let the Comptroller of the Currency take notice.

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Mining Company Reports

The season of the appearance of the annual reports of the principal mining companies is now drawing to a close. Of the big companies only the Anaconda and the Calumet & Hecla have not yet been heard from. The coincidence of most of the reports during the third and fourth months of the year results from the common adoption of the calendar year as the statistical period, which in itself was a commendable innovation, establishing uniformity and enabling comparison among the individual reports and other statistical data to be made readily. There are now but few concerns of importance that adhere to an irregular fiscal year.

The character of the company reports has been improving year by year. In this connection a good deal of credit is due to the companies controlled by Hayden, Stone & Co. and Messrs. Jackling, McNeill and Penrose, which were among the first to adopt the policy of communicating full information to their stockholders. We have at last reached a point where many of the big companies appear to be animated by a spirit of emulation as to which shall tell its stockholders the most, while there is scarcely any one now that scurvily issues a few unintelligible figures and calls them a balance sheet and annual report, as they did 10 years ago.

However, we have now some companies which issue elaborate pamphlets and make a pretense of frankness, imitating the better concerns but carefully avoiding telling the important things. These concerns make a good deal of noise, which like the beating of tom-toms in Timbuctu is intended to drown the small voice of truth, or scare away the enemy. Of course no expert critic is deceived.

But certainly quite outside of that class are such recent reports as those of the Utah, Chino, Ray and Nevada Consolidated; Miami; Phelps, Dodge & Co. and Calumet & Arizona; the Lake Superior companies generally; the St. Joseph Lead Co.; the companies managed by F. W. Bradley; the Federal Mining & Smelting Co.; the principal Tonopah companies; and Goldfield Consolidated.

Some of these companies go into technical details that are far beyond the understanding of the average stockholder into things indeed that it is quite unnecessary for him to know. Such a report is the last one of Goldfield Consolidated, which presents data of mining and milling costs in a way superior to anything we have ever known previously. Such a report is to be regarded not merely as a communication to the stockholders but also as a contribution to technical literature, as an imparting of valuable information to the engineering profession at large. No company would be open to any criticism for not doing this, but when a company does do it, high praise is deserved.

Rio Tinto Affairs

In the gloomy days for copper—about six months ago—but little was heard respecting things at Rio Tinto, although we knew that production had been severely curtailed. The statement of Mr. Fielding, chairman of the board, at the stockholders' meeting on Mar. 31 throws a little light upon affairs at the mines. Mr. Fielding said:

> I am certain that the shareholders will approve of the precautions we have been taking so to manage our business as to make it practically certain that none of our production could by any indirect channel get to the King's enemies. They will also approve of the fact that we have granted leave of absence on full pay to most of our younger engineers and other English employees on joining the army. You will be glad to hear that a large number of them have been found fitted for commissioned rank.
>
> The Spanish workpeople have had a hard time, as such of the markets as remained open to us did not absorb even half our usual output, but the board kept all departments going three days a week, and thus enabled the men to get a bare living. Since the beginning of the year we have been able to find work for most of them for four days a week. Part of the work is unproductive of immediate profit, but is done in anticipation of the future. It is always well in a great mine like ours to have the opening up of orebodies well ahead of actual requirements, and, indeed, funds when available for such anticipatory work are often very well spent, and later on enhance the profits through the future economies they make possible.
>
> The copper output from the ores in process of treatment at the mines and from the local smelteries is now progressing satisfactorily, and certain economies in the costs of some of the operations should now be felt. All the same, we can not, of course, expect any return to the old scale of prosperity while the unhappy war lasts.
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> We have done, and are doing, our best in every way for the company's interests, and, with others, we must be contented to await for the full return of our old-time prosperity until England and her allies have firmly established the peace of Europe.

In reading this we were inclined to rub our eyes and we looked to see if we had inadvertently picked up the report for a previous quarter. But no, the date was correct—Mar. 31, 1915. Evidently British copper directors are not yet feeling so good as ours. However, that is not unnatural. They are nearer to the scene of the war.

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Rail Production in 1914

The depression of the steel trade in 1914 is illustrated by the American Iron & Steel Association's report of the production of steel rails in that year. The total make was only 1,945,095 tons, which was only 55% of the total for 1913. It was the smallest reported since 1908, and we have to go back to 1898 to find another year with so small an output. Foreign as well as domestic consumption decreased largely, the exports of rails falling from 460,553 tons in 1913 to 174,680 tons in 1914, a reduction not wholly due to the war, as only a small proportion of these exports is to European countries. As the imports were only 22,571 tons, the approximate consumption in this country in 1914 was 1,792,986 tons. The new track built during the year was a smaller total than for several years past, and the railroads evidently cut down renewals to the lowest possible point.

The remarkable feature in rail making is the change in the material used. Up to 1903 practically all our rails were rolled from bessemer steel, and in the succeeding five years the proportion made from openhearth steel increased but slowly up to 1908, when the total was 571,791 tons. In the next five years openhearth gained rapidly upon bessemer steel, passing it in 1911 and reaching 72% of the total in 1913. In 1914 it again increased, being 78.5% of the total. If the change continues bessemer steel will cease to be of importance in railmaking. Iron rails are no longer made, none having been reported for four years, while before that the quantity was small.

The loss in production was mainly in the heavier sections. Light rails seem to have been in demand, for the decrease in those under 50 lb. to the yard was small, and the proportion of the total rose from 7.7 to 11.8%. Apparently the demand for light and industrial railroads kept up much better than that for the heavier steam railroads.

Another point worth remark is the decrease in alloy-steel rails, which reached their maximum in 1910 with 257,324 tons, and fell last year to 27,937 tons. Of the reasons for this we have little information, the time not having been sufficient to test fully the endurance of these rails. Apparently a conclusion has been reached that their value did not compensate for the additional cost. About five-sixths of these rails were of titanium steel and one-sixth of manganese steel.

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Smelting as a Public Utility

There has been considerable agitation in Colorado respecting legislation to put the smelting business in that state upon the footing of a public utility, much as the milling of grain used to be in country towns. In those cases where the total business was sufficient for only one mill, and the farmers could not therefore enjoy the advantage of competition, there was a good deal to be said in favor of regulation of a public utility in the common interest, even though it were owned and operated by a private person. However, this was before the advent of the railway, which widened the field of everybody.

One of the bills introduced in the Senate of Colorad provided for the submission to the people at the next general election of an amendment to the state constitutio so as to make Section 16 read: "Any person, company association or corporation, engaged in this state in smelting ores, minerals or metals, shall be regarded as engage in a business affected with a public interest and devote to a public use." This bill was killed in a joint committe of the senate and the house and was not submitted to th senate for vote. Our Denver correspondent reports tha nothing more will be done respecting this matter at thi session of the legislature, and therefore the subject wil be dropped for at least two years. This is fortunate, in asmuch as the subject is one that bristles with difficultie and if there is to be any legislation about it there oug to be a lot of time for consideration before any action i taken.

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Don't Buy Zinc Mines Now

The phenomenal price for zinc now prevailing wi inevitably induce unscrupulous promoters to attempt t foist zinc mining stocks upon ill-informed persons wh have money to risk. Let such persons take note th the present price for zinc is abnormal, unprecedent and far above what is reasonably to be expected as a average price; moreover, that it is due simply to co ditions produced by the war and will last no longer tha the war, perhaps not even so long.

Persons who own zinc mines are enjoying a windfa superior to anything they ever dreamed, but this is n time for "have-nots" to consider becoming "haves." Those disregarding this advice will find that they have zinc mines purchased upon inflated valuations, while shrewder persons will have the money.

These remarks are inspired by the report of our Joplin correspondent that a "press bureau" is being organized by promoters of that district. The wise will understand without any explanation what that portends.

BY THE WAY

Mexican courts have adjudged Leonard Worcester, the American mining engineer, guiltless of charges of fraud in the carrying out of an ore-purchasing contract, according to information telegraphed to the State Department late on Mar. 16. Worcester had been held prisoner for some time in Chihuahua and strong representations had been made by the State Department in his case. Worcester on being released is understood to have started for the United States.

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George Graham Rice has been entertained gorgeously in Salt Lake City by the mining brokers, who tendered him a vote of thanks—for what, it is not quite clear. The list of names of those attending the several functions is not impressive. One of our subscribers in Salt Lake City writes: "Every parasite of mining here is toasting and running after this man. It is disgusting." He hints that things are incubating that will not be liked by those who are seriously engaged in the mining industry.

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The chairman of South Crofty, Ltd., announced at the recent annual meeting in London that the company had sold its wolfram output for a period of two years. The company controls several important tin mines in Cornwall, which produce wolfram and arsenic in addition to tin. Formerly it sold its wolfram to German buyers, having been unable to find any market in the British Isles. Shortly after war was declared the company found itself with a large stock of wolfram, which was declared contraband. The chairman reported that this accumulation was sold on Mar. 3 and a contract entered into for the company's entire wolfram output during the next two years.

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The annual report of the De Lamar company, together with the supplementary report of the meeting in November, 1914, makes interesting reading. A tabulated statement records the progress of this property from 1891 to the present time, and the record of dividends paid reflects the changing fortunes of this well-known mine. Reported to have been worked out in 1902, it started to rework some of the old tails, and these with a small amount of new ore furnished substantial dividends during the next three years. Then came three lean years, when the receipts scarcely equaled the expenses. New discoveries in the Somercamp section of the property, with lower expenses, then gave three more years with substantial dividends, which was followed by another three years with no profit. In 1914 new discoveries in the Somercamp and Afterthought sections of the property have been encouraging and a mill is now being erected on the latter section of the property for the treatment of its ores. Owing to the conservative management of this property the directors have not found it necessary to call upon the stockholders for the equipment and development of these latest discoveries and the prospects are that this old property, which has seen so many periods of discouragement, will soon be again upon a dividend-paying basis.

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At the last meeting of the New York Section of the Mining & Metallurgical Society M. L. Requa, of San Francisco, delivered a masterly address upon the valuation of petroleum land, especially with reference to California The petroleum industry of California has not been profitable, and recently has been practically prostrate. An effort is being made to consolidate all of the producers other than the Standard Oil Co., etc., and enable them to get upon the right kind of a basis. Mr. Requa has been in charge of determining the value of the respective properties, and in doing it has applied more or less of the methods used in valuing mines, elaborated with many original ideas to fit the special case. The work, which has been one of herculean proportions, is now approaching completion. Mr. Requa remarked that just before he left San Francisco a friend said to him: "Requa, when you publish your figures you will do well to leave the state for a while." Mr. Requa added that lately he had been engaged in New York in allotting the subscriptions for the Alaska-Juneau stock that was offered early in April. To the surprise of everybody, this issue was four times oversubscribed, and there were all kinds of wire-pulling to get the stock. "Requa," said one of his friends, "after you have made the Alaska-Juneau allotments you'd better get out of New York for a while." "So," continued Mr. Requa, "I am advised not to be in California and not to be in New York. If I can't be in either place, I really do not know what to do."

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Mining operators in Mexico have their problems, even in the "undisturbed" districts, as may be noted from the report of the Esperanza company for the quarter ended Dec. 31, 1914: "Operations during the period under review were governed by the small stock of cyanide on hand at the mine. The production of San Carlos ores was reduced in virtue of the fact that this class of material consumes much cyanide, due to the baser ingredients of the ore. The tonnage of those ores more amenable to the process was increased in so far as the stock of cyanide on hand would permit. No sand-dump material was treated, since the consumption of cyanide would be excessive in virtue of the profit won. In order to maintain a fair production and profit, a small tonnage of high-grade ore from the San Carlos vein was concentrated in water, a rich lead streak being cut off from the lower grade iron concentrates and melted directly with the bullion. The relatively small tonnage of iron concentrates produced was stacked at the mill for shipment to the smelter. Actual results of this scheme of operation came out as was expected, but due to the unsatisfactory transportation service of the railways much metal in concentrates has been 'tied up' at the mill." The secretary of the company states that as a result of the chaotic conditions of the mail service in Mexico no definite statement of receipts and expenses has been received from the mine, but adds that "advice has been received by letter, dated Feb. 28, that all work had been suspended and that the native population had deserted the camp."

PERSONALS

Emil Baerwald has removed his offices to No. 61 Broadway, New York.

H. P. Henderson, mining engineer, has removed his office to No. 60 Broadway, New York.

Arthur Thacher is in New York on matters connected with the New Jersey Zinc Company.

Haas Brothers have removed their offices to the Adams Building, 61 Broadway, New York.

Libbey & Updike have opened offices as engineers and assayers at 228 Sierra St., Reno, Nevada.

C. M. Weld, consulting mining engineer, has removed his office to No. 60 Broadway, New York.

W. H. Aldridge is about to leave for a trip to northern Mexico to inspect the mining interests that are in his charge.

Arthur Neustaedter has been appointed manager of the pyrite mine of the Arminius Chemical Co. at Mineral, Virginia.

G. O. Bradley, for a number of years consulting engineer for the Utah Copper Co., has resigned, and will open offices in San Francisco.

Professor D. Copeland has resigned the directorship of the Rolla School of Mines and will return to South America to resume mining.

Geo. D. James, of Napa, Calif., is at present in Auburn, Placer County, Calif., on professional business in connection with mining properties in that vicinity.

Philip Argall, of Denver, Colo., sailed on Apr. 21 for London where he will be engaged on business for two or three weeks after which he will return directly to this country.

H. W. Gepp, from the Broken Hill district, Australia, was in St. Louis recently investigating the shipment of Australian zinc concentrates to the Middle-West smelters.

Wm. B. Ruggles, president of the Ruggles-Cole Engineering Co., returned from Russia on Apr. 10. He was abroad for 2½ months, one month of which he spent in Petrograd.

F. Charles Merry writes us that the personal note in the "Journal" of Apr. 17 stating that he had gone to Utah was incorrect, except that he passed through Salt Lake City on his way to New York.

E. F. Gray, general manager of the Consolidated Coppermines Co., Ely, Nev., has been in New York and other Eastern cities for several weeks on company matters. He will return to the mines late in April.

O. M. Bilharz has moved from Flat River to St. Louis, since he resigned as manager of the St. Joe Lead Co., and will make that his headquarters for the present pending the consideration of a large mining proposition.

Frederic R. Weekes, Marion L. Thomas, and Eugene H. Dawson, who have been associated with A. Chester Beatty in the Empire Building, 71 Broadway, will continue their engineering practice in the offices they formerly occupied with Mr. Beatty.

H. Foster Bain stopped over a day in St. Louis, on his journey to London to take the editorship of the London "Mining Magazine," to attend a dinner given in his honor by Philip N. Moore that was attended by the prominent local mining engineers.

The committee on the Samuel Franklin Emmons memorial fellowship has awarded it this year to Mr. Max Roesler. Mr. Roesler after a few years of mining experience in Montana, following his graduation at the Sheffield Scientific School of Yale University, was attached to the geological staff of the Copper Queen mine at Bisbee, Arizona. After six years in this connection, he has recently been doing special work in the East, being among other things, one of the technical advisers of the Palisade Park Commission of New York State.

OBITUARY

A. S. Glück, of Roswell, N. M., a recent graduate of the University of Illinois, was accidentally killed in the Portland mill at Cripple Creek, Colo., Apr. 14. He had been working in the mill only a few weeks.

Franz von Kugelgen, a well-known German electrometallurgist, who came to this country several years ago and engaged in the manufacture of magnesium, calcium and other electric furnace products at Holcomb Rocks, W. Va., returned to Germany last summer to rejoin his regiment. He was wounded in Poland, Nov. 21, 1914, and is now reported dead.

Wilbur H. Travers, of Chicago, representative of the Chicago Pneumatic Tool Co. in the Lake Superior District, died Apr. 15, at Houghton. He contracted a cold in the copper country, which developed into pneumonia. Mr. Travers had traveled in the Lake Superior District and other mining sections of the country for a great many years and was well known to a large number of mining men. He leaves a wife and two sons.

Major Luther Stedman Bent, former president and chairman of the board of directors of the Pennsylvania Steel Co., a veteran of the Civil War and a prominent civil engineer, died at his home in Philadelphia, Apr. 19. He was 86 years old. Major Bent was born in Quincy, Mass., and served throughout the Civil War. After the close of the war he was employed supervising the construction of the Northern Pacific Ry., and in 1874 became connected with the Pennsylvania Steel Co. He retired as head of the company about 10 years ago.

John M. Sherrerd died at his home in Easton, Penn., Apr. 15. Mr. Sherrerd was a graduate of Rensselaer Polytechnic Institute and a member of Phi Beta Kappa. At the time of his death, Mr. Sherrerd held the position of assistant to the president of the Kennedy-Stroh Corporation, Pittsburgh, Penn.; before its absorption by that concern, he was secretary of the Stroh Steel Hardening Process Co. of Pittsburgh. Prior to his connection with the Stroh interests, Mr. Sherrerd was for 18 years with the Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Captain John T. Rosewall of the Cyrus mine, Buhl, Minn., was killed instantly underground Apr. 16. A cap was being placed in position when it gave away, injuring three miners besides killing Captain Rosewall. He had only recently taken his position at the Cyrus. For a number of years he was mining captain at the Mississippi mine of the Oliver Iron Mining Co. at Keewatin, Minn. The Mississippi was on the Hill lands and reverted to the Great Northern Co. the first of the year. His cousin, Captain James Rosewall, is in charge of a number of properties for the Oliver company on the Mesabi range.

SOCIETIES

The Minnesota Sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers will hold a joint meeting in Duluth on June 11 and 12. Details of the meeting, subjects of papers, etc., not yet announced, excepting that June 12 will be devoted to a trip through Minnesota Steel Co.'s plant, various ore and coal docks, and blast furnaces of Zenith Furnace Co., at Duluth.

Oregon School of Mines—The first annual show by the School of Mines of the Oregon Agricultural College, April 5, was a success. A model mine shaft equipped with the latest improved type of drilling machinery and a relief map of Oregon prepared by the Oregon Bureau of Mines were features of the exhibits. This map will soon be sent to San Francisco to become a part of the exhibits in the Oregon Building at the Panama-Pacific Exposition.

In the ceramics laboratory types of machines used in the manufacture of drain tile and other clay products were demonstrated and the methods of assaying precious metals were made plain to visitors in the assaying laboratory by the students in charge. The School of Mines plans to make this an annual event.

INDUSTRIAL NEWS

The Lehigh Valley Coal Co., No. 133 North River St., Wilkes-Barre, Penn., is calling for bids on driving a 19,500-ft. tunnel near Drums, Luzerne County, Penn. Bids will be received until May 15, 1915.

On Mar. 11, 1915, Henry R. Towne having declined reëlection as president of the Yale & Towne Manufacturing Co. after 46 years of service in that position, was elected chairman of the board and Walter C. Allen, previously a vice-president and general manager, was elected president. The other executive officers of the company are now as follows: Schuyler Merritt, vice-president; J. H. Towne, secretary; John B Milliken, treasurer; Joseph A. Horne, general superintendent of the works The years of employment in the company's service of these officers vary from five to 46, all but one having served over 20 years.

Editorial Correspondence

SAN FRANCISCO—Apr. 14

North End Comstock Mines have been unwatered to within 25 ft. of the 2700 level with air-lift pumps and the new electrical pumps were dropped on Apr. 10. It is expected the electric pumps will have cleared water from the 2700 level before end of month. These lower levels of the Mexican, Union and Sierra Nevada were flooded in 1885 and were not explored below the 2500 level. The ground to be exposed by the unwatering extends along the lode for a length of 1½ miles and for a width of 1000 ft. and to a depth of 200 ft. Similar ground above the 2500 level has within 10 years yielded $7,000,000, and it is believed the orebodies persist to the 2700 level and below. It seems to have been the policy of the early day management to deepen the mines and open up new ground without prospecting. The present management has knowledge of bodies of low-grade ore in these levels and purposes going after it in the belief that there are also high-grade shoots of ore that will prove very profitable.

The Two Inimical Legislative Bills for the mining industry, known as the non-English speaking bill and the collar-to-collar bill are not likely to be passed by this legislature. These bills were very strongly opposed by a number of mine operators in discussion in committee. It was shown that in California a large number of laboring men or carmen and muckers employed in the copper and gold mines are foreigners of whom quite a proportion are either unable or unwilling to speak the English language; that continued operation of the larger mines is wholly dependent upon securing this class of labor. The day has gone by, in California at any rate, when Americans will perform the labor essential to the handling of ores extracted by machine drills. It was shown to the committee and to the author of the bill that in the early day when drilling was done by hand the carman was called a carman and he had opportunity to graduate to a drillman; that in the present day there are naturally fewer drillers owing to the use of machine drills and there is scarcely any opportunity for a carman to become else than a common aborer. It was shown further that the wage of the mucker oday is equal to the wage of the carman 25 to 35 years ago and that the price of board in California and other Western mining states has not changed materially in the past 30 years. The most effective point made in this discussion was that the barring of non-English speaking labor in the California mines would certainly reduce production and in some cases actually lose down the mines. Effective argument was presented in he discussion of the collar-to-collar bill showing that it would be impossible to reduce the number of hours of actual abor underground without seriously affecting mining operaions and that in some instances such reduction would result n actually closing down of the mines. The Melones in Calaveras County is the most striking example of the effect that uch a law would have. That mine is a low-grade producer which has been in operation for a great many years, and while t has employed a large number of men and has been for long time operating a 100-stamp mill and is equipped with very modern appliance, the mine has never paid a dividend. The property covers a large area and if the time of the men hould begin and end at the boundary of the company's proprty there would be an aggregate loss of time from actual abor that would discourage the company in the effort to continue operation in the hope of ultimately developing ore of ufficient value to warrant the payment of dividends. A trong opposition offered to these bills was made possible by he thorough organization of mine owners, managers and uperintendents accomplished in the California Metal Proucers' Association. It is the first time in the history of modrn mining in California that the operators have got together s a unit to oppose wisely the passage of laws that are detrimental to the interests of the mining industry. The danger in the employment of non-English speaking races will be argely reduced by the inspection rules that are to be adopted, s these rules provide that the most essential paragraphs shall be printed in the various languages spoken by the men who perform the common labor. The objection to the regulation of he eight-hour law by the individual mine is overcome to a arge extent by employers who consider the welfare of the men as well as their own interests. In some districts the men start to work on their own time and leave work on the company's time. In some districts, notably in Nevada County, the miners very strongly opposed the passage of the collar-to-collar bill on the ground that their working hours were properly regulated by themselves and their employers under mutual agreement. A significant feature of these discussions was that none of the mine workers were present before the committees to demand the passage of either of these laws. The plea was made by their representative that the men could not afford the time. But it was quickly shown by the employers present that they would all have been glad to allow the men full time had they desired to be present at these discussions.

DENVER—Apr. 18

Mining Men of Ouray are negotiating with the state geological survey for a report on their region, the fieldwork to be accomplished during this coming summer. Although the region is quiet, an effort is being made to exploit the resources and to publish reports that may attract capital. The Wanakah smeltery, rebuilt last year, has proved adequate in treating ores of this district and it will hereafter be an active bidder for custom patronage.

Idaho Springs Mills are all working to capacity. Ore is being produced in sufficient quantities to justify erection of additional custom plants. Just over the county line there exists a congestion of ore on the one-cord-car service of the Gilpin County Tramway and at the few mills that are operating. A close canvass of the mining situation in these districts shows that, with the opening of new custom mills ready to purchase and treat sulphide ores, production would probably fill the increased outlet.

The Portland Mine, Victor, according to the daily press during the past three weeks, has been making remarkable strikes. According to such statements, a 4-ft. body averaging better than $4000 per ton was opened between the 15th and 16th levels, this shoot having a central core worth more than $60,000 per ton. Since popular credence was given to these reports on account of the bonanza over in the Cresson mine, not far away, Frank G. Peck, president of the Portland company, to satisfy inquiries, has stated that no phenomenally rich bodies of ore had been disclosed, either recently or for several years, if exception be made of numerous small pockets or vugs that are encountered in all orebodies. Mr. Peck states that the mine is in excellent shape long to maintain a heavy tonnage that will average from $25 to $60 per ton, which of itself is somewhat of a bonanza. He says further, "With our company, the work of producing gold and selling it to the United States mint is an industry and not a venture. We have never tried to manipulate the price of stock but have busied ourselves in building up our mine and mills, increasing our ore reserves and maintaining dividends. We pay no attention whatever to quotations on exchanges."

BUTTE—Apr. 15

President Thayer of the Anaconda arrived in Butte Apr. 11 to make his annual inspection of the company's properties in Butte and other sections of the state. He brought with him good news for the Butte district. "We are now working every mine that is possible to work," said Mr. Thayer in speaking of the situation. "The only mines that are down are the Mountain View, the Mountain Con and one or two smaller properties. The Mountain View is the only large producer that has not been started. Extensive changes and improvements are being made at that mine, employing some 100 men. The surface plant is being remodeled, new drums and cables installed and practically the entire shaft retimbered. As soon as this work is finished, the Mountain View will be started up. It produces about 40,000 tons of ore per month when in operation. The Mountain Con will resume operations in a day or two with 350 men and a production of from 600 to 700 tons per day. The work on the new refinery at Great Falls is going steadily forward. It will have a capacity of 10,000,000 lb. of copper per month. Alto[illegible] $1,750,000 will be expended at the Great Falls works. A[illegible] Washoe plant in Anaconda improvements that comp[illegible] have cost $4,000,000, are going on steadily. The im[illegible] at both plants will result in an increase of 12[illegible] and in a saving of 90% of the mineral conten[illegible]." With the resumption of operations at the various mines, the Anaconda company has increased its output to [illegible] 80%

of the normal. The March output amounted to 23,180,000 lb. of copper, which includes the North Butte production. At this property the new electric hoist which is of the Ilgner type with the Ward Leonard control and is the largest hoist of its kind in America, is being tried out. It will greatly increase the mining possibilities at the North Butte properties. The work of putting the new Granite Mountain shaft as well as the Speculator shaft in shape for increased production, will be carried forward rapidly. Eventually the new hoist will carry all the ore from the underground workings of the North Butte company to the surface and the old Speculator shaft will be used only for subsidiary purposes. There are now more than 600 men employed at the North Butte mines and the production has been increased from 50% to 75% of normal capacity. Probably no attempt will be made further to increase the present output until the crosscutting on the 3000 level is continued to the ledge of the Edith May and the orebody is opened up there.

JUNEAU, ALASKA—Apr. 10

A Wireless Station at Juneau will be built by the Marconi Wireless Co. as soon as a suitable location for the station can be secured and the work of installation completed. A representative of the wireless company is in Juneau and promises to be transmitting marconigrams not later than 30 days after work begins. He says the company will reduce the present cable rates on all commercial business and keep three operators at the Juneau station.

KETCHIKAN, ALASKA—Apr. 8

A 200-Ton Smeltery for Ketchikan to be erected and operated by the United States Bureau of Mines is asked for in a petition being circulated throughout the Ketchikan district, and later to be presented to the Alaska Legislature, asking them to transmit to Congress a memorial requesting that the enterprise be consummated as described. The petition sets forth that there are many large bodies of iron ore in the district; that the copper, gold and silver contained in this ore is all of value that is recovered and that the total iron goes into the slag when this ore is smelted; that this iron might be used for the manufacture of iron and steel products which now sell on the Pacific coast at a considerable advance over Eastern prices; that smelting rates at present with no competition are exorbitant and leave the shipping miner little profit; and the petition further sets forth that there are at least 25,000,000 tons of this iron ore and that at present every ton shipped shows an economic loss of $6 per ton, which makes a total of $150,000,000 to be reclaimed by this project which will otherwise be wasted.

SEATTLE—Apr. 14

The Citizens' Stamp Mill, built with money donated by business men of Fairbanks and used for several years to test small lots of ore free of charge, has been leased by Stevens & Perrault and will be moved to Murphy-Perrault property on Pearl Creek.

Koyukuk Output for 1915 is expected to reach $200,000, about the same as the average for several years past. Many prospectors have spent the winter on the Arctic Slope but it is not known whether important discoveries were made. The Wild Creek district is turning out well; one shaft sunk last winter is something of a freak in that it penetrated more than 100 ft. of clear ice without reaching the bottom. Hammond River, the old stand-by, will again be an important producer. Captain Haines is reported to have proved a large body of pay on the south fork of the Koyukuk, but the report has not been verified.

Latest Reports from Tolovana are most encouraging. According to [illegible] Conradt, the well known Fairbanks operator, Stone, [illegible] & Verdi, laymen on the lower 1000 ft. of Discovery claim, Olive Creek, have proved a paystreak 200 ft. wide running [illegible] to the sq. ft. The depth to bedrock is 24 ft. Some prospecting has been done on claims above and below the [illegible] but no pay has yet been found. Olive Creek is two miles long and enters the Tolovana a short distance above Livengood. On Livengood Creek pay has been found at intervals for four miles [illegible] a sq. ft., the paystreak is [illegible] ft. wide and the depth to bedrock ranges from 25 to 28 ft. [illegible], [illegible], [illegible] and [illegible] tributaries of Livengood, have shown good prospects but no pay. Opencut mining will probably be of more importance than drift mining. It is not expected that the output for the year will be large, owing to the lack of machinery for large-scale operations. Much dissatisfaction is felt by the prospectors in the district in regard to the Regan mining law, which is blamed for setting the camp back a year. The law required $100 worth of location work within [illegible] days of the date of location of a placer claim and [illegible] worth of assessment work for each year, including the year of the location, thus making $200 for each claim where nothing was required before. The prospectors were kept so busy complying with the terms of the law, as they understood it, that they had no time prior to Jan. 1 to carry on a systematic search for pay. By the time pay was proved the trails were commencing to break up and it was too late to transport heavy machinery. It will therefore be possible to do little besides prospecting work this summer.

TONOPAH—Apr. 14

I. W. W. Invasion of Tonopah is again threatened. Posters, supposed to have been printed in San Francisco, have been spread around the town threatening revenge by the Industrial Workers of the World for the imprisonment of John Pancner, who shot a miner, and for the fatal wounding of Jack Whyte, a national I. W. W. organizer. The posters read as follows:

> I. W. W.'S—Take a look at this.
>
> John Pancner is still unjustly rotting in the pen at Carson City, Nev.
>
> The master's law, through one of its courts, declares him guilty.
>
> The worker's law declares him innocent and demands that he shall be set free.
>
> On to Nevada!
>
> The fight for John Pancner is a fight for the future of the I. W. W. in Nevada. Help us to win, for without your coöperation the master's class will triumph.
>
> Spend your summer in Nevada. Be on the job.
>
> Direct Action. Sabotage. Revenge for the brutal assault of the gunmen at Tonopah, in which course Jack Whyte was killed.
>
> When in Tonopah, join the Propaganda League.
>
> At Goldfield, Miners' Industrial Union.

JOPLIN—Apr. 17

The Opening of the Zinc Smeltery at Pittsburg, Kan., by Joplin mine operators is the latest development in the zinc-mining field. A company to be known as the Joplin Ore & Spelter Co., with a capital stock of $100,000 has been organized by Turner & Co. of New York and S. Y. Ramage of Oil City, Penn., to smelt zinc ore from the Joplin district. The old North Pittsburg smelteries have been purchased and are being overhauled and rebuilt preparatory to being put in operation. The smelteries have six blocks of 224 retorts each, making a total of 1344 retorts and are the largest zinc smelteries in Pittsburg. The work of placing these plants in shape for steady operation is now in progress and it is estimated that within two weeks two blocks will be running and that the whole plant will be operating at capacity within 30 days. The Joplin Ore & Spelter Co. will handle only Joplin concentrates, buying in the open market, and although the owners of the new company are among the district's heaviest producers of zinc ore, it will be the policy of the smelting company to smelt the ore produced at their mines only when it will be advantageous to do so. Articles of association have been filed in the Recorder's office at Carthage, Jasper County, Mo., stockholders and their holdings announced are, N. E. Walker, $49,995; Ralph Butler, $1; George W. Means, $1; E. D. Edmonson, $1; B. B. Hamilton, $1; R. O. Robinson, $1. The capital stock is divided into shares of $1 each, one-half the capital stock being paid in. All the stockholders mentioned are residents of Joplin. The smelteries purchased by the Joplin Ore & Spelter Co. have been idle about 18 years and were last operated by the Cockerill Zinc Co., and are situated about one mile north of Pittsburg. It is given out that the unsatisfactory condition of the zinc-ore market for the past several months and the extremely high price of spelter, coupled with the strong demand for that metal, are the prime reasons for the starting of the new smelting company by the Joplin ore producers.

TORONTO—Apr. 17

Full Electric Power is again obtainable at Cobalt and Porcupine and the companies can again resume operations at capacity.. It is expected that several of the Cobalt companies which had suspended work will resume activity at once.

No Further Extension of Time for the performance of work on mining claims will be granted, so Hon. G. Howard Ferguson, Ontario Minister of Mines, has officially announced. Last year the government issued an Order-in-Council providing that the period between Aug. 15, 1914, and Apr. 15, 1915, should be excluded in computing the time in which assessment work should be done. The Department has been besieged with requests for a further extension but the Minister considers that in view of the unemployment situation and in the interests of mining development a further extension would be undesirable.

The Mining News

ALASKA

NELSON LOTT MINE (Juneau)—This old mine, adjoining Jackling property near Juneau, has been purchased by Boston and Seattle capitalists, who plan to spend $250,000 in development work.

ALASKA JUNEAU (Juneau) — Heavy oversubscription to new stock offered public. Furnishes $3,600,000 to liquidate present indebtedness of $800,000 and provide funds for development and equipment. Expected ultimate earnings $1,400,000 per year.

SILVER KING (Fairbanks)—H. M. Henning, of San Diego, has bonded Silver King lode claims in Koyukuk district, on which have been exposed several veins of argentiferous galena. Purchase price is $350,000; no cash payment made, but terms call for $1000 worth of development work monthly until Sept. 1, 1916, when payment of $87,500 is due.

ALASKA EXPLORATION (Fairbanks)—G. Aarons, manager, is on his way from London to superintend work of company on Twin Creek, tributary of upper Goldstream. Ground will be mined by hydraulicking or by means of large steam shovel. This company has been operating 3½-cu.ft. dredge on Fairbanks Creek for several years and success of last season's work has led to expansion of activity.

ARIZONA

Gila County

ARIZONA COMMERCIAL (Globe)—Shipments at rate 100 tons per day resumed on starting up again of Old Dominion smeltery. Commercial's production should reach rate of 6,000,000 lb. per annum soon.

Mohave County

GOLCONDA (Cerbat)—Largest zinc mine in southwest is under option to New York banking interests.

UNITED EASTERN—Promotion of company due to Long, McIver, Keith and Seeley Mudd, former two men being in active charge of development work. Property consists of seven claims and adjoins the Tom Reed property. First ore was found at a depth of 100 ft. where vein was small and averaged $7 per ton. On 300 level first high-grade ore found, vein at that point being about 16 ft. wide averaging over $20 per ton.

TOM REED (Oatman)—Company has built road from Oatman to Topock, where Santa Fe railroad crosses Colorado River, for purpose of reducing haulage charges to mine. Railroad spur and warehouse have been built at Topock. Road is approximately 24 miles long and cost about $25,000. Three miles of it, through heavy sand near Topock has been oiled. A Jeffrey quad truck and trailer have been purchased; capacity two tons on truck and four tons on trailer. This is first truck of this type in Arizona.

Pinal County

LUCKY STRIKE (Kelvin)—E. J. Turner has announced that mill is to be built on property this summer.

Pima County

IMPERIAL COPPER (Silverbell)—Mine formerly owned by Development Company of America has been purchased at receiver's sale by Leo Goldschmidt, of Tucson for $104,000; has record of having produced more than $1,000,000 worth of copper ore in one year.

L. C. FRIEND (Tucson)—Is preparing to install hydraulic equipment to cost about $150,000 upon his 500-acre placer property in Guijas Mountains and to carry on development operations on large scale. Gold-bearing gravels between Arivaca and Guijas creeks give average yield of $1 per yard.

Santa Cruz County

RUBY COPPER (Mansfeld)—Will soon resume operations.

Yavapai County

RINCON (Congress Junction)—Has been purchased by John McCabe owner of Silver King mine in Pinal county. Newly acquired property is well equipped with machinery.

McCABE (McCabe)—Col. J. C. Rankin has received word from London office of Copper Gold Consolidated owning Gladstone and McCabe mines that proposed development will not be started until close of European war.

CONSOLIDATED ARIZONA SMELTING—Is building an electric power transmission line to De Soto mine, Middleton, Ariz., from its plant at Blue Bell mine. Power drills will be placed in operation as soon as line is finished.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Tailing flume, partially destroyed by heavy winter winds, completely repaired and in better condition than when first built. Shaft repairs in progress and winze started from 3100 level. Twenty stamps are dropping on ore extracted from the 2800, 3000 and 3100 levels. J. A. Davis is superintendent.

Calaveras County

GOLDEN SIERRA (Stonyford)—Reported that this paint mine will be reopened. Property is owned by Welch, Harlan and others of Williams.

ECONOMIC (Esmeralda)—Electrical plant put in working condition and power plant ready to be connected with main plant at Blair upon completion of transformers and motors. Most of timbering is completed. Mill will be in charge of Henry Williams. About 700 tons of ore in the bins ready for the mill. V. M. Weill of Boston is manager.

Eldorado County

LARKIN (Placerville)—Property to be sold at public auction to satisfy court judgment. William M. Sims and Herbert C. Bollanbacher represent the petitioners and stockholders.

Inyo County

UNEXPECTED (Bishop)—Ledge of high-grade ore 6 ft. wide reported disclosed in this mine on Pine Mountain, at an elevation of 9000 ft. Installation of 50-ton mill contemplated.

WILSHIRE BISHOP CREEK (Bishop)—Miners and supplies have been sent in and active development resumed. Unwatering of the underground was begun the first of April. There is still some snow. E. W. Walter is superintendent.

Kern County

KING SOLOMON (Randsburg)—Milling of 50 tons of ore average $75 per ton being hauled to Red Dog Mill.

BALTIC (Johannesburg)—Mine and 10-stamp mill will resume operation after recent closing down due to litigation.

PETERSON-DIETRICH (Randsburg)—Six tons of ore milled at the Red Dog produced $600. Ore comes from 100 level.

WINDY (Randsburg)—Patrick and Charles Fahey who are operating this mine under lease contemplate installation of mill.

YELLOW ASTER (Randsburg)—Dewatering system to be installed, north of 100-stamp mill. Tanks will receive the water coming from mill, thus preventing waste.

CONSOLIDATED MINES (Randsburg)—Screening of old dump in progress; contents as high as $17 per ton. Recent cleanup at 5-stamp mill showed recovery of $2000 from 76 tons.

SUNSHINE (Randsburg)—Latest cleanup reported netted $9850, making a total of $20,600 recovery from the rich ore body disclosed two months ago. Cleanup included four tons of concentrates valued at $900 per ton.

Placer County

ELDORADO AND PLACER COUNTIES DREDGE (Auburn)—Last cleanup of 10 days' run netted $2500.

BOREALIS CONSOLIDATED (Newcastle)—Carload of concentrates shipped to Selby for test run. Company has 15-ton mill on property which will be increased to 30-ton if present test run warrants.

Plumas County

GOLD LEAF (Quincy)—An 8-ft. ledge of good ore disclosed at breast of 1000-ft. tunnel at vertical depth of 150 ft. below surface. Ore contains large amount of sulphides. Mine is equipped with stamp mill. Installation of concentrators contemplated.

Riverside County

MOLYBDENITE DEPOSIT has been reported near Hemet by J. C. Tipton, forest ranger, who with Guy Exton and others of Riverside have made mining location.

Shasta County

VICTOR POWER & MINING (Harrison Gulch) — Recent cleanup of two weeks' run of the cyanide plant netted $2500. New Lane mill recently installed proved efficient in trial run. 75 men on pay roll. Company contemplates installation of electric power plant, water for generation of electricity to be taken from Cottonwood Creek.

Siskiyou County

ASH CREEK MINING CO. (Hornbrook)—Nigger Boy, Indian Girl and Klondike mines being operated. Mill on Nigger Boy crushing 15 tons per day, averaging $10 per ton.

TAYLOR CREEK (Yreka)—This mine in Salmon River district sold to Holland people few years ago for more than $100,000 has resumed operation at mill since snows are melting. Development has progressed during last 9 months with satisfactory results.

Tulare County

OLD MAGNESITE MINE near Rocky Hill is to be reopened by H. A. Doyle and others of Portland. Development of water supply and installation of kilns and other improvements contemplated.

Tuolumne County

HARVARD (Jamestown)—Installation of new [illegible] plant in progress.

ATLAS (Tuttletown)—Reported that mine has been [illegible] over by New York men who are said to be also [illegible] of [illegible] Rawhide mine.

MIRIAM MINING (San Francisco)—New incorporation [illegible] with capital stock of $100,000 organized to operate [illegible] in Columbia district. The incorporators are C. [illegible], W. D. Banister and Carl C. Gross, who are the [illegible] first year.

COLORADO

Clear Creek County

TREASURE VAULT (Idaho Springs)—Rich strike recently made in ground worked under Machol lease. Pocket of ore found which assayed 26 oz. gold per ton. Shipment of two tons returned $1000.

TENNESSEE MINING, MILLING & TUNNEL (Idaho Springs)—Active development and mining will be resumed by company, which has equipped its property with new electric-driven compressor plant. Work will be carried on through Tennessee tunnel.

Gilpin County

OLD TOWN (Russel Gulch)—High-grade gold ore has been opened by Roberts & Hutchins, leasers, operating on 1200 level. Drift has been advanced 70 ft. in pay ore 12 ft. wide. Shipments made to Iron City and to Most mills. Shoot has been opened to height of 87 ft. above the 1200 level. The 1100 level will be advanced to intersect this shoot. Bray & Co., leasers, are raising from 1300 level on 8-ft. vein of pay ore. Development has been resumed in 1500 level. George K. Kimball, of Idaho Springs, is manager.

San Juan County

AMY (Silverton)—Crosscut tunnel being driven to cut m. in vein of this property in Maggie Gulch, now 300 ft. long, will be advanced another 400 ft. David Jones is superintendent.

GOLD KING (Gladstone)—Recent development opened large bodies of low-grade ore. Improvements made in mill and flotation equipment has been installed. Shipped 45 cars of concentrates during March.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—Is rebuilding its railroad to mill, which will be ready to start one head about May 15.

WHITE PINE (Ontonagon)—Made mill test run of rock from No. 3 stockpile last week; results will be made known soon.

INDIANA (Houghton)—Has cut rich-looking lode with diamond drill and an attempt is being made to reach it with crosscut from sixth level

ALGOMAH (Lake Mine)—Is unwatering its shaft and as soon as mine is dry two machines and small force of men will be put to work underground.

FRANKLIN (Demmon)—Will begin sending rock to its own mill between May 15 and June 1, according to President R. M. Edwards, who returned from Boston this week.

SOUTH LAKE (Houghton)—Will at once install a 15-drill compressor to push operations on four lodes cut. Ground being opened is rich, with much stamp copper and many masses of good size.

AHMEEK (Kearsarge)—Will have two more heads in its mill ready before June 1 and will resume mining in shafts Nos. 3 and 4 about that date, increasing its output about 50%. Ahmeek is shipping 2500 tons daily.

MOHAWK (Mohawk)—Is preparing to erect new steel shafthouse at No. 5 shaft and is testing ground for foundations. Building will be completed by November. Output of No. 6 shaft is to be increased on closing of No. 5

TAMARACK (Calumet)—Began this week shipping rock to Tamarack mills at rate of 500 tons daily. This will gradually be increased to 1800 tons. At present 150 men are employed in No. 5, only shaft operating. No. 3 shaft will resume mining shortly.

HOUGHTON COPPER (Houghton)—Which has called an assessment of $1 per share, payable May 25, is building spur to Isle Royale railroad and will ship rock from its stockpile of 8000 tons to Franklin mill for treatment. Mining will be resumed shortly after May 1.

KEWEENAW COPPER (Mandan)—Keweenaw Central R.R., controlled by this company, will resume operations May 1. Has been decided not to build proposed extension to Lac La Belle nor to repair old extension because of rough nature of country and high cost of work.

OSCEOLA CONSOLIDATED (Osceola)—Has resumed construction work on shafthouse No. 3 shaft of Old Osceola mine, which was suspended at time of general curtailment last fall. This shaft should be in position to resume production about June 1. No. 6 is producing 900 tons daily.

CALUMET & HECLA (Calumet)—And all subsidiary companies excepting White Pine will put increased wage scale into effect May 1 for all employees excepting for salaried men, who received increase Mar. 1. Scale will be brought up to that in effect prior to Sept. 1, meaning an average increase of 10% for all underground and surface men and those employed in mills and smelters. About 9000 men are affected, as follows: Calumet & Hecla, 5000; Lake Milling Co., 130; Tamarack, 200; Superior, 150; Osceola Consolidated, 1200; Centennial, 150, Isle Royale, 650; Allouez, 300; Ahmeek, 500; Lake Superior Smelting Co., 150. Wages of crews at White Pine mine were not reduced last fall.

Iron

PENN IRON (Vulcan)—Steam shovel commenced loading ore here several days ago for Escanaba docks of St. Paul railroad. This is first company in Iron Mountain district to load this season.

BRISTOL (Crystal Falls)—Forty-five cars are being loaded daily here for Escanaba. Dunn is sending twelve cars daily. The Tully mine at Iron River is also shipping.

REPUBLIC IRON & STEEL (Negaunee)—The Cambria mines are the first shippers on the Marquette range this year. A boat reached Marquette on Apr. 20 to receive 4500 tons for Lake Erie port.

OLIVER IRON MINING (Ishpeming)—Lake Superior hematite mine will be abandoned about May 1. Ore supply is exhausted. Men will be transferred to one of company's other properties in Ishpeming.

MINNESOTA

Duluth

GREAT NORTHERN ORE PROPERTIES (Duluth)—This season ore mined from these Hill properties will be hauled by Duluth, Missabe & Northern Ry. instead of Hill-owned Great Northern Ry. as heretofore. In 1914 tonnage from these properties was approximately 7,000,000 gross, while D. M. & N. docks handled but 6,300,000 tons all told. This means doubling of tonnage going over the D. M. & N. docks this season. No reason has been assigned for this change, but it is verified by W. J. Olcott, vice-president of the D. M. & N. and president of Oliver Iron Mining Company.

MONTANA

Beaverhead County

BANNACK CONSOLIDATED (Bannack)—Company recently acquired Golden Leaf group in old Bannack district at consideration of $200,000 in round figures, has announced its plans of operation: Company to make extensive developments at Golden Leaf properties, consisting of tunneling and sinking; mill will be erected, capacity to handle all ore extracted; at present there are 100,000 tons ready for treatment. Near Golden Leaf is promising copper field which has never been developed. New owners planning to develop them extensively.

Silver Bow County

DAVIS-DALY (Butte)—Official announcement by company states that in development at Colorado shaft discovered east-west vein on 2500 level, average width is from 1 to 7 ft., whole width averaging 5% copper. Extent of orebody yet to be determined.

BUTTE DULUTH (Butte)—Charles M. Everett has filed first report as receiver of company. Taken in $8784.29 for copper sold; expended $1341 for labor and supplies to keep plant in order; incurred indebtedness of $1926.36 for same purpose. Court authorized receiver to insure plant for $61,000 and pay therefor premium of $1522.

PILOT-BUTTE (Butte)—Apr. 8, Judge Lynch rendered decision in injunction suit of Anaconda against Pilot-Butte. It restrains defendant from mining or extracting any ores from beneath surface of Emily claim, between west end line of Emily and east end line of Badger claim. Counsel for defendant presented bill of exceptions which court refused to sign, whereupon attorney applied for and was granted 30 days in which to prepare and serve additional bill of exceptions. Whole matter will now be heard on its merits when legal steps contemplated by defense shall have been disposed of by supreme court.

NEVADA

Esmeralda County

SILVER PEAK CONSOLIDATED (Goldfield)—Shaft now down 622 ft. Flow of water increased with depth to 130,000 gal. daily.

JUMBO EXTENSION (Goldfield)—Drift for 100 ft. along latite shale contact on 880-ft. intermediate level has shown ore steadily increasing in grade; now assays $75 across 7-ft. face.

DAISY (Diamondfield)—Justice company has made third 40-ton shipment within three weeks from 265-ft. level stope. First two shipments averaged $45, last expected to average $70 per ton.

ATLANTA (Goldfield)—Raise from 1750 level to connect with winze from 1400 level of Grizzly Bear workings of Goldfield Consolidated expected to hole though soon. This will give good ventilation on lowest Atlanta level where temperature is now high. Incline raise and crosscut from air raise opened 30-ft. commercial oreshoot believed to be extension of shoot on 1400 level of Grizzly Bear. Lease secured on south half of Grizzly Bear below 1400 level.

Eureka County

UNION MINES (Palisade)—Property 35 miles south of Palisade, consists of 12 claims will resume. Large tonnage silver-lead ore developed in tunnel levels and 3000 tons, assaying from $15 to $27, broken.

Humboldt County

NEW STRIKE NEAR ROCHESTER, on east side of range, made recently. Strike developing rapidly and new mining district of Buena organized, extending from South American Cañon to Cow Cañon. Buena townsite established near center of district. Several leases let on original strike.

LINCOLN HILL (Rochester)—Compressor driven by oil engine will be installed.

ROCHESTER-LINCOLN CONSOLIDATED (Rochester)—Ore bins being built. Winze being sunk on good-grade oreshoot. Electric hoist will be installed.

NEVADA PACKARD (Rochester)—Construction of milling plant will begin soon, funds have been raised. Option on block of stock given to Ohio and Pennsylvania men; first payment made. Water rights to several springs one mile above mine acquired; pipe line being installed. Considerable ore developed and 8000 tons of milling grade on dump. Total shipments to date $109,934.

Mineral County

LUCKY BOY MINING (Hawthorne)—Ore recently found in tunnel still bunchy; tunnel must be driven 200 ft. further to reach ore zone known on levels above.

Nye County

TONOPAH ORE PRODUCTION for week ended Apr. 10 was 10,913 with a total estimated value of $222,394 compared with 10,117 tons last week. Producers were: Tonopah Belmont, 3955; Tonopah Mining, 2750; Tonopah Extension, 1700; West End, 1008; Jim Butler, 1050; Tonopah Merger, 200; North Star, 50; and Halifax 200 tons.

TONOPAH BELMONT (Tonopah)—Cast-iron drum on hoist broke, necessitating curtailment of operations for two days. Ore hoisted through Desert Queen shaft. Steel drum installed and regular production resumed. Oreshoot in Favorite vein now 10 ft. wide.

Storey County

KINKEAD MILL (Virginia City)—Car concentrates shipped recently to Selby smelting plant.

OPHIR (Virginia City)—South laterals Nos. 1 and 2 being advanced. Connection made between tunnel level and 50-ft. level at point north of main crosscut. Stope above No. 1 south lateral being cleaned out to aid ventilation. From this development work 308 cars ore saved during week. Together with Consolidated Virginia, east crosscut on joint boundary line on 2500 level will be repaired preparatory to further work. Joint winze sunk from this crosscut to 2700 level.

White Pine County

POTASH DISCOVERY EAST OF ELY made recently. Stated deposit is alunite assaying 13% in potassium salts. Assays made at Mackay School of Mines, Reno. Sinking under way; grade increases with depth.

NEW MEXICO

Don Ana County

EXCELSIOR (Organ)—Verdict for defendant returned in the litigation of Paul Davis vs. heirs of G. E. Wood, and B. L. Farrar, Martin Fisback and E. C. Rice. Mine was jumped by plaintiff on ground assessment had not been done according to law. Property will now be operated, according to reports, and new machinery installed.

STEPHENSON-BENNETT (Organ)—Newspaper reports, on information from circular issued by Organ Mountain Mining Co., state American Smelting & Refining Co. is considering lease and bond on Stephenson-Bennett, Torpedo, Memphis and other mines in Organ district. Examinations will be made this month.

Grant County

CHINO (Hurley)—A new and more elaborate sampling works now being built.

OCTO (Lordsburg)—Company calling for bids for sinking main shaft 500 ft. deeper. Property located at Lee's Peak.

STAUBER & WRIGHT (Pinos Altos)—Work has been commenced on excavation and erection of new mill on Gillette mine site.

WALDO (Lordsburg)—Mine has been sold to California capitalists who intend erecting small concentrator. Operations will commence in 30 days.

MOBILE M. & M. (Bayard)—Incorporation papers filed this week. D. H. Howze, statutory agent. Company plans erection of 25-ton mill at Bayard Station.

IRON CREEK (Tyrone)—Option on 65 claims has been secured by Dolan & Curtis, of Colorado Springs. Property considered among best in Burro Mountain district and is well developed.

BURRO MOUNTAIN COPPER (Tyrone)—Contracts being let for building of new town of Tyrone in draw above "The Pines." General store to cost $100,000; hospital, $50,000. and company houses will be built.

LA FORTUNA MINE (Pinos Altos)—Upper works of mine dynamited recently. New equipment will be purchased for further development within 60 days. Mine has not yet been placed in class of regular producers but indications for summer activity are very good. No employees at present.

COPPER BASIN (Twin Peaks)—Development work in Copper Basin (via Duncan, Ariz) has uncovered high-grade ore. Prospecting by churn drill under way. Strike has caused rush to district. Twin Peaks mine being sampled and trial mill run made. D. Gough and E. A. Wayne, formerly of Ernestine Mining Co., Mogollon, on ground.

Sandoval County

COSSAK (Bland)—New 100-ton cyanide plant now in successful operation; $20,000 in bullion shipped during March. Pebbles are being obtained locally instead of shipping from Norway. Capacity of plant may be enlarged

Sierra County

CALUMET (Phillipsburg)—Company will rebuild $150,000 mill recently destroyed by fire. Work continues at mine.

GOLDEN KNOW (Hillsboro)—Hiltscher Bros preparing to operate placers with Quinner dry process: New engines and machinery ordered.

BLACK RANGE TUNNEL & MINING (Chloride)—Property will be sold under foreclosure of mortgage to satisfy sum of $32,000. W. F. Schmidt appointed special master.

Socorro County

FORTY-EIGHT bars of gold and silver bullion were shipped from Mogollon Mar. 27, weighing 3500 lb. and valued at $70,000. One of largest shipments ever made at one time in history of camp. Post office of Cooney has been discontinued by government. Mail now going direct to Mogollon, N. M.

OREGON

Baker County

GOLDEN GATE MINE (Greenhorn District)—New 10-stamp mill is in steady operation and management states saving is satisfactory.

IBEX MINE (Cracker Creek District)—R. C. Redding, of San Francisco has spent month at mine sampling and making examination for owners looking to resumption of operations.

CONNOR CREEK (Connor Creek)—Mine has been bonded and leased to Albert Geiser et al. of Baker City for three years by Reed Institute of Portland, owner. Mine is part of endowment to institution by estates of S. J. Reed who owned and operated mine in early days and who took out over $1,000,000. Work will be under management of Albert Geiser and will start at once.

RAINBOW MINE (Rye Valley)—Shipment of $7000 bullion result of weekly clean-up at this mine owned by A. S. & R. Co. was cause of hold-up on April 5 in true Western fashion. Bullion was being shipped by stage from [illegible] at Rye Valley to Durkee where it was to be expressed to [illegible]. Hold-ups have been located according to late report [illegible] gold found cached near scene of hold-up recovered. Com[illegible] had offered reward of $1000. Two men and a woman are arrested.

TENNESSEE

Polk County

TENNESSEE COPPER (Copperhill)—During 1914 there were produced 12,871,113 lb. copper and 420,326,[illegible] lb. of 60 deg. Baumé acid.

UTAH

Beaver County

INDIAN QUEEN (Frisco)—Directors are making inspection; will report on advisability of resuming work.

CEDAR-TALISMAN (Milford)—Work is being done here and at the Cedar Extension under direction of S. S. Pond.

LEONORA M. & M. (Milford)—Recent development has opened high-grade silver-lead ore for 195 ft. along strike, with zinc in same neighborhood, assaying 24 to 50%. Shipment of material from stockpile, recently sampled and showing 41% zinc, will be made soon.

Juab County

SIOUX MILL (Mammoth)—Arrangements have been made for shipment of tailings dump from old Sioux or Farrell mill.

GEMINI (Eureka)—Extensive operations are being carried on by leasers. Mules being used underground to facilitate tramming.

EAGLE & BLUE BELL (Eureka)—Recent development in south drift on 1700 level has opened full face of high-grade lead-silver ore.

COLORADO (Silver City)—Leasers are mining zinc ores some of which run as high as 40%, from ground bordering former high-grade lead stopes.

UTAH ORE SAMPLING (Silver City)—Sampler at this place unusually busy sampling zinc ore, which is shipped direct to Eastern smelteries.

BECK TUNNEL (Eureka)—Company is prospecting on 300 level north of shaft. Quartz has been encountered. Some lead-silver and zinc ores are being shipped by leasers.

YANKEE (Eureka)—This company has lease on block of Beck Tunnel ground in which it is doing work at a depth of 300 ft., to gain information as to Beck Tunnel vein, which makes into Yankee.

IRON BLOSSOM (Silver City)—During March zinc ore, averaging about 36%, was shipped from 400 level of No. 3 workings. This came from ore channel first encountered, where it occurred as casing about former lead ore stoped.

DRAGON CONSOLIDATED (Silver City)—Drifting being done on 800 level in search of Martha Washington vein. Most of ore at present coming from north end of property, where work is being handled through Iron Blossom. Twelve cars were shipped in March.

Salt Lake County

UTAH COPPER (Bingham)—February production was 8,202,647, as compared to 8,009,646 in January. At present there are 3500 men employed.

ALTA-COTTONWOOD (Alta)—Articles of incorporation were filed by this company, Apr. 10; capitalization 1,000,000 shares, par value 25c. Company will take over Webb ground and has lease on Argentina near Maxfield. Purposed to drive tunnel toward Alta from Big Cottonwood side. A. O. Jacobson is interested.

WASATCH MINES (Alta)—Five feet of shipping ore has been opened in raise from Howland tunnel. Ore occurs in Brain fissure. Development on tunnel level has opened 18 in. of high grade silver-lead ore. Wasatch Power Co., owned by Wasatch Mines, having hydro-electric power plant in Little Cottonwood, few miles below Alta, has signed contracts to furnish power to Alta Consolidated, Sells Mining and Emma Copper companies.

Summit County

THREE KINGS (Park City)—Shaft is down to 375 level; conditions reported encouraging.

CANADA

Ontario

ORE SHIPMENTS over Temiskaming & Northern Ontario Ry., for March amounted to 1351 tons silver ore, two tons gold ore, and 879 tons nickel ore. The gold ore was from the Vipond, the nickel from the Alexo and the silver shipments as follows:

Cobalt proper—Beaver, 99; Chambers Ferland, 43; Cobalt Comet, By Dom. Red. Co., 51; Coniagas, 124; Crown Reserve, by Dom. Red. Co., 79; Kerr Lake, by Dom. Red. Co., 46; La Rose, 169; McKinley Darragh, 171; Mining Corporation of Canada Ltd, Townsite City, 248; Nipissing, 65; O'Brien, 51; Penn Canadian, 63; Peterson Lake, Seneca Superior Lease, 66; Temiskaming, 31; Trethewey, 40; Elk Lake; Mapes Johnston, 3 tons.

LA ROSE (Cobalt)—Annual report shows big decrease in production and profits. Production for last year 1,36[illegible] oz silver at cost of 37.2c. per oz., a decrease of 1,268,11[illegible] and an increase in cost of 14.4 cents.

PEARL LAKE (Porcupine)—Plan for reorganization under consideration involves forming new company [illegible] at $2,500,000. Proposed to offer 2,000,000 shares [illegible] to shareholders in proportion of 400 new shares [illegible] 500 now held, at price of 11 cents per share. [illegible] 500,000 shares will be retained in treasury to finance [illegible] development work.

The Market Report

METAL MARKETS

NEW YORK—Apr. 21

Copper experienced a sharp rise, and tin a sharp decline. Lead was a little stronger, as also was spelter, but the latter market has fallen into a condition that is difficult of brief characterization.

Copper, Tin, Lead and Zinc

Copper—On large business this market advanced sharply from day to day, and on each day there were wide ranges in prices realized. Sales were made at the lower prices early in the day, and on a scale upward during the day, the market closing at the highest. On the next day business would begin at the level established at the end of the previous day, and so on. Sales on Tuesday, Apr. 20, occurred at a particularly wide range, and some round lots were reported sold at figures both above and below our quotation, which represents the average for the day as nearly as we can determine it. The bulk of the business continued to be for military purposes, but there was a noteworthy increase in buying for domestic peaceful purposes. Special brands and Lake copper were reported sold at all kinds of fancy prices. Calumet & Hecla is said to have got 21c. per lb. for its metal.

Visible stocks of copper in Europe on Apr. 15 are reported as follows: Great Britain, 15,408; France, 1965; afloat from Chile, 1575; afloat from Australia, 5300; total, 24,248 long tons, an increase of 315 tons over the Mar. 31 report.

Copper exports for the week ended Apr. 10 are reported by the Department of Commerce at 5,853,254 lb.; the larger items being 2,747,861 lb. to France, 2,050,565 lb. to Great Britain, 558,936 lb. to Italy and 448,062 lb. to Sweden. The imports were 1,547,884 lb. metal and 1,136,073 lb. in ore and matte; 2,683,957 lb. in all.

Copper Sheets base price was advanced ¼c. per lb. on Apr. 14, another ½c. on Apr. 17 and a further ½c. on Apr. 19 and is now 22½c. per lb. for hot rolled and 23½c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 18¾@19c. per lb. carload lots at mill.

Brass Prices were again advanced Apr. 15, and are now: Sheets, high brass, 19c. net per lb.; low brass, 20¼c. Wire, high brass, 19¾c.; low brass, 20¼c. Rods, high brass, 18¾c.; low brass, 21c. Tubes, 22⅝c. Angles and channels, 22⅝c. Scrap allowance, 13½c. net per lb. for high brass; 14¼c. for low brass.

Tin—The arrival of relatively large supplies from the East produced the long expected collapse in this market, which for a long time previous has been but a nominal affair.

Tin output of Federated Malay States in March was 49,693 pikuls. For the three months ended Mar. 31 the total was 11,663 long tons in 1914 and 10,733 in 1915, a decrease of 930 tons.

Tin shipments from the Straits four months, estimating April, were 20,886 tons in 1914 and 20,692 in 1915, a decrease of 194 tons.

Lead—While there was no great volume of business reported last week, the market was stronger in tone. Lead for near-by shipment was freely obtainable in the New York market at the price of the A. S. & R. Co., but sellers have been able to obtain a premium on round lots contracted for delivery ahead.

Spelter—A large business was done in intermediate and brass special grades, 12½c. being realized for brass specials in tonnages. The aggregate of reported sales of common spelter was light. The transactions, however, indicated an increased willingness in some quarters at least, to enter into contracts for delivery further ahead than heretofore. Smelters are becoming more insistent upon selling in that way as the only means of extricating themselves from a difficult position. Prompt spelter and even May spelter is available only in trifling quantities. The buyer who had to have April-May spelter in the latter part of the week was obliged to pay 10½@11c. a lb. On the other hand, sellers found it difficult to place tonnages for later deliveries at much lower prices. The situation is in all respects much confused, and it is extremely difficult, nay, even impossible, to arrive at the precise status of the market as a whole. Our quotations represent the average as nearly as we can determine it.

We hear that the old smelters at Collinsville, Ill., and Chanute, Kan., are to be put in operation.

Zinc sheets, base price remains $13.50 per 100 lb., f.o.b La Salle, Ill., less 8% discount. Usual extras charged. The demand is reported good and sales large.

Other Metals

NEW YORK—Apr. 21

Aluminum continues about the same with moderate sales. Quotations are unchanged at 18¾@19c. for No. 1 ingots, New York. The latest London quotation is £90@95 per long ton, equal to 19.92c. per lb., average.—**Antimony** is in fair demand and prices are strong. Ordinary brands have been sold at 23½

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Apr.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb
15	4.7925	50	16.30 @16.50	54	4.20	4.10 @4.15	9.17½ @9.67½	9.00 @9.50
16	4.7925	49⅞	16.50 @16.60	52	4.20 @4.25	4.10 @4.15	9.17½ @9.67½	9.00 @9.50
17	4.7925	50	16.65 @16.75	50	4.20 @4.25	4.10 @4.15	9.17½ @9.92½	9.00 @9.75
19	4.7913	50⅜	16.80 @17.10	48	4.20 @4.25	4.10 @4.15	9.17½ @10.17½	9.00 @10.00
20	4.7931	50¾	17.10 @17.30	46	4.20 @4.25	4.10 @4.15	9.42½ @10.42½	9.25 @10.25
21	4.7919	50½	17.30 @17.60	44	4.20 @4.25	4.10 @4.15	9.42½ @10.42½	9.25 @10.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York. 17c ; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Apr.	Silver	£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb
15	23 9/16	73¾	15.91	74		167½	167	20¾	4.51	46	9.99
16	23½	74½	16.18	75¼		165	164½	20⅝	4.43	46	9.99
17	23 9/16										
19	23¼	76⅜	16.65	77⅜		167½	167½	20 7/16	4.44	46½	10.10
20	23¼	75¾	16.46	76½		167	167	20½	4.45	48	10.42
21	23 13/16	77⅞	16.85	78⅜		164¼	164¾	20⅛	4.37	49	10.65

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.86: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

@25c. per lb. Cookson's is held at 31@32c. per lb. with small supplies. **Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is rather quieter with only small business doing. New York quotation is $65 per flask of 75 lb., nominal. For small lots, one to five flasks, there is a wide range of prices, $75@85 having been paid. San Francisco price is telegraphed at $62.50@65 for large orders, with some agents holding for higher prices. London price is £12 per flask, with £11 17s. 6d. quoted from second hands.

Gold, Silver and Platinum

NEW YORK—Apr. 21

Gold imports in Great Britain two months ended Feb. 28 were £2,523,736; exports, £1,552,620; excess of imports, £971,116, against £2,365,808 last year.

Silver—There seems to be a fair demand for silver. Letters from London are to the effect that since the Easter holidays a good inquiry for the metal, partly on Indian and partly on Continental account, has sprung up and prices are likely to be maintained.

Silver imports in Great Britain two months ended Feb. 28 were valued at £2,021,907; exports, £1,515,627; excess of imports, £506,280, which compares with an excess of exports of £577,329 last year.

Platinum—The market continues dull with small sales and prices largely nominal. Dealers ask $38@40 per oz. for refined platinum and $43@47 per oz. for hard metal, according to grade.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Apr. 17

The base price paid this week for 60% zinc ore was $5[illegible] per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS WEEK ENDED APR. 17

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,548,120	252,800	753,520
Year	58,416,760	1,639,190	6,470,410

Shipped during week to separating plants, 4,387,760 lb. zinc ore.

JOPLIN, MO.—Apr. 17

Blende, high price $63; assay base 60% zinc, premium grades, $60@59; medium grades, ranging down to $55, and lower grades to $51 per ton; calamine base $37@33 per ton of 40% zinc; average, all grades of zinc, $55.44 per ton. Lead, high price $53; base, $51@52 per ton of 80% metal content; average, all grades of lead, $50.72 per ton.

SHIPMENTS WEEK ENDED APR. 17

	Blende	Calamine	Lead	Values
Totals this week..	11,150,820	862,880	1,877,940	$380,630
Totals this year..	160,307,450	14,021,050	24,461,070	5,684,160

Blende value, the week, $317,450; 16 weeks, $4,829,400.

Calamine value, the week, $15,570; 16 weeks, $253,580.

Lead value, the week, $47,610; 16 weeks, $581,180.

One buyer estimates there were 6500 tons of ore sold this week, most of it for next week's delivery. This is about [illegible]00 tons in excess of the production.

Iron Trade Review

NEW YORK—Apr. 21

There has been little change in the iron and steel markets, the hopeful tone still predominating. New business has been on a fair basis.

Export orders continue large, though not on quite as extravagant a scale as some daily papers have intimated. Nevertheless there is a good business doing and more coming in. An instance is that the exports from Baltimore last week included 14,206,753 lb. steel skelp and 6,617,220 lb. steel billets, all to Glasgow, Scotland.

PITTSBURGH—Apr. 20

It is announced that the Pennsylvania R.R. Co. will spend 20,000,000 and the Pennsylvania Lines West of Pittsburgh 12,000,000, or $32,000,000 in all, for equipment and track maintenance. This includes 16,000 freight cars, 141 locomotives and 146 all-steel passenger cars, worth about $20,000,000; the 70,000 tons of rails it was announced a couple of months ago would be bought, and about $7,000,000 to be otherwise expended. Whether the orders will be placed promptly or not is another matter. Only 10,000 tons of the rails, in five sample orders of 2000 tons each, have been bought thus far.

Reports of war orders being placed, particularly for shrapnel, doubtless represent many duplications. In any event, the business that goes to the steel mills is but a very small fraction of the price of the finished shells, since all the steel mills do is to furnish the steel rounds, generally [illegible]-in., at but little above the current market price for steel bars, 1.20c. per lb., and a ton of steel bars will make about 25 shrapnel cases.

Iron and steel exports in February, just reported from Washington, totaled 144,366 gross tons, against 139,791 tons in January and a maximum since last April of [illegible] tons, reached last October. If credence is to be placed in current reports of heavy export demand it must be concluded that the heavier shipments did not begin before last month.

On the whole, steel mill bookings have not been as heavy this month as they were in March, but the producers feel no uneasiness, recognizing that many low priced contracts expired Mar. 31 and there is soon to be a test of the advanced prices, which, if realized, will afford reasonable profits.

Pig Iron—The market on the whole continues very quiet. Prices are not quotably changed, but are regarded as a trifle less firm than a month ago. We quote: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, at Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—There is less uneasiness over the ferromanganese situation, as it is understood some cargoes are on the way, for the first time in months, and the prompt market has softened about $5 in consequence to $95; contract remaining at $78, Baltimore.

Steel—There have been no transactions sufficient to show where the market stands, consumers being covered by contracts. We continue to quote billets at $18.75@19 and sheet bars at $19@20, f.o.b. maker's mill, Youngstown, and about 50c. higher at maker's mill, Pittsburgh.

IRON ORE

Imports and Exports of Iron ore in the United States two months ended Feb. 28, in long tons:

	1914	1915	Changes	
Imports	214,378	154,059	D.	60,319
Exports	8,974	3,668	D.	5,306

Of the imports this year 101,955 tons are from Cuba, 26,633 tons from Cuba and 5193 tons from Spain.

Imports of manganese ore two months ended Feb. 28 were 39,155 tons in 1914, and 9876 in 1915; decrease 29,279 tons.

COKE

Connellsville—The market shows a stronger tone, at least sentimentally, and prompt furnace is actually stiffer, $1.55 being the minimum for standard brands, with $1.60 sometimes obtained. Coke operators are paying much attention to the labor situation, recognizing that while operations of late have been at only about two-thirds the nominal capacity of the region it would be quite impossible to operate the region at capacity, and a moderate further increase in consumption would probably make coke scarce, with fancy prices. We quote: Prompt furnace, $1.55@1.60; contract furnace to July 1, $1.60@1.65; contract furnace to Jan. 1, $1.75; prompt foundry, $2@2.35; contract foundry, $2.20@2.30, per net ton at ovens. The "Courier" reports production in the Connellsville and lower Connellsville region in the week ended Apr. 10 at 292,215 tons, an increase of 10,964 tons, and shipments at 287,829 tons, an increase of 9815 tons. Both production and shipments made new records for this movement.

Chemicals

NEW YORK—Apr. 21

The general market seems to be improving and a more even tone is manifest.

Arsenic—Business is slightly improved though still on a moderate scale. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is on about the usual scale. Prices have been advanced 25c. and are now $6.25 per 100 lb. for carload lots and $6.50 per 100 lb. for smaller orders.

Nitrate of Soda—Business has been rather quiet but the market is steady and prices firm. Current quotations are 2.30c. per lb. for all positions this year.

Pyrites—Imports at Baltimore for the past week included 6487 tons pyrites from Huelva, Spain.

Imports and exports of fertilizing chemicals in the month of January, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Kainit	68,[illegible]	306		
Manure salts...	25,[illegible]	[illegible]		
Other potash salts	3[illegible],[illegible]22	28,212	[illegible]	[illegible]
Nitrate of soda	32,[illegible]	18,[illegible]	[illegible]	[illegible]
Sulphate of ammonia	10,057	9,054		24
Phosphates			94	40

Exports include reëxports of foreign material. [illegible] phosphates are imported, but are not given separately in the returns.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	May 1	June 1	$0.005
Andes Silver, Nev	May 4	May 25	0.03
Best & Belcher, Nev.	May 12	June 1	0.05
Big Elk, Ida	Apr 15	May 15	0.001
Bobby Anderson, Ida	Apr 12	May 3	0.0025
Caledonia, Nev	May 11	June 1	0.05
Challenge, Nev	Mar 31	Apr 21	0.05
Consolidated Imperial, Nev	Apr 27	May 18	0.01
Con. Virginia, Nev	May 4	May 25	0.10
Diam'field Black Butte, Nev	Apr 30	June 3	0.01
East Hercules, Ida., (post.)		May 15	0.001
Eastern Star, Ida	Mar 25	Apr 25	0.002
Emerald, Utah [illegible]		June 9	0.01
Enterprise, Ida	Mar. 20	Apr 20	0.002
Florence, Ida.	Apr 15	May 4	0.001
Galena King, Ida	Mar 25	Apr 25	0.0075
Gethin Le Roy, Utah	Apr. 21	May 6	0.01
Giant, Ida	Apr. 9	May 14	0.002
Great Falls, Utah	Mar 18	Apr 22	0.01
Idaho-Los Angeles, Ida	Apr 24	May 15	0.005
[illegible], Ida (post.)		Apr. 24	0.005
Ivanhoe, Ida	Apr. 10	May 10	0.002
Jack Waite, Ida (post.)		Apr. 23	0.01
Knight Christensen, Utah			0.13
Lake Superior & West., Ariz			0.10
Lucky Boy, Nev	Apr. 9	Apr. 28	0.01
Majestic-Idol, Nev	Dec 15	Jul 20	0.005
Mullan, Ida.	Apr. 24	May 24	0.002
Mountain Rose, Ida	Apr 19	May 19	0.001
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Hope, Ida	May 5	June 2	0.002
Oreano, Ida	Mar 25	Apr 26	0.0015
Pandora, Ida	Apr. 15	May 7	0.003
Raven, Ida.	May 15	June 14	0.0006
Samson, Ida	Apr. 3	May 3	0.002
Sandstorm Kendall, Nev	Apr 1	May 6	0.01
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Cliff, Ida	Apr 3	Apr 24	0.0025
Silver Moon, Ida	May 18	June 18	0.005
Smuggler	Apr. 17	May 17	0.0025
Sunset, M. & D.	Mar 27	May 3	0.015
Tarbox, Ida	Apr 26	May 28	0.0025
Union, Nev	Apr. 6	Apr 28	0.05

Stock Quotations

In sales at auction we note: 4 shares N. J. Zinc Co., $623 per share; 5000 shares Kerber Mining & Development Co., a Colorado corporation, $5 lot.

COLO SPRINGS Apr. 20

Name of Comp.	Bid.
Acacia	04¾
Banner	01½
Cripple Cr'k Con	009
C. K. & N.	05½
Doctor Jack Pot.	08⅜
Elkton Con.	44
El Paso	1 10
Findlay	03¼
Gold Dollar	02⅛
Gold Sovereign.	04¾
Isabella	15¼
Jack Pot.	.06
Jennie Sample.	03
Jerry Johnson.	05¾
Lexington	008
Mary McKinney.	.33
Pharmacist.	01⅛
Portland	1.15½
Raven B. H.	.03⅜
Vindicator	1 62

SALT LAKE Apr. 20

Name of Comp.	Bid.
Beck Tunnel	07
Black Jack	.10
Colorado Mining.	12½
Crown Point	01¾
Daly-Judge.	5.25
Gold Chain	.09¾
Grand Central.	51
Iron Blossom	86
Little Bell	.14
Lower Mammoth	05
Mason Valley	2 50
May Day.	.14
Opohongo	01¼
Prince Con	39
Seven Troughs	.02¼
Silver King Coal'n	3.35
Silver King Con	1.87½
Sioux Con	03½
Uncle Sam	04
Yankee	05

TORONTO Apr. 20

Bailey	02½	Dome Exten	10
Coniagas	4 75	Foley O'Brien	30
Peterson Lake	23	Hollinger	23 50
Right of Way	05	Imperial.	05
Seneca Superior	1 30	Jupiter.	12
Silver Queen	01½	McIntyre	44
T. & Hudson Bay	27 00	Pearl Lake	01¼
Timiskaming	38	Porcu. Gold	‡ 25
Wettlaufer-Lor	04	Preston E. D.	03
Big Dome	13 25	Rea	15

SAN FRANCISCO Apr. 20

Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.04	Belmont	4.00
Belcher	.13	Jim Butler	.87
Best & Belcher	04	Lone Star	.08
Caledonia	.18	MacNamara.	.03
Challenge Con.	‡.06	Midway	15
Confidence	‡.15	Mont.-Tonopah	.37
Con. Virginia	.05	North Star	15
Crown Point (Nev	‡.32	Rescue Eula	13
Gould & Curry	.03	West End Con	74
Hale & Norcross	04	Atlanta	41
Julia	‡.01	Booth	15
Mexican	33	C. O. D. Con	05
Occidental.	79	Comb. Frac	13
Ophir.	05	Jumbo Extension	1 75
Overman.	‡.10	Pitts. Silver Peak	12
Potosi	04	Round Mountain	13
Savage	05	Sandstorm Kendall	12
Sierra Nevada	06	Silver Pick	.12
Union Con	20	Central Eureka	19
Yellow Jacket	19	So. Eureka	[illegible]

N. Y. EXCH. Apr. 20

Name of Comp.	Clg.
Amalgamated.	77⅛
Am.Sm.&Ref.,com.	73
Am. Sm. & Ref., pf	105½
Am. Sm. Sec., pf. B	82
Anaconda	37¼
Batopilas Min	2
Bethlehem Steel.	143
Bethlehem Steel, pf.	111
Chino	45⅜
Colo. Fuel & Iron.	33⅜
Federal M. & S., pf	32½
Great Nor., ore., ctf.	38
Guggen. Exp.	58½
Homestake	116
Inspiration Con	30½
Mex. Petroleum.	92
Miami Copper.	26½
Nat'l Lead, com.	65¼
National Lead, pf.	109¾
Nev. Consol.	15⅜
Ontario Min	3¼
Quicksilver, pf.	1½
Ray Con.	23⅜
Republic I&S, com.	29½
Republic I&S, pf.	86¼
SlossSheffi'd, com.	38
Tennessee Copper.	33¾
Utah Copper	67¼
U. S. Steel, com.	58⅝
U. S. Steel, pf.	109¼

BOSTON EXCH Apr. 20

Name of Comp.	Clg.
Adventure	3
Ahmeek.	340
Alaska Gold M	36¾
Algomah	3⅜
Allouez.	54¼
Am. Zinc.	37
Ariz. Com., ctfs.	6⅜
Bonanza.	.35
Butte-Ballaklava	‡3
Butte & Superior.	54¼
Calumet & Ariz	67½
Calumet & Hecla	535
Centennial	22
Cliff	‡1
Copper Range	56½
Daly West	3
East Butte	14⅛
Franklin.	13¼
Granby	81¼
Hancock.	19½
Hedley.	26⅝
Helvetia.	‡.75
Indiana	7¾
Island Cr'k, com.	46¼
Island Cr'k, pfd.	88½
Isle Royale.	29¾
Keweenaw	2½
Lake.	16
La Salle.	6¼
Mass	13⅝
Mayflower.	6⅞
Michigan.	‡1
Mohawk	75½
New Arcadian	7⅛
North Butte.	32½
North Lake.	2½
Ojibway.	1⅞
Old Colony	6¼
Old Dominion.	53¾
Osceola	85½
Quincy.	86
Santa Fe	1¼
Shannon	9¾
Shattuck-Ariz.	28½
Superior.	36¼
Superior & Bost.	2⅜
Tamarack.	39½
Trinity.	5½
Tuolumne.	‡.55
U. S. Smelting	33¼
U. S. Smelt'g, pf.	46
Utah Apex.	3⅜
Utah Con	13⅞
Victoria.	3⅝
Winona.	3¼
Wolverine	57½
Wyandot	1

N. Y. CURB Apr. 20

Name of Comp.	Clg.
Alaska Juneau, w.i.	14⅜
Alta Con	.85
Beaver Con	.40
Big Four.	.08
Blue Bell	.04
Braden Copper.	8⅜
Buffalo Mines.	.45
Can. Cop. Corpn.	1 3/16
Can. G. & S.	.04
Caribou	.50
Cashboy	.08
Chambers Ferland.	.22
Con. Ariz. Sm.	15/16
Con. Coppermines.	2
Davis-Daly	1 7/16
Diam'field-Daisy.	.07
Dia. Black B.	02½
Florence	57
Goldfield Con	1⅛
Goldfield Merger.	26½
Greene Cananea.	32½
Kerr Lake.	4 15/16
La Rose.	9/16
McKinley-Dar-Sa.	.33
Mines of Am.	2⅛
Nevada Hills	26
New Utah Bingham	1⅛
Nipissing Mines.	6
Ohio Copper.	28
Oro	.12
Pacific Smelt	‡.09⅜
South Utah.	.25
Stand'd Oil of N.J.	396
Standard S. L.	1¼
Stewart	1 15/16
Tonopah	6⅞
Tonopah Ex.	3 7/16
Tonopah Merger	.40
Tularosa	‡ 3/16
West End Ex.	06
Yukon Gold.	2⅛

LONDON Apr. 8

Alaska Tre'dwell	£7	6s	3d
Camp Bird	0	6	3
El Oro.	0	8	3
Esperanza.	0	9	3
Mexico Mines.	3	15	0
Oroville.	0	12	0
Philippine Dr.	1	0	0
Santa Gert'dis	0	8	1½
Tomboy	1	4	6
Tough Oakes.	0	14	3

BOSTON CURB Apr. 20

Name of Comp.	Bid
Alvarado	60
Bingham Mines.	5¼
Boston Ely.	35
Butte & Lon'n Dev	28
Calaveras	1⅞
Calumet-Corbin.	.13
Chief Con.	.98
Corbin.	.40
Cortez	.20
Crown Reserve.	.95
Eagle & Blue Bell	.90
First Nat. Cop	2 11/16
Houghton Copper.	3
Iron Cap Cop., pf.	4
Majestic.	24
Mexican Metals	19
Nevada-Douglas.	80
New Baltic	2⅜
Oneco.	1⅜
Raven Copper.	‡ 07
Smokey Dev.	40
So. Lake.	8¼
Tonopah Victor.	‡ 17
Trethewey	15
United Verde Ext.	3 9/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62 938	57.572	48 855	28 983	26 553	22 731
February	61 642	57 506	48.477	28 357	26 573	22 753
March	57 870	58.067	50 241	26 669	26 788	23.708
April	59 490	58 519		27.416	26 958	
May	60 361	58 175	......	27.825	26.704	
June	58 990	56 471		27 199	25 948	
July	58 721	54 678		27 074	25.219	
August	59 293	54 344		27 335	25 979	
September	60 640	53 290		27 986	24.260	
October	60 793	50 654		28 083	23 199	
November	58 995	49 082		27 263	22 703	
December	57.760	49.375		26 720	22 900	
Year	59 791	54 811	...	27 576	25 314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14 223	13.641	64 304	60.756	69.488	65.719
February	14 491	14 394	65 259	63 494	70.188	*
March	14.131	14.787	64. 276	66.152	69 170	*
April	14.211	..	64. 747		69 313	
May	13 99	..	63. 182		67 786	
June	13 603	.	61. 336		66 274	
July	13.223		60 540		64 955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11 739		53. 227		*	
December	12 801		56. 841		*	
Year					....	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37 779	34.260	171.905	156.55
February	39.830	37.415	181 556	176.92
March	38.038	48.426	173 619	180.14
April	36.154		163.963	
May	33 360		150 702	
June	30 577		138.321	
July	31 707		142 517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301		.	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	191
January	4.111	3.729	4.011	3.548	19 665	18.6
February	4 048	3.827	3 937	3.718	19 606	19.1
March	3 970	4.053	3.850	3.997	19 651	21.8
April	3.810		3 688		18 225	
May	3.900		3.808		18 503	
June	3.900		3 810		19 411	
July	3.891		3.738		19 051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19 097	
Year	3.862	..	3.737	..	..	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	19
January	5.262	6.386	5. 112	6.211	21 533	30.
February	5 377	8.436	5. 228	8.255	21 413	39.
March	5.250	8.541	5 100	8.366	21 460	44.
April	5.113		4.963		21.569	
May	5 074		4.924		21 393	
June	5 000		4.850		21 345	
July	4.920		4.770		21 568	
August	5 568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5 112		4 962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pou London, pounds sterling per long ton. * Not report ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	19
January	$14.94	$14.59	$13. 23	$13 45	$13 99	$1
February	15.06	14.55	14 12	13 45	14.08	1
March	15 07	14.55	13 94	13 45	14 10	1.
April	14.90		13.90		14 13	
May	14.90		13 90		14 27	
June	14.90		13 90		13 96	
July	14 90		13 90		13.90	
August	14.90		13 90		14 08	
September	14 90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13 83	
December	14.70		13.45		13 83	
Year	$14 88		$13 78		$14 01	

The Engineering and Mining Journal

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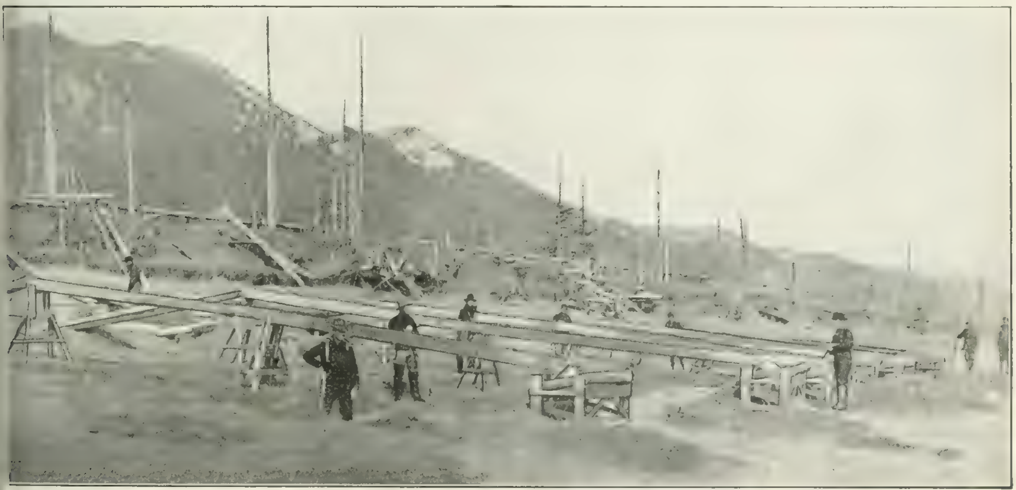
Yakataga Beach Placers

By Arthur G. Thompson[*]

SYNOPSIS—A description of a point on the Alaskan coast where the beach sands contain gold in payable quantity. At Yakataga Beach there are probably the richest of all these concentrations. At times the gold is visible in the concentrated sand.

At a number of places on the coast of central Alaska the sands of the ocean beach contain gold in paying quantities—that is, in quantities sufficient to warrant mining by the simple method of rocker or sluice-box. Among such places may be mentioned Yakataga Beach, Litouya Bay and Kodiak Island.

It is probable that the deposits of gold-bearing sand at Yakataga Beach, designated on the Government maps s Cape Yaktag, are the richest as well as the most xtensive. Here beach mining has been carried on connuously, having been the only industry of the place since 899. From 1903 to the present time there has been little colony of from 25 to 50 miners actively engaged working the sands of this beach, although in 1904 ports of rich pay caused an influx of about 250 men. lany of these were not miners and did only enough ining to find out that nuggets of gold were not to be icked out of the sand as potatoes are dug in a field.



Beach Sluicing Operations at Yakataga, Alaska

Having made this discovery, the first boat out carried most of them back to more congenial occupations with the report that Yakataga Beach was a "frost."

Although situated near the 60th parallel, the climatic conditions at Yakataga are such that during mild winters the miners are able to work the beach without hindrance from freezing except during short periods of one or two weeks' duration. The deposit of auriferous sand extends for about 18 miles along the coast, and reaches in places as much as a mile back from the beach. It appears to be a continuous deposit of sea sand and gravel, stratified and more or less classified in places by the action of the waves.

As the level of the seepage water percolating through the sand corresponds closely with the level of mean high tide, the prospecting of the sand deposit below this level has been difficult. Without machinery the miners have not been able to cope with the seepage through the loose sand, and the consequent caving of the walls of shafts and prospect holes. Below the drainage level little is known of the depth of the sand deposits or of the values it may contain. However, from Cape Yaktag, for 8 miles eastward, no bedrock has been found, although the creeks, as well as some of the ditches made by the miners for the purpose of conveying water for sluicing, cut through the sand to a depth of from 16 to 18 ft.

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[*] Mining engineer, Katalla, Alaska.

Topographically the features of the sand deposit, which lies between the sea and the base of the mountains to the north, are two parallel ridges of sand following the line of the coast, with a gently sloped depression lying between, forming a lagoon or pond in the rainy season and a marshy meadow during the dry months of midsummer. Another depression of less prominence extends in most places from the most northerly of the ridges to the slope of the mountain.

The first ridge, lying just back of the present sea beach, has an average elevation of 12 ft. above the level of mean high tide, and the second ridge, approximately from 1000 to 1500 ft. back from the sea, has an average elevation of 25 ft. above the same level. The depression between the two ridges, which has an elevation of a few feet above mean high tide, is partly filled with a deposit of clay—the settling from the muddy waters that fill the lagoons during heavy rains.

Both ridges are of the same composition of stratified sand and gravel as the present beach. This is disclosed in numerous places where they have been cut through by streams, as well as by the ditches of the miners. The first ridge from the sea is covered with a growth of the wild rice and redtop grasses indigenous to this section, while the second supports a good stand of spruce and hemlock trees of suitable size for saw timber. Both lie above the present beach and are not affected by the sea, which beats upon the unprotected beach in front. Evidently these ridges are ancient sea beaches, where the waves have washed back and forth and concentrated the ruby sand, the black sand and the gold in the strata to be seen there today.

Workings in the Ridges

The first ridge has been worked to some extent by the miners, and contains the ruby strata and values in gold approximately the same as the present beach. Borings made in the bottom of the lagoon between the first and second ridges show a continuation of the sand deposit under the covering of alluvial sediment, which in some places was found to be four or five feet in thickness. It is probable that the ridges are the result of a gradual elevation of the sea floor for certain periods of time, combined with the erosive action of the waters of streams flowing for some distance along the level coast more or less parallel to the sea, although at the present time the coast line is receding. Earthquake shocks and earth tremors are not infrequent in this section, but are not such as to cause serious damage.

All of the sand contains gold, but it is only the concentrated strata of ruby and black sand which have sufficient value to be profitably worked by the present methods of mining on the beach. These strata occur all through the present and the ancient sea beaches and range from 0.5 to 20 in. in thickness. On the present beach they are the result of storm and tidal action, and come and go with the changing conditions of the beach, which is subjected to a periodic advancing and receding action from causes as yet not well understood. It is possible that a variation of the thrust of the ocean current which flows along this coast from the east toward the west has something to do with it.

The Beach Formation

The present beach, which ranges up to 100 or 500 ft. in width and has a slope of from 10 to 25°, forms a natural concentrating table upon which the waves, driven by the wind and tide, accomplish surprising results.

During violent storms the water rushing back and forth upon the beach becomes loaded with sand, which is swept across the beach many hundreds of times during the continuance of the storm. It is during this backward and forward movement of the sand that the separation of the heavier sands and gold occurs and the strata of ruby sand worked by the miners are built up.

Concentration of Heavy Sands

The onward rush of the wave carrying its burden of sand in suspension is arrested by the vertical bank, or by the steep slope of the beach. The crest of the wave striking against the bank—usually from two to 10 ft. in height—is followed by a second impulse or swell of water; then with the volume of water brought in by the momentum of the wave pressed up against the bank, there ensue a few moments of quiet or "slack" water preceding the outward flow of the wave, when the heavy sand and the gold begin to settle. The outward flow of the water down the slope of the beach gathers momentum until it begins to disturb the sand on the surface of the beach, which is the lower limit of the concentrated layer thus deposited. The lighter sand, of a gray color, still remaining in suspension is carried back to the sea or remains until it meets the onrush of the second wave. This action, continued with more or less uniformity for several hours, or during several succeeding tides, covers the upper part of the beach for a width of 25 to 150 ft. with a sheet of ruby sand several inches in thickness. It extends laterally along the beach as far as the same conditions of the bank, slope, etc., continue.

I have watched this interesting exhibition of one of Nature's milling operations conducted on a scale much larger, and with a force more powerful than any used by man. I have seen each succeeding wave adding its smal portion to a mantle of garnet (for the ruby sand i nothing but fine garnet) which covered the beach fo miles to a depth of from 18 to 20 in. This concentration occurred in the fall of 1903, and was the best I have seen at Yakataga. Undoubtedly hundreds of thousands o dollars in gold lay upon the surface of the beach within easy reach at this time; but the miners there got onl a very small part of it. Succeeding storms mixed i back with the gray sand, carried it out, and in place covered it to a depth of 6 ft. with the poorer sand of th beach. It was paying us $5 per hr. per man for th actual time spent in shoveling, the gold being saved b amalgamation on copper plates placed in a light, portabl sluice box. While this saving per hour is not unusuall high as mining goes at Yakataga, I have since never see as large a deposit of "pay dirt" spread so uniformly ove the whole beach.

Working the Sands

The concentrated ruby sand is worked in rockers an sluice boxes, being shoveled in by hand. It usuall averages from $1 to $50 per cu.yd., depending on th degree of concentration. It contains a very sma percentage of black (magnetic) sand, though at time there is sufficient to give it a purplish cast. The gold bright and clean and averages about $18.50 per oz. Th individual particles vary in size somewhat at differen places on the beach, from mere specks to pieces as larg as a grain of wheat. All of them are much flattened, du no doubt, to the constant hammering of the sand and gravel by the waves.

I have seen the concentration of the wave action carried so far that the gold could be plainly seen in the sand lying upon the beach. These extremely rich strata are usually quite thin, due to a partial reconcentration of existing strata of greater thickness. I have known two men working together with one rocker to clean up 28 oz. of amalgam, valued at $5 per oz., from the rocker plates at the end of a day's work on rich "pay."

The source of the gold at Yakataga is supposed to be White River, a short stream emerging from under a glacier and debouching upon the gold-bearing beach at about its middle point. The bars of this river carry gold, and a mining company has installed a hydraulic plant near the head of the river and is engaged in mining there during the summer season. It is probable that the application of modern mining methods with the use of dredgers to handle the vast deposit of auriferous sand at Yakataga would prove profitable.

Piling up Rich "Pay" Preparatory to Rocking. The White Pieces Are Chunks of Glacial Ice Thrown Up by the Tide

⁂

Queensland Mineral Production in 1914

Gold production of Queensland in 1914 was 249,468 oz. fine, being 16,267 oz. less than in 1913. Other mineral production was as follows, figures in parentheses being the production for 1913: Silver, 253,964 oz. (604,979); copper, 18,436 tons (23,655); tin, 2085 tons (3197); lead, 724 tons (3603); wolfram, 241 tons (359); bismuth-wolfram, 194 tons (184); manganese, 6 tons (27); molybdenite, 78 tons (66); limestone flux, 119,805 tons (161,165); ironstone flux, 48,090 tons (40,838); fireclay, 5317 tons (8388); coal, 1,053,990 tons (1,037,944). The production of opal was valued at $9700 in 1914 and $14,600 in 1913; of other gems $76,800 in 1914 and $210,399 in 1913. No scheelite was reported. The total estimated value of the production, including gold, in 1914 was $14,545,601, a decrease of $4,228,581 from the previous year.

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Use of Liquid Air in Industry

The uses of liquid air were recently described in *Engineering,* Vol. 99, pp. 98 and 155; abstr. *Journ. Soc. Chem. Ind.,* Mar. 31, 1915. The use of liquid air in industry has now reached considerable proportions, and it is stated that there are machines of the Linde and Claude types installed which are capable of producing well over 30,000 gallons of liquid air per hour. The greater part of this liquid air is used for the production of oxygen and nitrogen; neon is obtained as a byproduct and is used for filling tubes for electric lighting.

Liquid air is also used for separating pure hydrogen from "blue" water gas. The only rival to the liquid-air method of producing oxygen is the process of decomposing water by electricity, and this cannot compete in cost unless a market can be found for the hydrogen as well as the oxygen. Oxygen is now very largely used for welding and cutting metals by the oxyacetylene blowpipe, for enriching air for blast furnaces, and for increasing the yield of nitric acid in the Birkeland-Eyde electric and the Haeusser explosion processes. Liquid oxygen mixed with organic substances has been tried as an explosive. Nitrogen is largely used for the manufacture of cyanamide, for the Serpek process of preparing aluminium nitride, and for the Haber process of synthesizing ammonia.

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The Mineral Production of Nova Scotia for 1914 amounted to: Coal, 7,005,164 long tons; pig iron, 281,428 short tons; steel ingots, 341,818; limestone, 335,515; gypsum, 283,340; coke, 467,730; gold ore, 13,156 short tons; gold, 3158 ounces.

Miami Copper in 1914

The Miami Copper Co., Miami, Ariz., for 1914 reports that 1,099,208 tons of ore was hoisted and 1,096,633 tons milled, averaging 2.28% copper. From this ore 44,579 tons of concentrates was produced, averaging 39.31% copper. The total copper in concentrates amounted to 35,048,445 lb., of which 33,296,010 lb. was recovered as refined copper. Copper sales for 1914 aggregated 32,879,447 lb. at 14.3488c. per lb. The following tabulation is an analysis of the financial statements of Miami for 1914:

SUMMARY OF TOTAL RECEIPTS

From sale of 32,879,447 lb. of copper at 13.3488c.	$4,389,026
From silver proceeds	38,888
From house rentals	10,293
From gain in power and supply account	27,868
From dividends on stock investments	57,750
From sale of capital stock	6,000
Total receipts	$4,529,826

SUMMARY OF TOTAL EXPENDITURES

Mining and milling		$1,835,081	
General mine expense		298,019	
Freight on concentrates		213,659	
Smelting, refining and freight		613,911	
Selling, freight and export insurance		85,837	
Legal expenses		15,162	
New York office expenses		41,775	
Total operating expense reported		$3,103,446	
Less:			
Depreciation shown by property and development accounts	$182,338		
Depreciation written off profit and loss	135,278		
Net depreciation charged off		47,060	
Actual expenditure			$3,056,386
Interest paid on loans			52,274
Interest paid on bonds			1,290
Added to construction account			69,023
Bonds redeemed			6,000
Total expenditure for year			$3,184,973
Balance available for dividends			1,344,853
To balance with total receipts			$4,529,826

Dividends amounting to $1,120,375 were paid during the year and $224,478.43 was added to the balance of quick assets. The operating profit for the year, as shown by the profit and loss statement, was $1,366,816, and after charging off depreciation a balance of $1,231,538 was carried to the general balance sheet. The total operating cost of producing copper as reported was 9.2045c. per lb. The following table gives details of costs as shown in the report:

		Per Ton Ore	Per Lb. Ref. Copper
Mining:			
Development		$0.31000	.....
Extraction of ore		.87756	.....
Total mining		$1.18756	3.9205c.
Milling:			
Direct crushing	$0.17755		.....
Direct concentrating	.17173		.....
Tailing and concentrate handling	.04375		.....
Water for concentrating	09425		.....
Betterments	.01235		.....
Total milling		.49963	1.6456c.
General expenses		.27176	.8951c.
Total cost of producing concentrates		$1.95895	6.4612c.

Underground development consisted of 22,865 ft. within the Captain orebody. On account of the thickness of the ore it is planned to extract it in two lifts, the upper one consisting of ore above the 270-ft. level, from which point a transfer will be made to the main tramming level through specially prepared raises. Blasting of the pillars between the shrinkage stope rooms in the Northwest orebody was completed in the early part of the year and the drawing of broken ore started. About 60% of the total ore hoisted came from this area. A 60,000-cu.ft. ventilating fan now supplies air to the workings, and the beneficial effect from this fan led to the installation of a second one, of the suction type, on the surface above the Captain orebody.

The mill was operated at full capacity during the first seven months of the year, but production was reduced in the latter part of the year on account of the war. Improvements made in Section 6 proved a success, and plans were made for remodeling the entire plant to treat 4200 tons a day. The change consists principally in finer grinding and additional table treatment on the sand floor of the mill and improved methods of handling and treating the slime products. The increased capacity on the sand floor will be obtained by using double-deck tables, and finer grinding will be accomplished by 8-ft. by 66-in. Hardinge conical pebble mills in the sand-floor tunnels. The product of these mills will be raised by elevators and reclassified for table treatment. The material leaving the sand floor will have the fine sands removed in 8-ft. conical tanks, the overflow of which will pass to six Dorr thickeners 46 ft. in diameter by 10 ft. deep, one to each section, and located outside of the mill building. The thickened pulp will join the reject from the slime tables for further treatment. The mill bins will be raised to 10,000 tons' capacity.

Further prospecting was stopped at the time of the curtailment in production, so no increase in ore reserves is shown except what was opened by current development. Ore reserves are estimated to contain 19,500,000 tons of sulphide ore averaging 2.4% copper; 17,000,000 tons averaging 1.21% copper and 6,000,000 tons of mixed sulphide and oxidized ore averaging about 2% copper. Experiments are under way to determine some way to treat this mixed ore, and it is hoped that within a reasonable time this ore will be available for treatment. According to these figures, there are about 13 years of operations on the high-grade ore alone and about 25 years of life on an average grade of 1.85% ore, if the 17,000,000 tons of 1.21% ore is considered.

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America's Opportunity in Argentina

One of the principal mining operators of the Argentine Republic, an Argentino himself, when questioned regarding mining conditions and opportunities in his country, replied as follows:

> Argentina is in the same condition now that the United States was in 1805, before the mines were discovered. Then the entire interest of your country was in agriculture and stockraising. Argentina is in about the same condition now. The people are not progressive—they are satisfied to do things the way their forefathers did them, and their only salvation is in the introduction of American capital and brains in the development of mines that up to now are practically untouched. The mineral resources of Argentina are wonderful. I have lived 15 years in the Sierras, and I know what I am talking about. You are going to find the Argentine people opposed to the adoption of novel ideas. The only advancement made here has been by foreign capital and foreign brains and methods. America's opportunity comes now. The richest families here are yet uncultivated and unrefined, a strange fact in view of the opportunities they have had to advance themselves. The fact is they lack the necessary ambition. We must work to bring Americans in here to develop the rich mineral resources that are now lying idle and to set an example of progress for our people to follow. Of course the war is a handicap, but it provides the right time to begin, since you can get more attention and respect now than were the people busy with other things.

Mining Low-Grade Copper Ore by Ray Consolidated

By Alec N. Penny*

SYNOPSIS—Ore mined by shrinkage stoping, with subsequent pillar caving. Main shafts located with reference to centers of gravities of orebodies determined by previous churn drilling. Bonus, contract and leasing systems used in combination regularly as part of mining method. High timbering costs offset by unusual economy in breaking of ore by system employed.

The mines of the Ray Consolidated Copper Co. are situated on the west side of Mineral Creek, at Ray, Pinal County, Ariz. The country is mountainous, rising to a height of 3000 ft. above the creek on the east side, but on the west the rise is rather less abrupt, being about 300 ft. to the mile, steep enough, however, to make transportation difficult.

The ore occurs in two large lenticular bodies which dip gently in a northeasterly direction. Though generally spoken of as two separate orebodies, the ore is really continuous, merely thinning down between the two main lenses and consists essentially of disseminated chalcocite in schist. The orebody is extremely irregular in shape and is covered by a leached capping of the same rock several hundred feet in thickness, and is underlaid by primary rock—i.e., schist mineralized with cuperiferous pyrite below commercial grade. The transition from eached capping to ore is very abrupt and well marked, but the change from ore to primary rock is only moderately so.

Before commencing mining operations, the company ystematically blocked out the ore by means of churn-drill oles spaced 200 ft. apart each way. From these holes he tonnage and grade of the ore were accurately determined and the centers of gravity of the two orebodies ocated. This made it possible to plan the development work to much greater advantage than can usually be done n mining. In locating the main shafts, three points were onsidered: (1) Surface topography and ground likely to e encountered in sinking; (2) convenience to the raiload; (3) distance to center of gravity of orebodies. Two main vertical shafts were established about a mile apart, ach with its independent coarse-crushing plant and ore ns. The two main shafts are used exclusively for hoistg ore, while an inclined shaft at each plant handles aste rock, timber and supplies and is provided with a airway for the men.

The controlling factor in locating the main haulage vels was the vertical range of the ore. The orebodies at eir highest portion are about 150 ft. above the railroad ade along Mineral Creek and extend to a depth of about 0 ft. below it. An adit was driven at each mine at the vation of the railroad. This level takes care of all the e above it. Three other main levels will take care of the ore below the adit. The distance between these els varies somewhat, depending upon the shape of the ebodies, but the maximum distance between motor levels is 175 ft. Main haulage drifts were laid out on the two upper levels in each mine. These haulageways were planned with two ends in view—to get the shortest possible haul for the ore and to pass under as little mineable ore as possible. The caving system contemplated was expected to cause immense pressure on the drifts under the caved area. For this reason any ore overlying the main haulage drift could not be mined until all other work on the level was finished. In other words, a pillar must be preserved around the main haulage drifts until the level is exhausted.

From the main haulage, parallel drifts are driven on north and south lines, 50 ft. apart, through the orebody. These drifts are connected at the far ends by what is called a fringe drift. This gives access to all drifts from both ends, as may be seen in the plan. When mining operations commence, empty cars are run in from the fringe drift and the loads taken out from the main drift end.

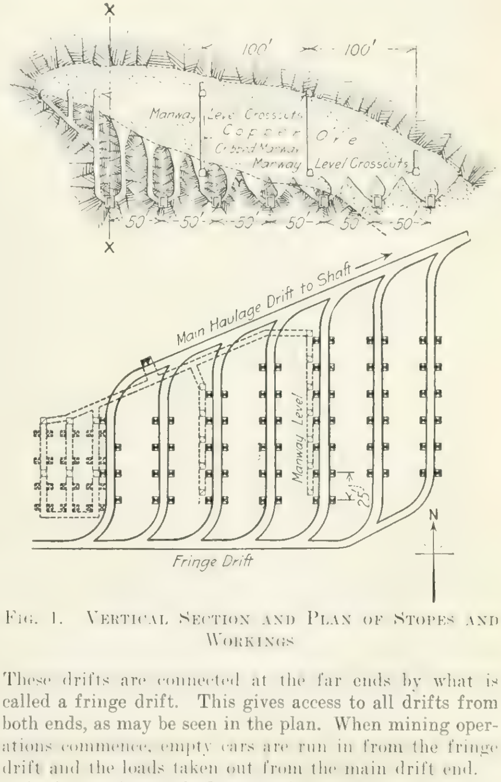

Fig. 1. Vertical Section and Plan of Stopes and Workings

An interesting method was used to lay out the grades of the main levels. Assuming the main shaft to lie to the northeast, the whole level is assumed to be a plane tipped at such an angle that the downgrade to the north is 1 in. in 100 ft., and the downgrade to the east the same. A datum point on the level is established, and from this point it is a simple matter to figure the proper elevation of any other point on the level. This simple system, once in force, requires little extra work on the part of the surveyor and eliminates the common condition underground of two drifts on the same nominal level, but not driven with the idea of connection, ultimately connecting at an ugly difference of elevation.

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*Mining engineer, Bingham Cañon, Utah.

The system of mining in use comprises shrinkage stopes with subsequent pillar caving. There are two variations in the method of extracting the ore. In Fig. 1 is shown a plan and section which illustrate the application of the two systems, which for convenience we will call system A and system B. System A is used to extract the main portions of the orebody. System B is applied to those outlying portions of the orebody which are too thin to warrant the more expensive development of system A.

Mining the Main Orebody

In the figure the portion of the orebody to the right of the line *X-X* is stoped by system A. The plan shows a series of north and south crosscuts spaced on 50-ft. centers, connected at one end by the main haulage drift to the shaft and at the other end by the fringe drift. Chutes are built in these drifts within the orebody, on east and west lines 25 ft. center to center, and from these chutes raises are run up to a height of 25 or 30 ft. above the track level or to the ore. Where ore is encountered within 25 ft., the raises are connected by east and west drifts forming the stope sill level. In the section it will be seen that such a drift going west would encounter waste at *Y*. From this point an inclined raise is run up along the bottom of the ore to connect the remaining chutes. The stope sill development is completed by north and south crosscuts, not shown in the illustration, driven every 100 ft., intersecting the east and west stope-drifts. At a convenient height above the stope sill, a manway level is provided (shown in dash lines in the plan). The manway level consists of north and south crosscuts located vertically above the corresponding north and south crosscuts on the stope sill level.

Stoping is commenced preferably next to the fringe drift. The width of the stope depends on the nature of the ground, which of course is variable. The wider the stope can be carried, the cheaper it can be broken, and the easier it will be subsequently to cave the pillars. A good average width for stopes, spaced on 25-ft. centers, is 15 ft., which leaves a 10-ft. pillar, running east and west, between adjacent stopes.

The first operation preparatory to stoping is to bell the raises. A man with a stoper widens out the chute raises in the form of inverted cones until the top is the full width of the stope and stretches east and west to the neighboring raises, 15 ft. wide north and south and 25 ft. east and west. This work is started near the chute so that nearly all the ground broken in the process can be left in the raise, forming a working floor upon which the machine men can stand when they drill the back of the stope. In each stope sill crosscut, 7 ft. north of the stope center, a manway set is erected. The manway set is merely an elaborated square set which serves as a foundation for, and a means of entrance to, a cribbed manway, which is built upon it as the stope progresses upward. Before blasting the back the first time, the manway set is lagged on the three sides nearest the stope, and it is usual to drive a vertical raise over the manway sets before stoping begins. These raises connect through to the manway level above and provide ventilation in the stopes and also serve as an extra means of entrance and exit. For this purpose ladders are placed in the raises and from the lower wooden ladder a chain ladder is hung into the stope.

Stoping proceeds as usual by drilling and shooting down the back, just enough muck being drawn from the chutes below to leave a convenient working distance above for the men to drill.

While this stope is being mined the next stope is prepared. When stope number two is started it cuts off the sill floor manways to stope number one, but as stope number one approaches the manway level the lower manways cease to be of any importance and may be abandoned. Thus two stopes may be worked simultaneously. The stoping sections are considerably larger than the ideal plan shown and a number of them are operated at once to yield the required tonnage.

Mining is continued in the manner described until a whole section has been stoped out. At this stage 35% of the ore broken in stoping has been drawn out of the chutes. There is left 65% of the broken ore in the stopes and all of the pillars. Assuming the stopes to have been 15 ft. wide, 79% of the ore still remains to be taken out.

Mining the Hand-Tramming Portions

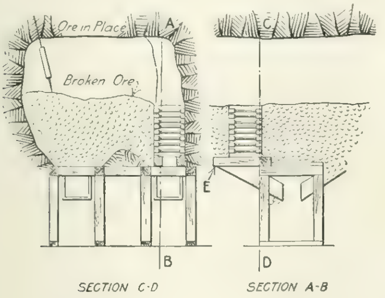
It is obvious that before the pillars can be caved and this ore drawn out, all adjacent ore at a higher level must be extracted, such as that portion shown in Fig. 1 west of the line *X-X*. These smaller portions of the orebody are developed by smaller drifts suitable for hand-tramming. A manway level may often be extended to serve these outlying sections. These levels are provided with a two-compartment timbered raise from the main level, located outside the orebody. One compartment is a ladderway and the other serves for a bucket operated by a small hoist for handling timber and supplies.

The drifts in these sections are spaced on 25-ft. centers. The stopes run at right angles to the drifts, and are also spaced 25-ft. centers, as in system A. In these hand-tramming sections, however, flat raises are run from the chutes connecting midway between the drifts, and the stope is silled right over the drift timbers. Manways ar provided in every third or fourth drift. In the secon set of timbers from the stope chute, a chute is built fo the manway, as shown in Fig. 2, which is to catch th muck broken in the construction of the manway and an ore that may be shot into the manway during stoping A vertical raise is started just inside the chute and ca ried up about 10 ft. above the back of the drift. Tw stringers are laid, one end resting on the drift sets, th other end in a hitch in the raise (see *E* in Fig. 2), an a manway set is usually built upon them. Although tl manway set facilitates drawing the chute later when tl pillars are caved, as the posts can be shot out, where cribbing would be difficult to break, it is not necessa during stoping, as entrance is from below, and it usually omitted when the manway is at the end of t stope. The manway is connected with the flat raises a the chutes which have been kept open to this point a allowed to fill with broken ore. The stope is widened o from the chute raises by inclined holes to each side. T manway is cribbed up to within 3 or 4 ft. of the ba and stoping proceeds as in system A. In carrying up t stopes, the ground over the manway is drilled somew in advance of the rest of the stope, thus allowing the ma way to be cribbed up high enough so that the ground s down in the stope proper will not run down into the m way chute.

The stoping crew consists of a stope boss, two or th machine men, and if the stope is a large one, two or th pickmen. In the smaller stopes the machine men bar down before drilling. Wherever possible it is arranged that each shift will leave one manway clear—i.e., not drill that part of the stope. This leaves a safe entrance for the opposite shift, and the pickmen start from this manway to bar down the stope. They are followed by the machine men, who thus have a solid back to drill. All drilling in the stopes is done with the regular stoping drill.

Drawing the Chutes and Pillars

As fast as the small sections are stoped out additional chutes are built in every drift, midway between the stope chutes. When these chutes are completed, drawing officially commences. Wherever the ground is solid, flat raises are started from these pillar chutes exactly as in starting a new stope; but often the ground will already have started to crush and a few holes drilled from the chutes will be sufficient to start the muck running. Whenever a large boulder appears in the chute, a little powder is placed under it, which usually starts the muck again. Where the ground is not so crushed, the flat raises are onnected as in stoping. If the ground still remains firm, he backs of the raises are drilled and shot. Eventually hutes are built in each set of timber.



SECTIONS THROUGH STOPE IN HAND TRAMMING WORK

FIG. 2

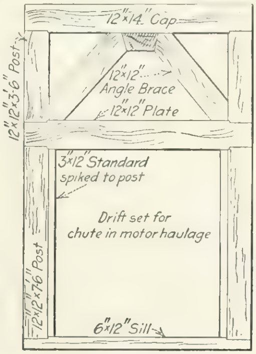
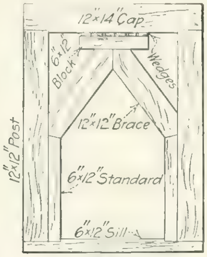


FIG. 3



Drift set for hand tramming

FIG. 4

Details of Stope and Drift Sets

As soon as drawing begins, the section is provided with car checker, who reports the number of cars drawn from ıch chute. The engineering department keeps track of iis work and certain chutes are sealed up when necessary ı insure the ore being drawn evenly so that as little capping as possible will be mixed with the ore. A chute is ealed permanently as soon as capping appears in it and ie drawing continues from other chutes until the section empty. When drawing is completed in all the adjacent ections, the main portion of the orebody may be drawn in ie same way. The process of caving the pillars is much ie same as in the small stoping sections, but the stopes ing silled higher and the drifts farther apart, the eparation is rather more elaborate. Chutes are built idway between the stope chutes, and flat inclined raises e driven from these chutes connecting from one drift another. Then starting about 7 ft. inside the chute, anch raises are driven inclined back over the drift. If e ground remains solid these branch raises are also connected, and the back and sides of all raises are drilled and shot. Drawing then proceeds as in system B.

When all the chutes in a section have been drawn to capping, there remains a pyramid of ore between the drifts. This point has not yet been reached in any of the large motor haulage sections, however. In the hand-tramming sections, if the grade of the ore warrants it, new drifts are driven midway between the old tramming drifts to tap this remaining ore. These drifts, locally known as cone drifts, are driven and timbered on contract. Between the original drifts spaced on 25-ft. centers there is an 18-ft. pillar of ore. As has been shown, the rock drawn from a chute under these conditions leaves it in the form of an inverted cone. The sides of this cone are much steeper than if the ore were drawn from a chute in the bottom of a flat-bottom bin. In drawing a caved orebody, the chutes are never empty, the ore being finally replaced in the chute by waste. The waste exerts a supporting force upon the ore forming the sides of the cone, so that the line of division between ore and waste stands at an angle of about 50 degrees. This can be seen very nicely in opening up the ground adjacent to old chutes, when a distinct dividing line may be seen between the red capping and the gray ore.

On account of this high angle of the cones a large amount of ore is obtained from the cone drifts. Chutes are built in every set of timbers, and when these have been drawn empty, back chutes are put in and the last car of ore that can be obtained is drawn out.

The section is then turned over to leasers, who take out the ore below the level of the chutes and deliver it to the motor cars at so much per ton.

Motor Haulage and Tramming

By far the greater part of the ore is drawn direct from chutes into the five-ton cars of the motor haulage system. Empty cars are generally run into each drift where drawing is in progress, and are loaded by crews of two men each. The motorman and brakeman are occupied continuously taking away the loaded cars and bringing empties back. The loads are generally taken out to the shaft in trains of nine or 12 cars and dumped three at a time in a revolving tipple. On levels where there is a long straightaway haul much longer trains are handled.

In the smaller stoping sections, where hand tramming is used, the trammers work on a bonus system. One-ton cars are used, of the ordinary oblong type with hinged door in front. The length of tram varies considerably with the accessibility of the section to raises from the motor haulage level. In favorably located sections the average tram is not much over 25 ft. and the trammers will take out from 75 to 100 cars a shift, receiving a bonus of 3 or 4c. for each car over 50. In particularly inaccessible sections the tram may be 200 or 300 ft., with a correspondingly decreased production per man.

All drifting and raising is done on contract. The company furnishes all supplies and the contractor pays for all labor. Prices vary widely with the nature of the ground and the disposal of the muck. For motor drifts driven 8x8 ft. in the clear without timber, the price for good breaking ground is $3.50 to $4 per foot. For the smaller drifts, 5x7 ft., the price is from $1.75 to $2.75 per foot. Chute raises for stopes are contracted at 65c. to $1 per foot, the company handling the muck. Higher prices are paid for the longer raises. Stopes have been contracted both on yardage and on footage of holes drilled, but to little or no apparent advantage. Ordinarily the contractor is allowed five sticks of 30% powder for each hole drilled. The powder allowance may be increased at the discretion of the foreman, but this amount is usually sufficient to break the ground. Little wet ground is encountered and double primers are not found necessary.

TIMBERING

Nearly all drifts in ore will stand without timbering, and are only timbered in preparation for stoping. On the other hand, a good deal of the development in waste requires timbering. For this purpose either 10x10-in. or 12x12-in. timbers are used. The motor drifts are timbered 7 ft. wide and 8 ft. high in the clear, using vertical posts dapped 1 in. into cap and sill. Sills are always used, either 6x10-in. or 6x12-in. Turnouts are designed carefully, using 50- or 60-ft. radius for curves. When turnout timbering calls for caps over 12 ft. long, 12- or 15-in. I-beams are used. The I-beams are fitted with a steel plate at each end flanged down 1 in. all around to fit the top of the post.

Timber sets within the stoping area are specially designed, see Fig. 3, with the intention of converting them later into chute sets. The posts are shorter, 7½ ft., and a pony set 3½ ft. high, subsequently erected upon the cap, makes the total height 12 ft. Girts 12x12 in., beveled on the upper inside corner, fit between the lower caps and support the bottom of the chute. The chute itself is built of 3-in. lagging. All parts are cut to size in the framing shed. In good ground timber sets are spaced alternately 5- and 7½-ft. centers, and chutes are built in the 5-ft. sets. This provides stope chutes every 25 ft. along the drift, and pillar chutes half way between them. Before caving the pillars in any section, the pony sets are reinforced with three-piece angle braces, two 12x12-in. angle pieces with a key block.

The size of these sets is partly determined by the Arizona law, which provides that the trolley wire must be 6½ ft. above the rail. The only convenient arrangement of the trolley wire is at the side of the drift so that it passes under the chutes, which necessitates chutes much higher than is required to clear the cars.

In the hand-tramming sections the timber sets, see Fig. 4, are placed on 5-ft. centers, and are 5 ft. wide and 8 ft. high in the clear. Posts, 12x12 in., are used with 6x12-in. sill and 12x14-in. caps. Angle braces of 12x12 stuff are put in before pillar caving commences. To support the angle braces, 6x12-in. standards are placed against the inside of the posts. These standards are beveled slightly on top so that the angle braces resting upon them hold them in place against the posts. The two angle braces, as first planned, met under the caps, fitting tightly. It was found that when the cap took weight it was forced down upon the angle braces in the middle, so that the braces eventually cut completely through it. To prevent this, the angle braces were made to meet about 7 in. below the cap, and a 6x12-in. block about 2 ft. long was placed between the cap and the angle braces. Wedges were then driven tightly between the cap and the block.

By far the greatest part of the weight comes on the timbers when the chutes are being drawn; at this time the whole mass of broken ground is in slow motion, similar to the flow of a glacier. For repair work, a set may be opened up and the lagging cut out with little danger of the ground running, but all the time there is a slow settling that no timber will withstand. When the pillars in a section have been caved, the chutes are drawn as fast as possible and just enough repair work is done to keep the drift open and safe and the chutes running. As soon as the chutes are drawn down to capping, the drift is abandoned. The cost of timbering and repairing on the levels is a large item of expense, but is offset by the fact that no timbering is required in the stopes, that only a little more than half of the ore is actually blasted in the stopes, and that no shoveling is required at any point.

When a section of the mine has been stoped, cracks usually appear on the surface over the stoped area, or if stoping of itself does not produce cracks, they soon develop when caving commences. As the pillars are drawn the corresponding surface area settles and eventually large holes are formed. While the Arizona climate is generally dry, there are often very heavy rains, especially about January and September. At such times it is important to keep the surface drainage from running into the caved areas, and for this purpose an elaborate system of drainage tunnels and ditches is necessary. Over 5000 ft. of drain tunnels have already been driven, and a large concrete dam will be built in the principal gulch to keep the surface drainage out of the surface caves.

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Swedish 1913 Mineral Output

The official report of the Swedish output for 1913 show the following: Iron ore, 7,475,571 metric tons; bituminous coal, 363,965; zinc ore, 50,752; silver-lead ore 3222; iron pyrites, 34,319; feldspar, 37,878; quartz, 40,837; manganese ore, 4001; copper ore, 5458 metric tons Of the iron ore produced, 4,550,390 metric tons carrie between 60 and 70% Fe, and 1,820,439 tons more carried between 50 and 60% Fe.

The metal production, excluding iron, was: Coppe 6891 metric tons; zinc, 2114; lead, 1235 metric tons; silver, 1037 kg.; gold, 25 kg. Other products and byproducts of the mineral industry were: Roasted zinc blend 33,522 metric tons; copper sulphate, 428; alum, 144; ferrous sulphate, 320; graphite, 88; powdered pyrolusite, metric tons.

Recent Rand Metallurgical Practice

By M. Thornton Murray[*]

SYNOPSIS—A review of the recent changes in metallurgical practice on the Rand. The application of new methods and machinery, many of them of American origin, has produced results tending toward better extraction and lower costs.

The war in South Africa has not directly affected the gold-mining industry on the Rand to a great extent, but it has led to certain restrictions in the activities of metallurgists there insofar as invention, alteration of existing methods of procedure or the trial of new ideas is concerned. Such an intermission is not, however, altogether to be regretted. It has the merit of giving one an opportunity to take a more or less comprehensive view of the metallurgical situation, to examine the new methods of treatment and the modern appliances in use, and to estimate the progress made during the last year or two.

Generally speaking, all experiments which have been made have had greater profit as their goal. Three different routes have been followed for the journey: (1) Increased output, (2) reduced working cost, and (3) higher extraction. Of these the first lies more within the sphere of the miner than of the metallurgist, since (on the Rand, at any rate) the output of the plant is governed by the battery-feed; although the metallurgist must be in a position to handle the maximum output of the battery.

Of the two other considerations it may be said that hey are largely interdependent, since it would be easily possible to obtain a high extraction, but at a prohibitive cost. A metallurgical review of progress on the Rand, hen, resolves itself into a consideration of recent modifications in treatment methods, remembering that no alteration has been adopted which (so far as the metallurgists can see) has increased working costs beyond the limit of its usefulness. The remark that Rand metallurgy is 'merely a matter of economics" is largely true, but seems ather a compliment than the reverse.

Primary Crushing

Both spindle and jaw crushers are used for the preiminary breaking of the ore coming from the sorting belts; but there is a growing feeling in favor of the latter, wing to the frequency of breakdowns in the former type f machine and the time required and labor entailed in learing and starting up again. The replacement of the iners—a rather frequent operation when the crusher is working on the "banket"—is a tedious and somewhat ifficult operation.

The product from these crushers, forming the battery feed, usually averages 4 in. diameter, and a portion of his is now bypassed to the tube mills, to serve as tube-mill pebbles, the ore being hard enough, in most cases, to replace the old flint pebbles, which were not only expensive to buy but simply served to dilute the pulp with arren material.

Stamp Milling

It almost seems, at first sight, as if crushing in the attery had reached the limit of coarseness; although after the comparatively recent sweeping alterations in battery practice one hesitates to prophesy that there will be no further changes. However, coarser crushing would probably involve heavier stamps, and the wear on screens, frequency of breakage of camshafts and stems and comparatively high consumption of metal per ton of ore crushed, even under the present régime, make it difficult to imagine that heavier stamps could be worked satisfactorily without drastic structural alterations. In this connection the reinforced-concrete and steel kingposts which were tried at one mine may have proved satisfactory, but they have not been tried on any of the subsequently erected batteries on the Reef. Nissen individual-mortar stamps have been tried on the Rand and gave good results, but they have not been largely installed there, although on some of the newer propositions in other parts of the Transvaal and Rhodesia they are being used with success. Practically all the stamps installed in the new mills are of 1900-lb. weight, with long heads (up to 4 ft.) and open-front mortars, five heads falling in each box, but one camshaft generally serving 10 stamps. With the exceedingly coarse crushing at present obtaining (some screens have rectangular apertures measuring $\frac{3}{8}$ in. by $\frac{3}{4}$ in.) no amalgamation is done either in the mortar box or immediately in front of it. All the amalgamation takes place after the ore has passed the tube mill.

Tube Milling

The chief innovation in tube-mill practice has been the substitution, at one or two of the newer plants, of short tubes of greater diameter (6 ft. by 16 ft. 6 in.) for the standard 5-ft. 6-in. by 22-ft. mill. It is argued that the last few feet of the older type have little crushing efficiency, yet increase the power required for driving the mill. The new mills have given good results, requiring, it is claimed, little or no increase in the power. Experiments to discover the best speed and load for tube mills were carried out in 1913, a specially constructed section (full diameter) of a tube being used for the purpose. These experiments are said to have given highly interesting results, and the conclusions drawn from them have led at least one prominent metallurgist to experiment on a working scale.

In some of the more recent plants the returned oversize from the classifiers working on the tube-mill discharge is being dealt with by special tube mills set aside for the purpose instead of being returned, as heretofore, to the primary tube-mill circuit. A greater control, it is claimed, is thus obtained over the duty of the various mills, while these secondary-circuit mills can be adjusted, so far as load, moisture and speed are concerned, so as to deal more successfully with the relatively finer feed which they have to take. The tubes are usually run at from 31 to 34 r.p.m., on a thick, dewatered feed, liners of the Osborn (longitudinal steel rib) type being preferred.

The Hardinge conical mill, which has been lately tried on one of the mines, proved, we understand, remarkably efficient, so that it may figure in future installations. On the other hand, the improvement in crushing was not considered sufficiently great to warrant scrapping the present mills.

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Amalgamation and Classification

No drastic changes have taken place in amalgamation on the Rand, if we rule out the transfer of the plates from the mill to a special building or to the extractor house—a move brought about by the adoption of the coarse-crushing policy. J. R. Dowling's suggestion for increasing the grade of the plates, doing away with the shaking device and considerably thickening the pulp fed to them, has been adopted on several properties, with good results in labor saving and reduced plate area. Other points which have been discussed in this connection have been the absorption of gold by battery plates and the frequency of dressing the plates.

The chief novelties with regard to classification are regulating devices to prevent overflows when, through irregularity of feed, the classifier has to deal with rapidly varying conditions. Dr. Caldecott's cone, with its appurtenances, is successful in this direction, while other float devices have proved fairly satisfactory. Most of the classifiers on the Rand are now of the cone or spitzkasten type, spitzlutten or more complicated apparatus being generally found wanting under the conditions which obtain on the Reef.

Caldecott sand-filter tables are in use on several mines, and are efficient and cheap. Reinforced-concrete collecting tanks have not been used, except at the City Deep, where they were first installed. Whether we are to regard them as an experimental failure or not is a moot point; but the construction of the old-style steel tanks or newer plants would seem to lead to some such conclusion. They are still being used, however, on the City Deep plant.

In the later plants traveling belts have almost everywhere replaced the Kafir and the "coco pan" as a means of transporting sand, while disk distributors for filling the treatment tanks and Blaisdell plow excavators for emptying both collecting and treatment tanks are the rule. Both of these machines practically demand traveling-belt conveyance to work with them. So far as transportation of sand pulp is concerned, the general lack of natural fall in the ground all over the Rand mining area makes it essential to manufacture headroom by frequent pumping. Centrifugal pumps are usually used, though one or two tailings wheels are still working. With centrifugals, upkeep costs are rather high, especially when the pumps are dealing with a modern, coarse battery discharge, which is very hard on the liners.

Modern methods of sand treatment differ little from those in general use several years ago. At some reduction works which are working on an especially pyritic portion of the reef a pyritic concentrate is collected on blanket strakes and treated separately by grinding in small ball mills with mercury and treating the tailings from this operation with cyanide. The black-sand concentrates obtained from the plates, mortar boxes, etc., are often similarly treated. Lead acetate is now added to most of the sand-treatment tanks to counteract the action of soluble sulphides.

Sand Tailings and Their Disposal

Finer grinding and other improvements in treatment have effected a considerable reduction in the value of the sand tailings going to the dump. A few years ago a tailings value of from 50c. to 75c. a ton was common, as against 28c. to 35c. a ton, which is usual today.

Many of the older mines have considerable difficulty in finding enough dumping ground for their residues. This lack of space means that the dumps have often to be made much higher than would otherwise be the case, with consequent increases in the cost of hauling the tailings. Lack of space for redumping is also one of the chief causes militating against the success of schemes for the re-treatment of the old sand-residue dumps, many of which have a gold value sufficiently tempting to have lured speculators, usually to their undoing.

The blowing of dust from the tailings dumps has been given some attention lately, with the result that various measures, from the treatment of the surface of the dump with molasses or calcium chloride solution, to divert waste rock to the sand dumps, have been proposed, and are at present being tried out on several of the mines. Sand-filling is becoming increasingly important, though, and it is probable that the day is not far distant when most of the tailings will find their way back to the depths from which they came.

Slimes Treatment

The Butters filter was introduced a few years ago on the Crown Mines, and the experiment was so successful that a number of other plants have been put in. The marked success of the device on the Rand is probably partly due to the fact that it is capable of treating not only true slimes but slimes mixed with a large proportion of fine sand; and fine crushing of the banket (which contains comparatively small proportions of the ingredients of a true slime) gives rise to exactly such a mixture. In conjunction with Brown, or Pachuca, tanks using air-agitation the Butters filter has given excellent results, low residues and cheap operation being its chief advantages.

It may be noted in this connection that while the "all-sliming" proposition is not looked upon with any particular favor on the Rand, the proportion of sands to slimes (the terms have almost lost their original significance) produced and treated has gradually altered. One mine, at least, is treating as slimes over 50% of the ore which it crushes. Metallurgists on the Rand are often accused of conservatism; but since there have been very few reactions in favor of older processes in the history of the fields, a certain amount of conservatism seems to have been justified. While certain other mining localities which took up the all-sliming idea with enthusiasm are already exhibiting a tendency to return to the older methods of treatment, Rand metallurgists are apparently feeling their way slowly to a modified sliming system which will give them the best results, both as regards extraction and cost, under the peculiar conditions with which they have to contend.

Perhaps contributory causes to this attitude may be found in the large capital already sunk in sands-treatment tanks and in the fate which overtook the Benoni Consolidated plant. In any case, however, it is doubtful whether, with a hard, tough ore like the Rand banket, with its low gold value, the high cost of skilled labor and the comparatively high cost of water, all-sliming would be the most economical method of extracting the gold from Rand ore.

Precipitation

Precipitation has long been regarded as the weak spot in the cyanide process for gold ores, and as the clean-up of the zinc boxes is a long and laborious process, accompanied by danger of gold loss, this view is easily understood. The old zinc-shaving method, with the modifications of a lead-acetate dip for the zinc in the weak solution boxes, a cyanide drip at the head of the boxes and a careful adjustment of the alkalinity (0.006% to 0.008% NaOH is usual), still gives good results, and metallurgists seem unwilling to discard it in spite of its obvious disadvantages.

The zinc-dust processes of Merrill and others have been tried, and are giving satisfaction on one mine, at least, on the Rand; but considerable experimental work was necessary before the process was successful. The chief difficulty appeared to lie in the low gold value and cyanide strength of the weak (slimes) solutions and the difficulty of keeping these in contact with the zinc dust long enough for the precipitation to attain completion.

A new electrical process, which is without the chief drawbacks of the Siemens-Halske process—clumsiness and complexity—is at present under trial at one property. The laboratory tests were claimed to show astonishingly high and rapid extraction of the gold from solution, and preliminary tests were also favorably commented upon. t remains to be seen whether the process will be a sucess on the full working scale.

Smelting and Assaying

The Taverner pan furnace and cupellation furnace have een installed at practically all the new mines, replacing he old pot-smelting in Cornish coke-fired furnaces. Both hese furnaces are coal-fired reverberatories, and the high rice and poor quality of the local coke were probably sponsible for the introduction of the process, although ther considerations, such as economy of labor and time, ndoubtedly had their part in the decision.

Routine assaying of mine and surface samples by pot sion is now carried out in flat-bedded reverberatory furaces, using an assay pot of the "Battersea Juleff" form. he pots are more quickly and surely handled in this type f furnace; but the chief reason for the change lies again the high price of coke and the comparative cheapness coal.

Grading analyses were formerly performed in the assay lice, but they have become such an important part of the etallurgical work that a special room is set aside for em, a proceeding which has the additional advantage of eping the dust away from the assay office. Standard M. screens are usually used, and several types of grad g machines (Stadtler's, Blundun's, etc.) find favor.

The introduction of electrical machinery all over the surface plant of the modern Rand mine has probably done more toward bringing down working costs than anything else. As the work becomes more and more mechanical, fewer and fewer skilled white workers are required, and the Kafir is becoming less essential to the reduction works, as he has become below ground.

Careful design of plant, the introduction of devices such as the Butters filter, Blaisdell excavator, traveling belts, etc., and the centralization of control have also been responsible for much improvement. Working costs on the surface a few years ago were thought good if they were below $2 a ton; they are now nearer to $1 and there is every probability that they will go even lower.

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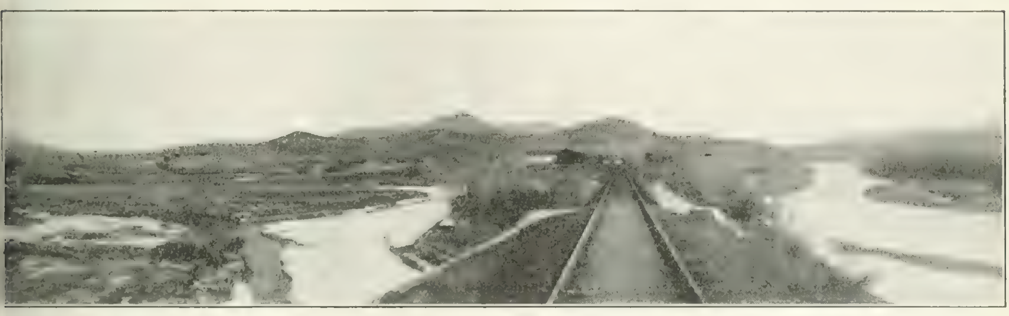
Bituminous Shales of Colorado

By G. R. DeBeque

While the recovery of oil from bituminous shale (or oil shale) has been an industry of considerable importance in Scotland for the last 50 yr. and in France since 1830, in this country it remains as an undeveloped industry worthy of investigation. The existence of highly bituminous shale in northwestern Colorado and northeastern Utah has been known for several years, but no particular attention had been paid to these formations until the summer of 1913, when an examination of the oil-shale deposits of that region was made by the United States Geological Survey under the supervision of E. G. Woodruff and D. T. Day. The results of this investigation are interestingly described by these gentlemen in *Bulletin 581A*, to which I am indebted for much of the information contained in this article. It is well, however, to explain that I am intimately familiar with the deposits.



View toward Town of DeBeque, Colo., Showing the Bituminous Shales in Background

The tests made during the examination, while not of a character to demonstrate the entire feasibility of utilizing the shale in the production of petroleum, show that the material compares favorably with the Scotch and French oil shales and indicate the existence of a large reserve of oil that will eventually be utilized. The shale area referred to extends westward from Rifle, Colo., to a point near Colton, Utah, a distance of 125 miles. Between these limits the Book Cliffs and the Roan Cliffs rise 1000 to 3000 ft. above an uneven lowland on the south to the plateaus on the north. The bituminous shales underlie the plateaus and outcrop along their southern edges. In Colorado the oil-shale area includes probably 20 townships; in Utah the area may be greater, although most of the shale is too thin and too deeply covered by other formations to make it of economic importance.

The examination in Colorado was made in the territory contiguous to the town of DeBeque, which is on the Denver & Rio Grande R.R., in the south-central edge of the oil-shale zone. In this territory the shale beds are exposed along a range of hills that rise to the north above the river valley. The entire Colorado area is probably encircled by a belt of outcropping shale between the levels of the lowlands and the plateaus. This condition should greatly enhance the mining possibilities, as the beds could be developed through a system of adits. The shale beds of Scotland and France occur in such conditions that they can be worked only through pits and shafts, some of which are 600 ft. deep.

The Colorado bituminous shale occurs in the Green River formation, of Tertiary age, and is found in lenticular beds from a fraction of an inch to 80 ft. in thickness. At some places the beds are thick and fairly uniform in bitumen content, while at others they split into many thin members, some rich in bitumen and others containing only moderate quantities. The shale does not split or break easily but separates readily from the associated strata. This should prove an important factor in the development of the proposed new industry, since the bitumen-bearing shale can thus be readily freed from the poorer or worthless materials.

In Scotland the oil shale is mined by the pillar-and-stall method when the beds are more than 4 ft. thick, the pillars being left large enough to hold until the second working. Beds under 4 ft. in thickness are worked by the longwall system. The shale is blasted with gunpowder and then passed over a 1-in. grizzly, the undersize being left in the mines. The oversize shale is hoisted and passed through a toothed breaker, in which it is reduced to flat pieces about 6 in. square, as much as 600 tons being handled per day by a single crusher. From the crusher the shale is charged into retorts that are heated with gas made from dross coal in gas producers.

Prospecting for oil in the DeBeque district has proved that a large supply of natural gas exists at no great depth in that territory. Consequently, the fuel question connected with the development of the oil-shale industry may be easily solved.

The Scotch oil-shale area has an extreme length of 24 miles. The Colorado area is at least 50 miles long and 20 miles wide. The beds of Scotland are from 2½ to 16 ft. thick; those in France have an average thickness of about 4½ ft. The Colorado beds are known to be as much as 80 ft. thick in some places along the outcrops. The richer shales in the Scotch fields produce from 30 to 40 gal. of oil and from 25 to 35 lb. of ammonium sulphate per ton of shale, while about 18 gal. of oil and from 60 to 70 lb. ammonium sulphate are recovered from a ton of the poorer grades. French shales produce from 70 to 80 liters (18½ to 21 gal.) of oil and from 5 to 7 kg. (11 to 15½ lb.) of ammonium sulphate per metric ton (2204 lb.) of shale treated. The field tests made by the U. S. Geological Survey experts on the Colorado shales gave returns in bitumen content ranging from 10.4 to 61.2 gal., with an average of 30 gal. of oil per ton of shale. One test, made on shale from a bed less than 3 ft. thick, gave a return of 68 gal. of oil and 22½ lb. of ammonium sulphate per ton. From these results it seems probable that the Colorado shale, at the lowest estimate, should equal in value the Scotch and French shales from which petroleum has been manufactured for so many years.

The proper development of this prospective industry in Colorado must depend upon research, which should be conducted by scientific men for the purpose of ascertaining the most economic methods of mining and distillation. It is hoped that technologists will become interested in this question and will prove whether these great beds of shale can be turned to commercial importance under present conditions.

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German Chemical Industry and the War

Special Correspondence

Geheimrath Professor Dr. Otto Witt, in *Chemiker Zeitung,* after pointing out that the war has, generally speaking, seriously curtailed the output of chemical products, owing mainly to the absence at the front of experts who cannot be replaced and the embargo on exports, states that the manufacture of sulphuric acid in Germany is wholly based on the Spanish and Portuguese supply of pyrites, of which there is certainly a very large stock still in hand. As this must eventually come to an end, it will have to be replaced by the cupriferous Norwegian pyrites (copper content about 1.50%). There are also some German pyrites available, and in case of necessity the Hungarian and Steyer pyrites at a heavy cost in transport. Finally, there is the Sicilian sulphur, the freight on which would be only half that of pyrites. In Hamburg there are probably large stocks of Louisiana sulphur.

As regards the question of nitric-acid combinations fo explosives, it is pointed out that the import of Chilea nitrate, hitherto mostly used for manurial purposes, ha been stopped, though there must be a considerable stoc of the latter now available for nitric acid, the farmer being confined to the use of synthetic ammoniates. Synthetic nitrates might also take the place of Chilea nitrate as a raw material if their production can b increased sufficiently to cover consumption. Thanks t the practically inexhaustible reserves at Stassfurt, Germany is particularly favorably situated as regards th salt, soda and potash industries, and she really inflict great injury on her enemies by withholding the potas salts, which are so valuable as a manure. In Franc there are those who now have their eyes on the recentl discovered Alsatian limestone deposits, which only occu on the German side of the frontier. Geheimrath Wi cannot understand why, at the beginning of the wa people feared for a salt famine, when it is borne i mind that Germany is the richest salt country in th world. Certainly the price has risen considerably, an often in the retail shops one may not get more than kg. But this trouble, he thinks, has more to do wi the incidence of taxation on the suddenly increasin quantities (there is a consumption tax on table salt), trouble which will soon disappear. The recently deve oped electro-alkali-chloride industry will only be unfa orably affected by the war in the same measure as oth German industries by the scarcity of labor and increas cost of fuel. There will also be difficulty in placin the whole of the produced chlorine—a point in fav of applying a large portion of it to nitric-acid purpos The existence of the great Badische Analin und Soda F brik is a sufficient guarantee that Germany will win so far as the supply of synthetic ammonia (Haber's method) is concerned, and that, too, even if agriculture is forced, owing to lack of nitrates, to take the whole of its requirements in the form of ammonia salts.

Equally important to agriculture are the phosphates. There is really no danger of any shortness in this branch in Germany, though it is quite possible that materials other than those hitherto used will be resorted to. Less phosphate will be available from bone, which is so largely imported from abroad during normal times. Nor will there be the usual supply of phosphorite from Algiers, Florida, the Carolinas and the South Sea Islands after the present stock has been used up for manurial purposes. Probably one will be referred to the numerous small, less valuable and abandoned German phosphorite deposits, such, for instance, as are found in the valley of the Rhine. The Thomas slags, whose output will not be affected by the war, will also furnish material rich in phosphoric acid. The want of many metallic combinations will be much felt, especially salts of quicksilver, copper and nickel. A quantity of the two last-mentioned metals is produced in Norway, and which can perhaps benefit the German market. There are also nickel deposits both in Hungary and Italy, which, if of little consequence in normal times, may be of importance when there is no nickel to be had from New Caledonia, Canada and the United States. There will, likewise, be pinch as regards chrome preparations, the raw material oming, in ordinary times, from the Caucasus and Asia Minor.

French bauxite has hitherto been mostly in use as raw material for aluminum. It must now be replaced y raw material from Dalmatia, which, being of a somehat different componency, requires different treatment. ossibly as a last resort, German kaolins will be reorted to. As regards iodine preparations, so important uring war, the whole of the world's product is in the ands of a syndicate, which, naturally enough, is in a osition to meet a considerably increased demand. But ere, also, all depends upon the location of the syndiate reserves.

The brown-coal industry has a good time during the ar. There is an excellent demand for its benzenes, ils and paraffin. The imports of Caucasian and Ameri-n mineral oils have ceased, while those of Roumania nd Galicia can, with difficulty, meet the greatly in-reased demand. It is fortunate, however, that the alician and Roumanian products are available, as the rown-coal industry could not, alone, suffice. Nor are e meager German mineral-oil fields of any importance, xcept perhaps those of Jegernsee (Bavaria), which, it as formerly said, should be reserved for the event of ar. As regards distilled coal tars, the conditions are ry fortunate, as in that branch, with the aid of coke roduction, one is independent of the foreign article. here is absolutely no lack of benzol, which often re-aces benzine as a motor fuel. Less abundant are tol-l and xylol, as these ingredients are only found in nall quantities in coke tar. Toluol's nitro association, initrotoluol, is of importance in the manufacture of plosives.

Formerly phenol played a great part as an antiseptic war, but as such it is now almost obsolete; but the ice of carbolic acid has risen so considerably since the outbreak of the war that manufacturers have begun to consider seriously the synthetic production of phenol. It is for the production of the important explosive ingredient picric acid that phenol is used. Naphthalene is the richest product of tar, and there will, therefore, be no lack of supply here. With nitro association, it is an important article in the explosives industry. The consumption of naphthalene in the dye factories in normal times is so large that the quantity now at liberty, owing to the curtailment of the above-named industry, is alone more than sufficient to meet the requirements for the manufacture of explosives. Of anthracene (used only for colors) there will certainly be a superfluity during the war. So far as the tar-dye manufacture is concerned, one may count on a reduction of about one-half of the normal production. Germany is here better placed than her enemy countries, who will lack the colors hitherto obtained from her. This applies especially to England and France, whose textile industries have been dealt a heavy blow and must remain at a standstill and helpless until such times as they can again be put on their legs, which, owing to the very nature of the manufacture, cannot be effected in a hurry.

Inter alia, the professor is of the opinion that England's attempt to promote a home dye industry will prove a costly experiment. Knitted to the color industries are the synthetically produced healing applications. In this industry Germany is independent of outside supply, and the factories concerned will be fully employed during the war. In the domain of soaps, perfumes, etc., the cheaper kinds can be produced synthetically, while the others, hitherto dependent on natural raw material from abroad, can be supplied from natural home products. The large camphor consumption is no longer dependent on Japan (Formosa), as camphor can be produced from turpentine.

Finally, the professor mentions that the cyanide industry will certainly not be able to market its large output, of which the bulk would otherwise have been exported. On the other hand, he is consoled by the reflection that foreign consumers will be affected to a much greater extent. The South African gold fields, for instance, were quickly disturbed in their operations as soon as the cyanate-free sodium-cyanide supply from Germany ceased.

New Chart of Knik Arm, Alaska

A publication of interest at this time is a large scale (1:40,000) chart, No. 8557, of Knik Arm above Fire Island, at the head of Cook Inlet, Alaska. This chart is in preparation by the United States Coast and Geodetic Survey in anticipation of the greatly increased traffic to that locality due to the extensive railroad construction to be inaugurated by the Government Alaskan Engineering Commission this summer. The chart is on a sufficient scale to serve as a harbor chart for vessels with railroad supplies to be landed at Woodrow Creek, and includes all surveys to date, including the resurvey by the steamer "Explorer" in 1914. Woodrow Creek is the name now authorized for what was formerly called Ship Creek.

This chart will be ready toward the end of May, and copies may then be obtained at nominal cost from the superintendent of the Coast and Geodetic Survey, Department of Commerce, Washington, D. C., or at any of the branch offices or sales agencies of that service.

Details of Practical Mining

Azimuth Observations on Polaris by Daylight

Polaris may always be found in clear weather as soon as the sun has set, and frequently for 5 or 10 min. before sunset or after sunrise, according to Robert V. R. Reynolds in *Engineering News,* Apr. 22, 1915. It is stated on good authority that under favorable conditions an observation has been successful as late as 10 a.m. In the northern parts of the United States the cross-wires may remain visible for a long time after sunset.

For the novice it is often difficult at the first few attempts to see Polaris while the sky is still bright, but having once found the star, which appears as a small white dot in the field, he will never thereafter feel in doubt. Tabulated settings (such as accompany this article) sufficiently accurate to bring the star into the field are required, but there remain several factors which must be given consideration before success can be assured:

TABLE TO FIND POLARIS BY DAYLIGHT

Hour Angle of Polaris Approximate† (Use Suitable Interpolations)	Azimuth Setting N.E. or N.W. Depending upon Position of Polaris E. or W. of Meridian	Altitude Setting Latitude Plus or Minus the Tabulated Quantities		
0.0 or 12.0	00′	Add to latitude for hour angles less than 6.	1° 08′	Subtract from latitude for hour angles exceeding 6.
0.5 or 11.5	12′		1° 07′	
1.0 or 11.0	24′		1° 06′	
1.5 or 10.5	36′		1° 04′	
2.0 or 10.0	47′		1° 00′	
2.5 or 9.5	57′		55′	
3.0 or 9.0	1° 06′		50′	
3.5 or 8.5	1° 15′		43′	
4.0 or 8.0	1° 22′		35′	
4.5 or 7.5	1° 27′		27′	
5.0 or 7.0	1° 30′		18′	
5.5 or 6.5	1° 33′		09′	
6.0 hours	1° 35′		00′	

†The hour angle used as the argument in this table needs only to be approximate. If it is correct within 5 min of time, sufficiently accurate settings will be indicated provided interpolation is made. Hence, there is no need of correcting for longitude until the surveyor has made the observation and is preparing to enter the table of azimuths of Polaris.

The table is computed for a mean latitude of 42°, but purposely modified slightly to make it more useful along the 49th parallel, where much of the Forest Service work is being done. It is accurate enough to bring Polaris within the field of an ordinary transit between latitudes of 10° and 58° N. It is not for use to determine the true azimuth after the observations.

1. A slight haziness, which may hardly be obvious to the eye, is sufficient to conceal the star until darkness comes on.

2. The telescope must be in exact focus for celestial objects. This may be accomplished either by focusing at night upon the moon and making a slight scratch upon the objective slide to show the point to which it should be extended, or the surveyor may focus at the time of observation upon a well-defined object three or four miles distant, which focus will usually be found sufficiently close. Accurate focusing is one of the most important factors in finding the star.

3. For the purpose of cutting off objectionable light, the sunshade should always be attached. Certainty of finding the star is assured by throwing a coat or other dark cloth over the head when searching through the telescope, as a photographer uses a focusing cloth.

4. An approximate meridian must be had, from which the azimuth settings are turned off. Commonly, the surveyor will already have such a meridian from his backsight. Otherwise, a rough determination from a solar attachment in reasonable adjustment will suffice. Sometimes, when the magnetic declination is closely known, it will even be possible to turn upon the star from the needle. A reference meridian which is true within 5 or 10′ will be precise enough to locate the star when the table of approximate settings is used.

Polaris having been found, the angle from the reference mark to the star should be measured twice, the second time with the telescope inverted. The mean time of observation and the mean angle are then used to find the azimuth of the mark by the simplified hour-angle method. There is practically no chance that any other star will be seen and mistaken for Polaris.

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Inclined Shaft for Timber

By L. D. Davenport*

For a small mine on the Mesabi, where the overburden is shallow, the inclined timber shaft or timber slide seems to have several advantages over the usual vertical shaft. First, only one top man is required to send down timber instead of two; second, no rope, windlass or headframe needed; third, it makes an easy and safe entrance to t mine.

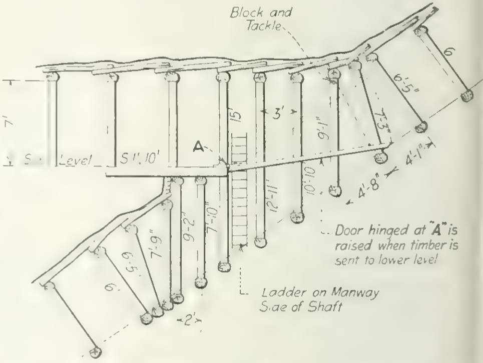

Fig. 1. Arrangement of Sets at Intersection o Incline and Sublevel

This description applies to the latest inclined timb shaft sunk by the Oliver Iron Mining Co., but there a a number of inclines in use at other mines in this di trict which are similar.

Fig. 1 shows the arrangement of the sets where the i cline intersects the top sublevel and Fig. 2 shows the tails of the timbering, the stairway and the timber sli A door made of double thickness of 2-in. plank defle the descending timber or lagging to the top sublev When it is desired to send timber to the lower level t door is raised by means of a block and tackle fastened one of the caps as shown. The free end of the rope is to the stairway side of the shaft, where it is pulled. A v tical ladder against the side of the shaft connects the s level and the stairway.

This shaft has a dip of 35° and is 110 ft. deep along slope. Timber travels down the slide faster than is n essary. In another mine the timber tends to hang up a 90-ft. incline which dips at 29°.

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*Assistant chief engineer, Oliver Iron Mining Co., Hibb District, Mesabi Range, Minn.

Fig. 3 shows the details of the headframe used in sinking the shaft. Two 9x16-in. by 28-ft. timbers supported by two bents of round timber carry the rails. The dump is made of 6x8-in. timber faced with 5/8x3-in. flat iron. The skip was made from a tramcar box with the end door removed and bail and wheels fitted to it. The rear wheels have a wide tread to pass the dump and the sides of the box are cut back as shown.

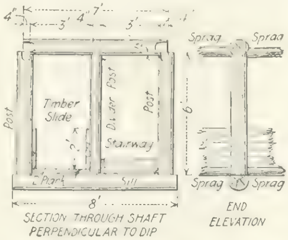

FIG. 2. DETAILS OF TIMBERING

The shaft was lined up by stakes on the surface at first and then from lines hung from spads in the caps. The proper grade was kept by means of a straightedge and a triangular template on a 35° angle, having a level set into it. The shaft was sunk through the overburden to the ore. To avoid hoisting any ore a raise was holed through from below and trimmed out; the timbering was then carried to the bottom. When the shaft was completed the headframe was removed and a small shed with three walls and a roof was built over the collar.

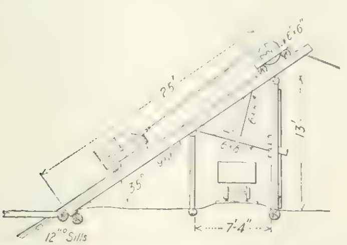

FIG. 3. HEADFRAME USED IN SINKING

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Locked Signal System

By H. H. Hodgkinson*

The signal system installed in the Palmer shaft of the New Jersey Zinc Co.'s mine at Franklin, N. J., by R. M. Catlin and designed by L. G. Rowand is unique and has many decided advantages over other signal devices. A signal box is located at each shaft station and is operated by a lever on the side, to which is attached a short chain and handle to facilitate pulling the lever. The cage, however, is moved only on signal given to the engineer by a man who carries a key to the device and who travels with the cage.

The signal boxes are situated at each station in such a position as to be easily accessible to the cage conductor and enable him to see his cage constantly, thus minimizing the danger of mishaps from the cage moving while men are getting on or off.

In operating, the pull and release of the lever ring the gongs in all other signal boxes, but do not ring the engineer. Thus it is always possible to signal for the cage from any station in the shaft and to notify anyone about to ring a signal from any other station that there is already a signal being rung, thus preventing confusion. As soon as the cage conductor receives a signal—provided there is nothing to prevent him from bringing the cage to the station from which the signal was rung—he inserts a special key in the lock on the front of the box and turns it, thus connecting the one signal box with the engineer's signal in the engine house. He then signals the engineer by means of the requisite number of pulls on the lever; this signal at the same time rings at each station, notifying the persons who rang the original signal that the cage is coming. The conductor remains at the signal box with his key in the lock waiting for the engineer to repeat his signal. If the engineer repeats correctly, the conductor removes his key, climbs on the cage and proceeds to the station signaling. If, however, the signal rung back by the engineer happens to be wrong, the conductor rings one bell to the engineer to stop and the exchange of signals is repeated. There is always ample time allowed the cage man to remove the key and climb on the cage.

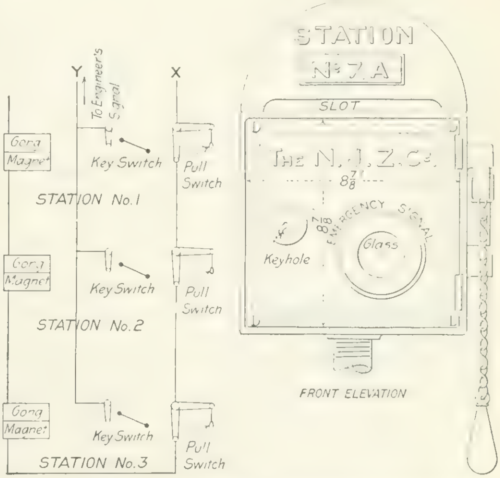

FIG. 1. DIAGRAM OF SYSTEM AND ELEVATION OF SIGNAL BOX

Fig. 1 is a diagram of the system. This consists of the two circuits *Y* and *X*. Through circuit *X* there is a constant current flowing which causes the electro-magnets to operate the clappers of the gongs in the signal boxes when the pull switch is thrown. It will be seen that this operation does not operate the engineer's signal. Through the circuit *Y* there is no current, and when the key switch is thrown the signal box is merely connected to the engineer's signal, which cannot ring until the pull switch is also thrown, causing the current to pass through circuit *Y* and operate the engineer's signal.

The signal boxes are constructed of cast iron as shown in Fig. 2. The front of the signal box is in the form of a door to permit repairs to be made inside. It is locked by means of the same key which operates the engineer's signal, in addition to being fastened by a screw at each corner. The doors are fitted on the inside with [illegible] round rubber gasket to prevent water from getting into the boxes. The locks are so constructed that it is impossible to remove the key and leave the key switch thrown and the signal box connected to the engineer's signal.

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*Mining engineer, Franklin Furnace, N. J.

On the door of the signal box an emergency signal device is placed so that the cage can be stopped immediately in case of an actual or threatened accident. This consists of a brass pin held in place by a round piece of window glass, which when broken permits the pin to be forced outward by means of a spring, making the same connection as the key switch would. The lever is then pulled once, which will bring the cage or skip to a stop if in motion.

The gong is placed on top of the signal box proper and over it is bolted a tightly fitting cast-iron cover, which prevents any water from working its way inside. The cover has a ½-in. slot on the front and sides to enable one to hear the gong more distinctly.

The lever *A* which operates the pull switch is situated on the outside of the box and has its movement confined to the space between the two lugs *L L* to prevent any injury to the switches inside.

The pull-switch lever *C* in the position shown permits the current to pass to the electro-magnet which holds the clapper up against the gong. When the lever *A* is pulled down, the lever *C* assumes the position shown by the dotted lines, which breaks the circuit *X*, causing the clapper to drop and at the same time closes the circuit *Y* when the key switch *K* is thrown, and thus rings the engineer's signal. Upon releasing the lever *A* it is returned to its normal position by the spring *S*, Fig. 3, the circuit *X* is closed again, causing the clapper to strike the gong, and the circuit *Y* is broken as before.

The spring *S* is fastened to the short lever *B*, which operates the shafting *E*, to which the lever *A* and the switch lever *C* are attached.

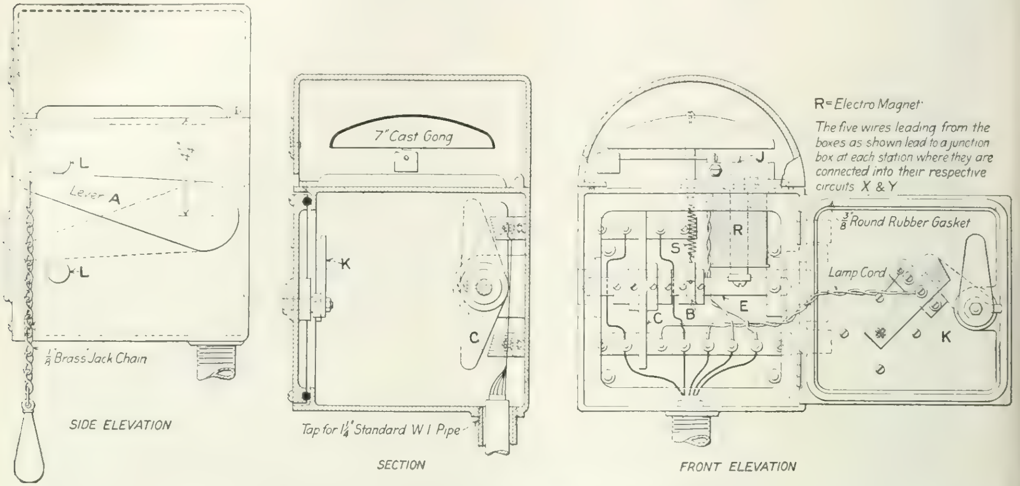
L
Lever A
L
⅛" Brass Jack Chain
SIDE ELEVATION
7" Cast Gong
K
C
Tap for 1¼" Standard W I Pipe
SECTION
R = Electro Magnet
The five wires leading from the boxes as shown lead to a junction box at each station where they are connected into their respective circuits X & Y
J
R
S
⅜" Round Rubber Gasket
Lamp Cord
E
C
B
K
FRONT ELEVATION

FIG. 2. SIDE ELEVATION AND INTERIOR OF SIGNAL BOX

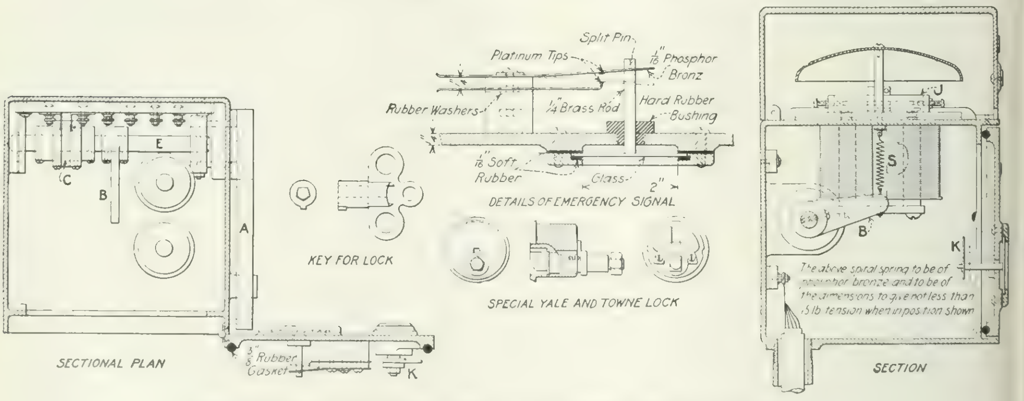
E
C
B
A
SECTIONAL PLAN
⅜" Rubber Gasket
K
KEY FOR LOCK
Split Pin
Platinum Tips
1/16" Phosphor Bronz
Rubber Washers
¼" Brass Rod
Hard Rubber Bushing
1/16" Soft Rubber
Glass
2"
DETAILS OF EMERGENCY SIGNAL
SPECIAL YALE AND TOWNE LOCK
J
S
B
K
The above spiral spring to be of phosphor bronze and to be of the dimensions to give not less than 5 lb tension when in position shown
SECTION

FIG. 3. DETAILS OF SIGNAL BOX AND SAFETY LOCK CONNECTIONS

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The Rivers of the United States Carry to Tidewater Every Year 270,000,000 tons of dissolved matter and 513,000,000 tons of suspended matter, according to the U. S. Geological Survey. This total of 783,000,000 tons represents more than 350,000,000 cu.yd. of rocks, or 610,000,000 cu.yd. of surface soil.

Details of Milling and Smelting

Allaying Dust on Tailings Dumps

An investigation looking toward the prevention of flying dust from tailings piles has been under way at several of the Rand properties[1]. The necessity for a remedy of this condition has been accentuated of late years by the finer grinding now being done in tube mills. The wind, carrying the loose, dry particles from the dump, produces a condition annoying to workmen and destructive to machinery. Experiments have been made using a solution of molasses; silicate of soda, in the form of slag; lime grouting, and many other possible mediums; but no great success has been obtained. An emulsion of black clay and water was then tried, which gave a successful result. The emulsion was made up in a mixing machine, and pumped through a plunger pump to a sprayer, which distributed the emulsion on the dump. The ratio of solids to water was about 5:1. This covering has proved effective for 16 months, during which time it has been subjected to the test of high winds and heavy rains. The dump treated was at the East Rand Proprietary Mines.

⁂

Rules for Cranemen*

Personal caution is the greatest safeguard, after all. The careless craneman, although provided with the best facilities for safe handling of materials, may by his carelessness thwart the most careful plans of the management for the safety of its employees. Similarly, the craneman who is well meaning but not thoroughly familiar with the cause and effect of right and wrong applications of the crane mechanism may blunder into a most disastrous accident. It is therefore imperative that cranemen should be thoroughly impressed with safe ways of handling the cranes under their charge.

Traveling cranes which are operated from a cage attached to the crane bridge are liable to cause more frequent and more serious injuries than other types because the former usually carry heavy loads at considerable speed over great areas of floor upon which employees are engaged in work. Most cage-operated cranes are electrically driven. The rules suggested below, therefore, are especially designed for electrically driven, cage-operated traveling cranes.

Satisfactory crane rules are in effect in many plants, yet they differ in language and in details. A number of these have been gathered and studied, while close observation of crane hazards in all kinds of plants has suggested others.

Not all of these rules, however, are applicable to every cage-operated, electrically driven crane in every plant, because of the great variety of such cranes in service and the many different conditions under which they must operate. These rules, if not adopted in their entirety, may nevertheless be used as a foundation upon which a set of rules may be formulated for each plant to suit local conditions; they may even suggest rules for operation of other types of cranes as well.

It is recommended that the rules be printed and copies posted conspicuously in each operator's crane cage and placed in the hands of all cranemen. When once adopted, the rules should be rigidly enforced.

GENERAL RULES FOR CRANEMEN

(1) Cranes must be operated only by regular crane operators, authorized substitutes, crane repairmen or inspectors; no one else should enter crane cage.

(2) Access to and exit from the crane cage should always be by stationary ladders, stairways or platforms provided for the purpose. Cranemen must keep their hands free when going up and down ladders.

(3) Articles which are too large to go into cranemen's pockets or belts should be lifted to or lowered from crane by hand line kept in cage for such use.

(4) Cages should be kept free of clothing and other personal belongings. Tools, extra fuses, oil cans, waste and other articles necessary in the crane cage should be stored in a tool box, and not left loose on or about crane.

(5) A pail filled with sand should be carried in the crane cage for use in case of fire.

RULES FOR CRANE OPERATORS

(6) Operator should familiarize himself fully with all crane rules and with the crane mechanism and its proper care. He must not tamper with any mechanical or electrical adjustment, but if adjustments are necessary, he should report the same at once to foreman or repairman.

(7) Operator must not eat, smoke or read while on duty, nor operate crane when he is in poor physical condition.

(8) Operator must be constantly alert in watching crane and floor operations, and workmen under or near the load.

(9) Operator or some one specially designated by the foreman must daily oil all working parts of crane, including sheave blocks, fill empty grease cups, turn down others and make sure that oil passages are not clogged. Hoist chains and cables must be lubricated regularly as directed by foreman.

(10) Operator must examine crane daily for loose parts or defects and report same immediately to foreman or repairman.

(11) Operator must clean crane weekly or oftener if necessary.

(12) Operator must test foot brake and limit switch at beginning of each working period.

(13) Operator must avoid, as far as possible, carrying loads over workmen; it must be absolutely avoided when carrying molten metal.

(14) Operator must lift loads only high enough to clear safely all men and obstacles upon the floor.

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[1] "Journ. Chem. Met. and Min. Soc. S. A.," February, 1915.

*"N. F. A. Safety Bulletin," Aug. 1, 1914.

(15) Whenever loads are to be carried over a long distance to a high position, they should be carried as close to floor as feasible until final location is reached; load should then be lifted to desired height.

(16) Operator must never go or allow any one else to go on crane bridge without first opening main switch; if crane is provided with an emergency switch, that also must be opened. Preferably, switch must be locked open, or warning sign placed and kept upon it, while any person remains on the bridge.

(17) Whenever operator finds main or emergency switch open, he must not close it, even when starting on regular duty, until he has made sure that no one is on or about the bridge or runway.

(18) Before closing main switch, operator must make sure that all controllers are in OFF position.

(19) Operator must move controllers slowly from point to point to increase speed of motors gradually, and must restrict speed until slack in chain or cable has been taken up.

(20) In case of electrical short circuit or if a controller should stick, operator must immediately throw all controllers, except the one that sticks, into OFF position, then open main switch with a rapid motion and notify foreman or repairman.

(21) If power goes off, operator must immediately throw all controllers to OFF position until power is again available.

(22) Operator must not run more than two motors at one time; when handling molten metal it is advisable to run only one motor at a time.

(23) Operator must not reverse a motor until it has come to a full stop, except to avoid accidents.

(24) Operator must pay special attention to the block when long hitches are made, to avoid tripping limit switch or running block upon the drum. When it is necessary to hoist beyond limit switch, operator must first secure foreman's approval.

(25) Operator must not lift or suspend a load when there are less than two full wraps of cable or chain upon the drum.

(26) Operator must recognize signals only from the one man who is supervising the lift. Operating signals should follow an approved standard; they should be manual, never verbal. Whistle signals may be used where one crane only is in operation.

(27) Before starting to hoist, operator must place trolley directly over load to avoid swinging it when being hoisted. This precaution is especially important when handling molten metal.

(28) Operator must not make side pulls with crane except when especially instructed by foremen.

(29) Except on order of foreman, operator must not lift load when operation of controller shows that load is excessively heavy.

(30) When handling maximum loads, particularly ladles of molten metal, operator must test hoist brakes after load has been lifted a few inches; if brakes do not hold, load should be lowered at once and the brakes adjusted or repaired.

(31) If hoist brakes refuse to hold while crane is handling molten metal, it may be necessary, in order not to interrupt the pouring operation, to sustain load by short upward movements of hoist, to counteract settling of load.

(32) Bumping into runway stops or other cranes must be avoided. When operator is ordered to engage with or push other cranes, he must do so with special care for safety of persons and cranes.

(33) When two or more cranes are used in combination to lift one load, the several operators must be careful to lift load evenly.

(34) When lowering a load, operator must proceed carefully and make sure that he has load under safe control at all times.

(35) When leaving cage, operator must throw all controllers to OFF position and open main switch.

(36) If crane is located outdoors, operator must also lock crane in secure position to prevent it from being blown off or along the track by severe wind.

(37) In all doubtful cases operator should consult foreman or inspector.

Rules for Floormen

(38) Floorman shall give all signals to the operator in accordance with approved standards.

(39) Floorman shall be responsible for the condition and selection of all hoisting accessories and for all hitches.

(40) Before operator moves crane upon which empty chain slings are hanging, floorman must hook both ends of slings to block.

(41) Floorman shall whenever possible walk ahead of moving load and warn people to keep clear of it. He shall see to it that load is carried high enough to clear all obstructions.

(42) Floorman must notify the foreman in advance when an extra-heavy load is to be handled.

(43) Floorman should not himself ride or allow others to ride on hook or load except upon authority of foreman.

Rules for Repairmen

(44) Repairman should have crane that is to be repaired run to a location where the repair work will least interfere with other cranes and with operations on floor

(45) Before starting repairs, repairman must see that all controllers are thrown to OFF position, that mai switch and emergency switch are opened and that, excep for short time repairs, all fuses are removed.

(46) Repairman should immediately place red flag or OUT OF ORDER signs on crane to be repaired an approved warning signs on floor beneath. Wher feasible, space under crane should be roped off. If othe cranes are operated on the same runway, he must als place rail stops at a safe distance.

(47) Before removing any part which may releas hoist block, repairman must run block to floor, or i this is not possible, he must wedge the gearing to preve drum from unwinding.

(48) When repairing runways, repairman shoul place rail stops and red flags at both ends of section t be repaired.

(49) Repairman must take care to prevent loo parts from falling or being thrown upon floor beneath.

(50) Upon completion of repairs, craneman mu remove all blocking and all loose parts, bolts and tool and put the crane in operating condition. He mu then remove rail stops, red flags and warning signs an turn the crane over to operator.

Personal caution is the greatest safeguard, after all.

Company Reports

Hollinger

For 1914 the Hollinger Gold Mines, Timmins, Ont., reports a profit of $1,611,058, after deducting $165,621 for depreciation. Dividend payments amounted to $1,170,000, making a total of $2,610,000 paid to date in dividends from 393,422 tons of ore yielding $6,134,339, or an average of about $15.30 per ton. Of the profits reported for 1914, apparently $312,302 was spent on plant and development and added to capital accounts. The capacity of the mill is being increased from 500 to 1600 tons a day. During the year 208,936 tons of Hollinger ore were treated, averaging $13.67 per ton. The total cost as reported follows:

	Per Ton Ore Milled
General charges	$0.197
Administration and management	.243
Taxes	.209
Insurance	.096
Clearing surface, roads, etc.	.032
Operating camp	.128
Operating boarding house	.048
Exploration	.056
Development	.403
Ore production	1.646
Milling operations	1.184
Mill alterations	.035
Alterations to plant	.019
Marketing bullion	.059
Fire protection	.021
Prospecting	.002
Loyal-service bonus	.043
	$4.421
Depreciation of plant	.792
Total cost	$5.213

Development work totaled 10,622 ft. and there was 2200 ft. of trenching done. Of the ore hoisted, 78.2% came from stopes and 21.8% from development. Ore reserves are estimated to contain 1,162,960 tons of ore, averaging $11.49 per ton. A diamond-drill hole was put down 2000 ft. on the incline, or 1425 ft. vertical, and it has shown that there is no change in rock formation or vein characteristics to a depth of 1425 ft. It is stated that as a result of drilling it may be anticipated with considerable assurance that operations will continue to a depth of 1500 ft., with strong possibilities of greater depth. A bonus system has been adopted which gives a bonus of 15c. a day after one year's service, 30c. a day after two years' and 45c. a day after four years' service. The vital parts of the works have been fitted with automatic sprinklers for protection against fire at a cost of $51,955. Additions to the mill will require extra expenditure for fire protection.

A summary of the accident and sickness report of the hospital shows that there were nine cases of typhoid, four of rheumatism, four of la grippe, two of stomach and intestines and six of throat and lungs. Of accidents there were 106 minor accidents entailing a loss of time and one fatal accident, which occurred while the victim was riding a cage. The greatest number of minor accidents from a single cause was 11, from falling rock; 11 were injured drawing ore from chutes and 10 slipped and fell while walking, seven were hurt handling cars, five caught between cars and chutes, while only one was injured from drilling into a missed hole. One accident is noted where a mill hand was disabled for five days on account of scalding his arm while washing his hands. Another occurred to a laborer from carrying his knife open in his pocket. The longest period of disability was nine months, from a broken leg, and the next longest eight months, from a broken arm. Only 34 of these accidents would have come under the new Workmen's Compensation Act which is now in effect.

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Portland

The Portland Gold Mining Co., Cripple Creek, Colo., reports a profit of $590,594 from 273,129 tons of ore during 1914. Dividends amounting to $360,000 were paid. The total production of the Portland from April 1, 1894, to Dec. 31, 1914, was 2,040,721 tons, having a gross value of $38,274,952. From this dividends amounting to $9,817,080 have been paid. Balance of quick assets amount to about $750,000, which added to the dividends would make a total profit of about $10,567,000. This would indicate a total cost of $27,707,000, or about $13.60 as an average cost per ton of ore to date. According to figures given the average grade of ore to date is $18.70 per ton.

During the year 15,592 ft. of development work was performed, making a total of 272,779 ft. to date, or about one foot for every 7.5 tons of ore produced. The cost of development per foot during 1914 was: Drifts, $6.62 per ft.; crosscuts, $6.99; raises and winzes, $7.77; 183 ft. of shaft sinking, $62.83; and 155 ft. of shaft sinking, $50.78 per ft. The cost of shaft sinking includes all timbers, guides, wiring, piping, chairs, and everything ready for use. A statement of mining costs as given in the report follows:

STOPING

	Per Ton		Per Ton
Breaking ore –		Assaying and sampling	$0.033
Labor	$0.361	Surveying	.015
Explosives	.177	Repairs, etc	.200
Machine drills	.119	General expense	.109
Tramming	.189	Office expense	.019
Timbering—			
Labor	.214	Stoping ...278,993 tons	$1.905
Timber	.128	Development 55,820 tons	2.352
Hoisting	.161		
Sorting and loading	.160	Total ...*334,813 tons	$1.98
Lighting	.020	*Crude ore	

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Bingham Mines Co.

The Bingham Mines Co., Salt Lake City, Utah, reports earnings of $172,530 for 1914. Of this $60,280 came from the earnings of the Dalton & Lark and Commercial mines of Bingham, Utah, and $104,250 from dividends received from the stock of the Eagle & Blue Bell, of Tintic, Utah, owned by the company. The operating statement of the Dalton & Lark and Commercial properties shows a production of 19,780 dry tons of ore, having a gross value of $291,787, from which $80,490 was deducted by the smelters for freight, sampling, assaying and smelting. The net smelters' returns were $211,[illegible]. The metal contents of the ore were: 3613 oz. of gold, 188,905 oz. of silver, 3,738,773 lb. of lead and 1,110,762 lb. of copper. The company now has outstanding $587,000 of first-mortgage 6% convertible bonds.

Crown Reserve Mining Co.

The Crown Reserve Mining Co., Cobalt, Ont., for 1914 shows a gross ore production of $740,092. The operating expenses were: Mining, development and depreciation, $286,757; Dominion Reduction Mill charge, $131,619; smelting charges and deductions, $17,219; bonus to employees, $13,212; royalty to Ontario Government, $51,808—total, $500,615, leaving a profit of $239,477 from the mine. In addition to the operating profit the company received $144,000 in dividends from its holdings in the Porcupine-Crown mines and $3832 in interest, making total profits for the year $387,309. There were other expenditures, for legal expenses and development of outside properties, amounting to $35,698, so that the net income for the year was $351,611. Dividends aggregated $424,515. Dividends to date amount to $5,996,279, and the company has paid the Ontario Government $861,834 in royalties.

There were 1,426,320 oz. of silver produced from 287.75 tons of high-grade ore and 31,347 tons of mill ore. There were 40,842 tons broken in the mine and 4056 ft. of development work performed. The following table shows the cost per ounce of silver as reported:

	Cents
Mining and development	8 70
Power, heat and light	1.90
Maintenance of plant	1 40
Ore handling	1 96
Mine, general expense	2 02
Superintendence	0 75
Smelter charges	1.27
Milling charges	9 00
Depreciation, head office, traveling	1.95
Total mine cost per ounce	28 95

The average price received for silver was 51.92c. per ounce. The high-grade ore averaged $3474 per ton and mill ore, $15. Mine bullion averaged 0.971 fine and mill bullion, 0.956 fine. The total production of the Crown-Reserve to date is 18,429,141 oz. at an average cost of 13,675c. The price received was 54.57c. per oz.

Daly-Judge

The Daly-Judge Mining Co., Park City, Utah, reports a profit of $127,803 for 1914 and dividend payments of $180,000, thereby reducing its cash balance $52,197. The following table gives details of production and selling price of the ore after deducting freights, smelting charges, losses, etc.:

FOR 1914

	Tons	Ag Oz.	Au Oz.	Pb %	Cu %	Zn %	Fe %	Sold for
Crude ore	5,606	29.65	0.027	19.29	1.51	12.37	7.10	$21.35
Concentrates	12,153	24.01	0.04	29.19	0.87	11.66	18.02	25.18
Zinc middlings	1,112	13.24	0.018	2.93	...	42.85	7.77	17.36

The ore statement shows that there was 51,701 tons of crude ore extracted from the mine, of which 5606 tons was shipped direct to the smelters and 19,095 tons was concentrated. The cost of extracting the ore from the mine was $3.067 per ton. Concentration costs were $0.763 per ton of ore concentrated. General expenses were 44.8c. per ton of ore extracted. Marketing expense amounted to $1.121 per ton on 22,201 tons marketed. The total operating cost reported was $4.656 per ton extracted; but in addition to this cost there were expenditures for prospecting, exploration and dead work amounting to $121,946; surveying and engineering, $2160; royalties, $14,646; and drainage, $12,000—a total of $150,752, or $2.74 per ton of crude ore. Adding these costs the total cost would be $7.39 per ton, not including freight, smelter charges and deductions. The ratio of concentration was 4:1 of lead concentrates and 3:1 of all products combined. The mill treated an average of 361 tons a day. Experiments are being conducted in oil flotation for the ores, and the results secured justify further effort. A high saving of the metals has been made with the process, but as yet a satisfactory separation of the concentrates into desirable lead-silver and zinc products has not been obtained.

Porcupine-Crown Mines

The report of the Porcupine-Crown mines, Porcupine, Ont., for 1914 shows a bullion production of $691,394. Expenditures for mining, milling, taxes, depreciation, etc., amounted to $341,092; development and exploration, $42,984; mint charges, $2243; bonus to employees, $5855—total, $392,174. Profit from the mine was $299,120 and interests and sundries made total profits $301,451 for the year. Dividends Nos. 1 to 4 inclusive aggregated $240,000. There were 65,198 tons of ore broken, of which 40,857 tons were milled and 24,341 tons left in the stopes. The average value of mill heads was $17.18, and tails averaged 47c., making an extraction of 97.26%. The mine also produced 11,554 tons of waste, and 4633 ft. of development work was performed. The following table gives the cost per ton of ore milled as reported:

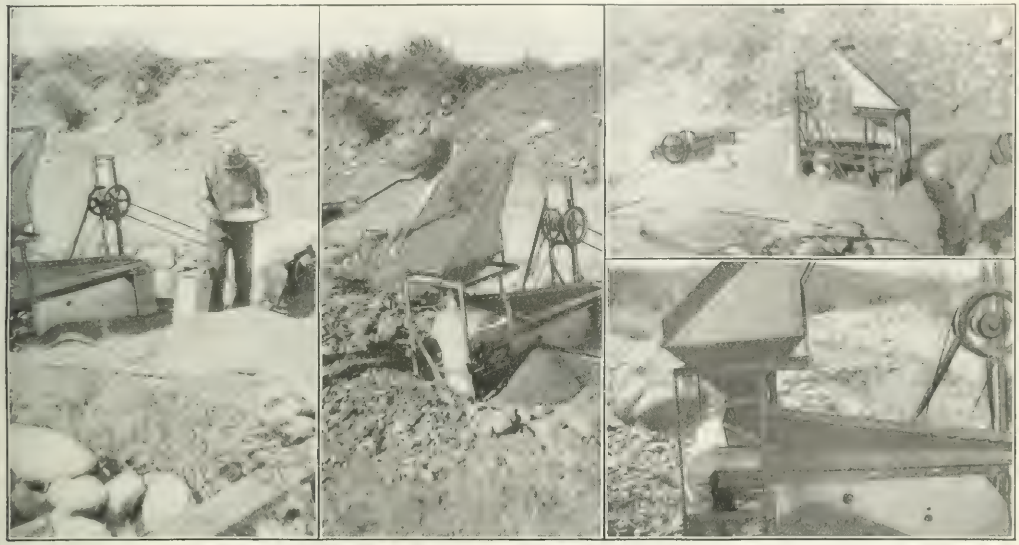
Mining, development, and explorations	$3.20
Hoisting and tramming	.39
Mill operation	1.31
Power, heat and maintenance	1.51
Mine, general expense	1.12
Depreciation, administration and taxes	.76
Total	$8 29
Less 24,341 tons ore broken and not milled	1.20
Cost per ton of ore milled	$7.09

Ore reserves are estimated to contain 85,000 tons of ore valued at $1,510,000. It is estimated that 40,000 tons containing $297,000 were added during the year.

Quincy

The Quincy Mining Co., Hancock, Mich., for 1914 reports a profit of $205,593 from 15,356,380 lb. of refined copper. The total receipts were $2,063,650, of which $12,630 came from the sale of silver and $9028 from interest receipts and the sale of real estate. The total expenses were $1,858,057, made up of $1,372,436 for mining, $132,776 for opening mine, $64,998 for Michigan taxes, $167,696 for smelting, transportation, etc.; $29,787 for strike expense, $76,662 for construction and betterments, and $13,702 for accident account. The total cost of producing copper was 12.1c. per lb. After paying dividends amounting to $55,000, a balance of $897,531 remained on hand at the end of 1914. Dividends paid to date amounted to $20,897,500. The company did not operate at a profit during the first six months owing to the strike, cost of repairs from air blasts, etc. No new construction work was undertaken during the year that could prudently be deferred until a more favorable time. In carrying out the Safety-First movement a physical examination by the medical staff is required before accepting an applicant for a position with the company.

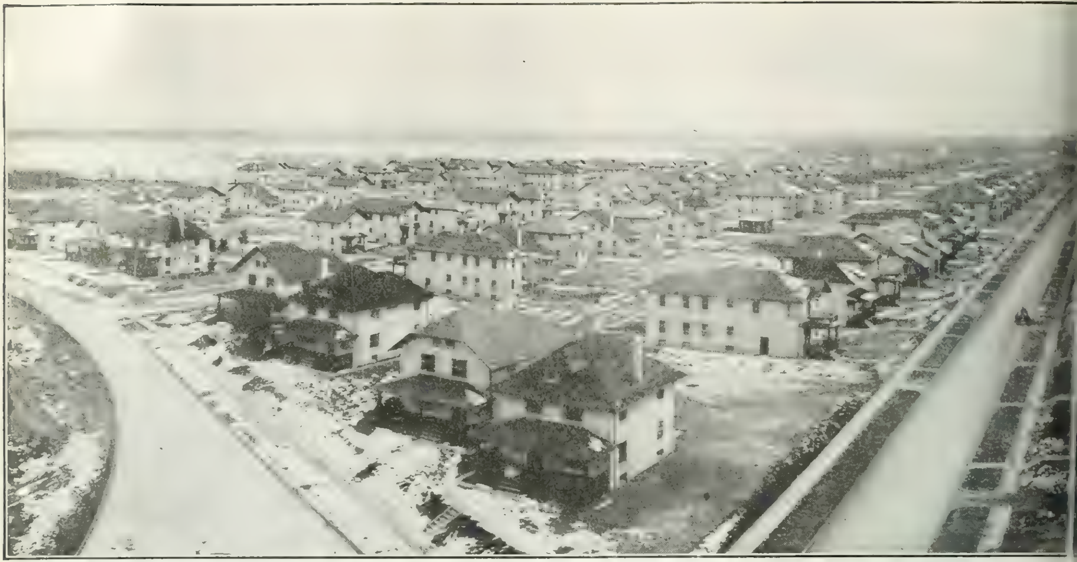
Photographs from the Field



A One-Man Dry-Placer Operation

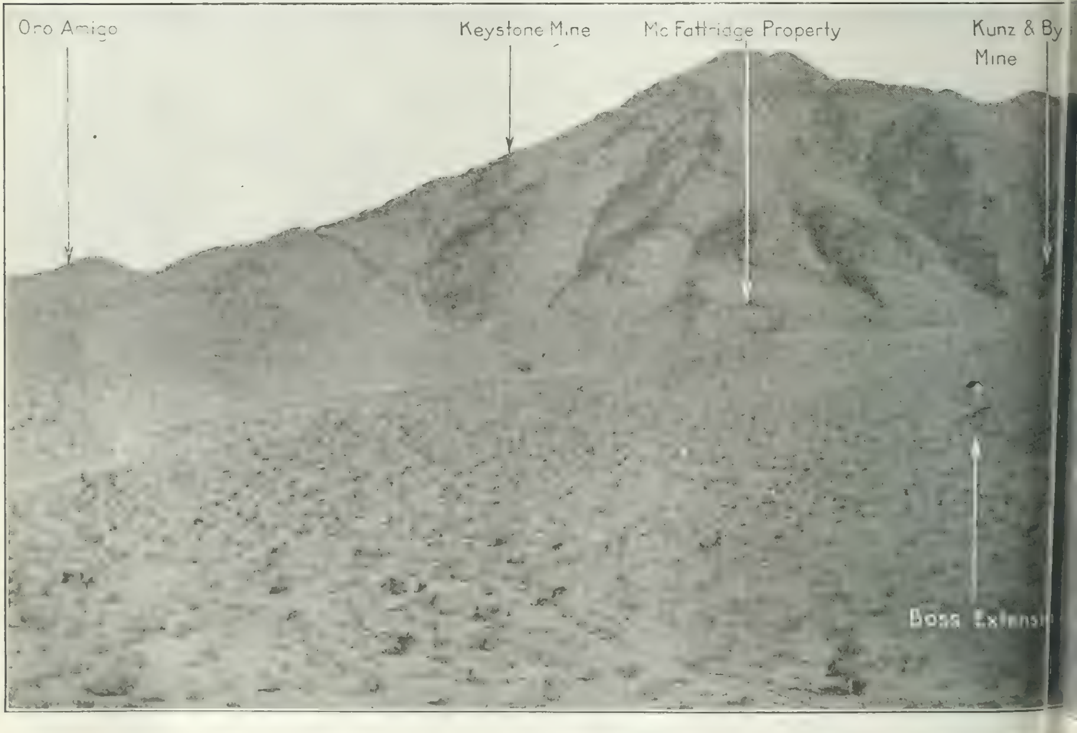
A machine made by A. H. Stebbins, of Los Angeles, with which the prospector can recover gold in the desert country

The New Commonwealth Mill at Pearce, Ariz.



Morgan Park, the Steel Corporation's Model City at the

About 170 houses have been completed, involving about $1,000,000. All are of steel and concrete construction,

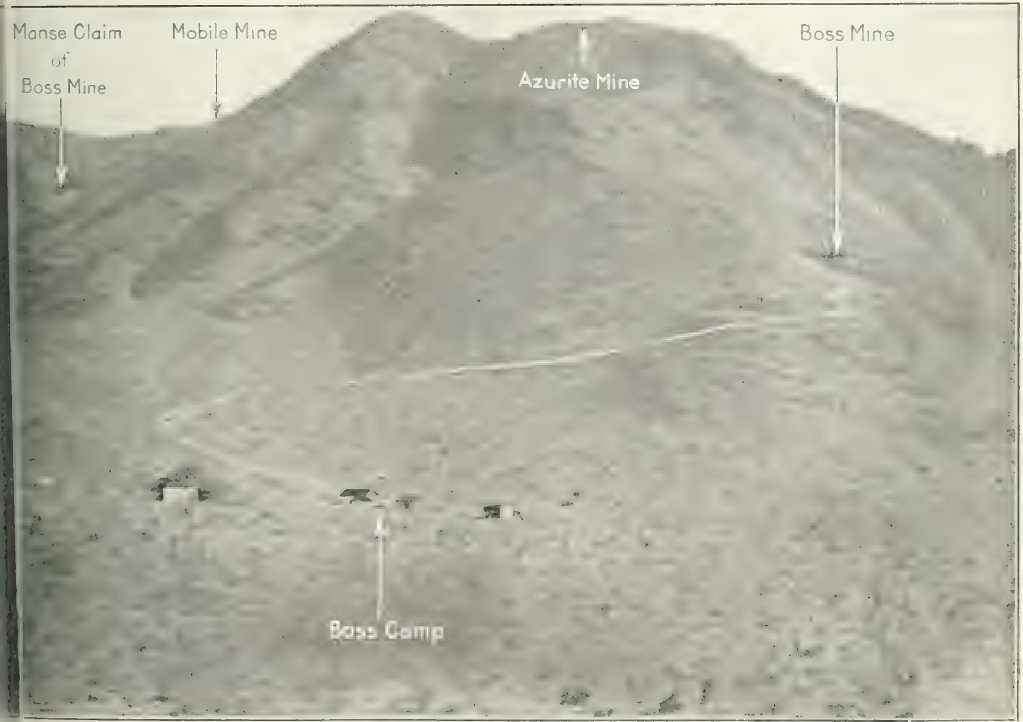


Vicinity of the Boss Mine, Near Goodspri

Scene of the recent important platinum discove

T of the Minnesota Steel Co., Near Duluth, Minn.

eproof. The company plans the construction of an elaborate office building in the near future



LW Pine Mining District, Nevada

s mine produces a gold-platinum ore

Notes on the Zinc Industry in Europe

According to German papers, the Zinkhüttenvereinigung, G.m.b.H., has now been formally organized. Its managers are Herr Schaltenbrand, of Michalkowitz; Geh. Bergrat Dr. Weidtmann, of Aachen, and Director Herkendell, of Köln-Lindenthal. The corporation intends to regulate the production, stocks and price of spelter.

At a recent meeting of the Zinkhüttenvereinigung the price of zinc was raised five marks per 100 kg. The average price in 1914 was 46.03 marks, compared to 45.55 in 1913 and 53.75 in 1912. The present price in Germany is considerably higher than in normal times. This is attributed in part to the increased cost of production owing to the war, many of the zinc miners and smelters being with the colors, while the supply of foreign ore is restricted. On the other hand, there is an increased consumption of spelter in substitution for copper and other metals of which there is a shortage.

The Vieille Montagne smeltery at Angleur, Belgium, is being operated in a small way. According to recent news in German papers, its production is being increased.

[The opinion is expressed in well-informed quarters here that when the war ends the huge stock of spelter that existed in Europe in the middle of 1914 will have been exhausted.

English zinc smelters are increasing their production. England is also obtaining spelter from the smeltery at Budel, in Holland. The production of Trollhättan, Sweden, and Sarpsborg and Ilen, Norway, is supposed to be going to Germany. The smeltery at Mortagne, France, is idle. St. Amand also is probably idle, being within the zone of German occupation. The Malfidano plant at Noyelle-Godault and the Vieille Montagne plant at Viviez presumably are being operated. However, France is manifestly short of spelter, inasmuch as she is a buyer abroad.—Editor.]

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Iron-Mining Situation in North China

Special Correspondence

The mining situation in the Republic of North China is an interesting one and throws some light on a present diplomatic problem of much importance to this country. In the past there has been a lot of superstition about mining, and therefore the immense mineral resources of the country have scarcely been touched. This condition was fostered a great deal by the late Ching dynasty of the Manchus. The Manchus were in a minority, probably in the ratio of about 1 to 70, and they considered it wise not to encourage mining, as it would tend to bring in foreigners and foreign ideas, which would eventually weaken the Manchu power. This dynasty has now fallen and a new and better order exists. Mining in general seems to be coming to the front and, in some ways, is being made more attractive to foreigners.

There is great need for a native-made iron for use in local manufacturing industries. There are large deposits of iron ore not very far from excellent coal fields, and the combination should make an attractive inducement to progressive capitalists. The most extensively developed field is that near the junction of the Yangtze and Han rivers at Hankow and Hanyang. The Japanese have invested a great deal of capital there, and depend largely on this district for their own supply of iron.

Since the European war began a different complexion has been put on the iron-mining situation, which is causing some concern here. Since Tsingtao has been occupied by the Japanese they have become bold and have made many serious demands on China. One of these is that the great iron works centered at Hanyang be practicall handed over to Japan, together with extensive mining concessions. The Chinese Government is taking steps to control all the iron mining of the country, both as a safeguard to prevent the mines being lost to the Chinese and as a precaution to secure their proper exploitation. There are other localities where considerable work has been done in the way of development of iron ore deposits, but while very promising, they have not been on such an extensive scale as around Hanyang.

Last fall, before the effect of the European war became such a factor, the writer was interested in planning some industries for some Chinese which required much iron. In order to make them successful it was necessary to obtain iron of good quality at lower prices than prevailed for imported iron. The present situation, however, makes it necessary to postpone work on these projects. Everything goes that way in China as yet, but facilities have been continually improving under the republic. This field offers wonderful opportunities, and it is a pity that American interests do not send technical experts to investigate the iron situation in China. It will take both money and patience to make this investigation, but the ultimate results would easily compensate for the effort.

Every year there are more and more Chinese students returning from foreign countries, where they have been securing their education, and there is a natural tendency to put them in all of the important positions which are available, often advancing them beyond their real capabilities. There is now quite a waiting list. Foreigners have no right to complain about this, however, but shoul expect it. These young men should make a very valuabl nucleus for a staff, not only on account of their Occidenta education, but because they are natives and couple witl the outside viewpoint a thorough and comprehendin knowledge of the local custom, viewpoints and conditions

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Legal Cause of Accident

By A. L. H. Street*

Although an ore car at a mine jumped the track o account of defects in it and the track, the mining compan is not liable for injury sustained by an employe in assist ing in replacing the car, through carelessness of a c employee, since such carelessness, and not the defect must be deemed to have been the direct cause of the acc dent. In deciding this point in the case of Sabela vs. New port Mining Co., 151 *Northwestern Reporter* 559, tl Michigan Supreme Court qualifies its decision by holdin that, if the co-employee had been habitually incompeten and the company was chargeable with notice of the fac liability against the company could be predicated on it negligence in retaining an employee whose service in periled other workmen.

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*Attorney, St. Paul, Minn.

Correspondence and Discussion

Alcohol and Inefficiency

Analyzing the accident figures quoted in the JOURNAL'S anti-booze editorial of Mar. 6, 1915, it looks as though the average number of accidents at the Anaconda Copper Mining Co. per month is 7.78 per 10,000 shifts; but you state that the September record was 4.21, with the saloons closed half of the month. Then the saving in averages was 3.57, or 44.5 per cent.

The labor unions might preserve their members by a campaign of education, if such figures are an index of general practice. Then, too, the general managers might save some of the stockholders' money which now goes to the hospital by imitating the Czar of Russia in respect to anything interfering with industrial efficiency (which is a kind of war itself).

Berton Braley has put the emotional alongside the efficiency argument. His poem deserves a frame and a place near the Safety-First symbols.

EFFICIENCY SEEKER.

San Francisco, Calif., Apr. 20, 1915.

Fond du Lac Silver Strike

There appeared in the JOURNAL of Apr. 3, 1915, a brief statement that native silver, in quantities to rival Cobalt, had been found at Fond du Lac on Lake Athabasca.

For the past week I have been trying out here to obtain definite confirmation of this, and have been unable to do so. I thought I had better let you know, so that if you wished to mention it you would have the facts as far as they go. A rush into this district would be ill advised, as it is a barren and inhospitable land, and the trip in would, to many who were not sufficiently financed, entail great hardships, and would probably result in death to some.

There is a stretch of 90 miles on the Athabasca River that is dangerous, and which should only be undertaken in large boats with experienced guides. Lake Athabasca is also dangerous for canoes.

However, with regard to the discovery the facts are as follows: Last August two men, Devlin and Dardier, went to Fond du Lac on the east end of Lake Athabasca and in October staked 22 claims. They returned to Athabasca Landing and Edmonton in January.

The claims were staked in a section that for some years had been known to contain a considerable showing of pyrrhotite, which is supposed to carry nickel. Some of these claims were staked over other claims that had been allowed to lapse.

Dardier, who represents English interests (his father is director of foreign affairs for Vickers, Ltd.), brought out with him 100 lb. of samples, which he took to England. He spoke about the possibilities for nickel, and I believe his claims were recorded for that mineral. At any rate, I have been unable to find anyone who has heard him say anything about there being native silver in the district, and no recording was made for native silver.

Devlin is a British Columbia prospector who does not command much respect. On his arrival at Athabasca Landing he gave away several small pieces of native silver, which he said came from Fond du Lac. One of these pieces was sent to be assayed and gave a return of 21,168 oz. per ton. I saw two of the other samples. They were small, about the size of a small bean, and were practically pure native silver. They certainly looked to me as if they came from Cobalt.

I was unable to see Devlin or Dardier, as they were both out of town, but I saw three men, one of them an engineer, who had just returned from staking. Within the last 10 days none of them saw any silver, although of course the snow was on the ground; but they did see plenty of pyrrhotite. I saw their samples, and the ore is a typical pyrrhotite.

I have interviewed a large number of people—prospectors, fur traders, Hudson Bay officials and others who know the district—and can obtain absolutely no definite confirmation of the presence of silver in that section. The only statement—and that not openly—is from an unreliable prospector who gave away a few minute samples that bear every indication of having come from Cobalt.

You will see that this is hardly sufficient justification for a rush into a district 600 miles away from a railway.

G. C. BATEMAN.

C. P. R.R., en route from Edmonton, Alta.,
Apr. 20, 1915.

Government Publicity Methods

Criticism of Doctor Rittman continues to fill a considerable portion of the oil journals and shows little signs of abating after more than six weeks from the date on which his discoveries were announced to the public. Since much of this criticism is based on an incomplete knowledge of the facts in the case, and is decidedly unjust to Doctor Rittman, I feel that it is only proper that I should make known certain conditions which up to now have apparently not been given proper consideration.

Doctor Rittman and I are rivals in the development of oil-converting processes, but I do not want any advantage in this contest to come to me because of wholly unmerited personal attacks on Rittman, or criticism of him, which is not only unfair, but almost wholly misdirected. In the May and June, 1914, numbers of the *Journal of Industrial and Engineering Chemistry* there will be found a most scholarly and comprehensive article by M. C. Whitaker and W. F. Rittman, in which the basis of Doctor Rittman's work in oil cracking is discussed in a thoroughly scientific spirit. This article should be sufficient to establish the scientific standing of Doctor Rittman, and forces anyone who gives it careful attention to admire the patient work and the brilliant results which were obtained. That Whitaker and Rittman have done most important and valuable work in the cracking of oils will not be doubted by anyone who takes the time to read the results obtained in these important papers.

That there have been some unfortunate, and probably highly improper, publicity methods used in bringing the Rittman work before the public is undoubted, and my purpose in this statement is to place the blame where it belongs. Up to now it has been laid on both Rittman and on the newspapers, but I believe I can show that in neither case is the criticism justified.

Although Congress has repeatedly insisted that no part of the funds allotted to the Government departments are to be used in press-agent work, it is a matter of common knowledge that several of the Government departments systematically violate these provisions. The Bureau of Mines, in particular, maintains an active publicity department, the work of which can be well seen in the recent Rittman announcements, including the numerous personal-interest stories of Rittman, his muscular development, his football prowess, his helpful wife, etc., etc., *ad nauseam*. No person who knows anything of the scientific work of Rittman can believe for a moment that he has been a willing party to publicity efforts of such a nature.

About a year ago the newspapers of this country were filled with radium press notices. A bill was before Congress carrying an appropriation of $450,000 for radium research by the Bureau of Mines, and apparently the Bureau press agents worked overtime in their efforts to convince the people of this country that radium had almost miracle-working properties. Day after day the newspapers carried press notices of a misleading, if not of a wholly false, character, and no efforts seem to have been spared in this campaign of publicity. In the Associated Sunday magazines, which form the supplement of many Sunday newspapers, on Feb. 22, 1914, there was published an article by Franklin K. Lane, and using his official title as Secretary of the Interior. The opening sentence of this article is as follows:

> When we reflect that the production of every additional half-gram of radium means the saving of a human life a day from the ravages of cancer, no question can remain of our obligation to conserve and make available for use all the radium resources of this country.

At the time this article was written it is not at all certain that a single human life had been saved by radium. As a matter of fact, eminent medical authorities insisted at that time, and still insist, that no case of deep-seated cancer has ever been cured by radium, and that its exploitation as a curative agent for cancer has been due largely, if not wholly, to the efforts of parties who expected to profit by it financially.

Personally, I believe that the numerous misstatements which went through all the American newspapers a year ago were part of a systematic and organized campaign for the purpose of insuring the passage of the Bureau of Mines appropriation bill of $450,000 for radium research. There are strong reasons for believing that the officials of the Bureau of Mines knew at the time that radium had no such curative powers as were being claimed for it.

The many points of similarity between the radium publicity methods and the methods recently used to introduce the Rittman discoveries to the public will probably be noted by anyone who cares to look into the matter. As a matter of fact, I have personally seen some of the press-notice sheets which were handed out to the newspapers of this country in regard to the Rittman publicity. The newspapers published these sheets in practically the identical form in which they came to them, and the cowardly charge that has recently been made, now that it has been found that these publicity efforts were overdone, that these wild and exaggerated statements were due to the "love of sensationalism" of American newspapers is quite as unjust as it is untrue.

WALTER O. SNELLING.

Pittsburgh, Penn., Apr. 20, 1915.

Tailings Disposal in the Mogollon District

In regard to the editorial correspondence appearing in the JOURNAL of Apr. 3, 1915, relative to the discharge of tailings from the mills in the Mogollon district, I inclose herewith a copy of a letter written to the attorney-general of Arizona, in which you will see that the Ernestine company is working in conjunction with all the companies of this district to abate any nuisance that might arise from such practice. The article as published did an injustice to the Ernestine company.

S. J. KIDDER,
General Manager, The Ernestine Mining Co.

Mogollon, N. M., Apr. 12, 1915.

Wiley E. Jones, Attorney-General,
Phœnix, Ariz.

I inclose herewith item taken from the "Engineering and Mining Journal" of Apr. 3, 1915, relative to the discharge of tailings from mills of the Mogollon district, in which the following item occurs:

> The Attorney-General of Arizona, who made the notification, states that the Socorro Mining & Milling Co. is making an effort to abate the nuisance, but that the other companies have made no effort to end the trouble, and that unless something is done at once he will take legal action.

As pointed out in my letter to you of Mar. 23, the Ernestine company has from the first coöperated in every way with the other companies of this district in taking steps to abate any nuisance that might arise from the discharge of its tailings. Further, as I pointed out to you in my letter of Mar. 23, up to Mar. 1 the Ernestine company had contributed $2175.75 toward the construction of dams and reservoirs for impounding tailings. I think you will agree that it is manifestly unfair to the Ernestine Mining Co. that a report such as cited above should receive such wide circulation. Such reports are damaging to this company and discriminate in an unfair manner against it. We feel that as the reports have evidently come through your office, it is only reasonable to expect that you will endeavor to correct the erroneous reports that have been circulated to the effect that the Ernestine company was making no effort to abate the nuisance mentioned.

We still have a large crew working on the dams, and with the decrease of flood waters from the various creeks of the district believe that the situation will be handled in a manner satisfactory to the Arizona farmers.

S. J. KIDDER,
General Manager.

Apr. 12, 1915.

Effect of Dry Steam on Molten Matte

Can you or any of the JOURNAL readers tell me what happens when dry steam is run into molten matte? I would like to know, but I do not want to know badly enough to take the chances of trying it. Do you know whether it has been tried? G. A. M.

[On a laboratory scale some reaction happens analogous to

$$FeS + 3\,H_2O = FeO + SO_2 + 6\,H$$

The reaction absorbs a great amount of heat and hence is not self propagating. It is safe so long as the steam is dry.—EDITOR.]

Editorials

Steel Trade Prospects

The steel trade today is undoubtedly on a firmer basis and with a better outlook for the future than it has had for over a year. We hear a great deal about the capacity of mills, and the current reports seem to give rather low averages, but it must be remembered that capacity has a variable meaning. There is no mill in the country that can operate at 100% of its capacity for any length of time; and 90 to 95% would be a hard standard to maintain. Taking the Pittsburgh, the Valley and the Chicago districts, it may be said that, in general, the steel mills of he country are operating at an average of 70% of capacity, the same as for three or four weeks past. More rolling schedules are made up for a week at a time and fewer are made up from day to day. If orders should ontinue at the present rate there might be a little slowng down in operations within a few weeks, but with strucural business materially increased and with prospects of better railroad buying, as suggested by the budget announced by the Pennsylvania system, there are possibilities of a considerable increase in demand. The labor sitution is such that the steel mills, blast furnaces and coke works could hardly operate at more than 85% of capacity; ence if demand should increase by 15%, with the mills ow operating at 70%, deliveries would begin to fall beind and buyers would be moved to order for stock, and his would fill the mills up solidly. In recent months he condition as to stocks in the hands of jobbers and manufacturing consumers has been abnormal, as the buyers could depend upon almost immediate shipment from mills even on miscellaneous specifications, while in normal mes they should carry stocks equivalent to several weeks of consumption. This condition has helped to induce ghter orders, and consequently an appearance of reduced usiness.

At the present time there is no doubt that a more substantial demand is developing, which will support the ade when the temporary rush of foreign orders is over. hese foreign orders, though much exaggerated in general lief, are not to be despised; but at the best their duration uncertain, and we cannot rely on their continuance. here is every reason to believe, however, that a solid domestic business is taking the place of the doubtful and hesitating conditions of a year ago and that the lookout r business is far from discouraging.

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Employment for Idle Engineers

An experienced Western mining engineer to whom we nt an inquiry not long ago replied by a letter comprising the following paragraphs, which include a bit interesting personal doings and a suggestion that has me merit:

> I left there 18 months ago and have wandered far and nt some money trying to find a mine that I would not be amed to ask my friends to develop but, alas! not yet. search has taken me to California, and this summer I ect to prospect in Colorado, which brings me to my grand thought. While in New York in January I was struck by the noble efforts of some friends who tried to appear busy. Why not get back to youthful days and go to work as I suggested? I suggest that some of the idle engineers quit trying to split hairs over difficult schemes and see whether engineers can find ore. Of course, I think of Colorado as a good place to try. I know of a dozen places I should like to prospect. This state needs scientific prospectors. The idle engineers need the stimulus of climate and health that can be found out here and elsewhere in the mining sections. Mining properties in Colorado are cheaper than in years, but money rates are high, and it is not coming out West as it should. I suggest that every engineer spend a month this summer prospecting. I believe that a few dozen such men in the hills of Colorado could find something worth while. In any event, they would have a healthful and instructive time.

The idea that first occurs to us is that many engineers who are not well occupied either have given hostages to fortune or lack the financial resources to permit them to go to the mountains for six months of prospecting. For those who are foot-loose our friend's suggestion looks good. What is needed is indeed scientific prospecting, both in the examination of country where no ore has yet been found and in the development of occurrences that are known but inadequately tested. For the latter kind of prospecting some Denver engineers recently united in an enterprise whereof they thought favorably and wherein they put their own money. This was certainly an exhibition of doctors having confidence in themselves. The last word we had of this venture was encouraging. All Colorado hopes, and so do we, that the engineers will find a bonanza.

But for those engineers who are disposed to go prospecting and lack the resources, why should not the good, old-fashioned practice of grub-staking be revived? Grubstaking does not necessarily imply a bearded pard and a burro. Even a graduate of Freiberg might be grubstaked, and out of a bunch of such prospectors somebody might discover something worth while, especially if they should give their attention to things that the scouts for the big exploration companies deem beneath their notice.

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A New Attitude toward Leasing

The leaser is attaining to a new dignity. Formerly he was looked upon with no little abhorrence by the manager, and when a mine began to grant any number of leases it was considered at least a tacit admission that the end was in sight. Either suggesting the approaching end of a mine, which is always more or less funereal, or being suggested by it, was equally baneful to the repute of the leaser. Furthermore, he was considered irregular, lazy and generally a poor miner.

Now, however, leasing is being adopted by some of the larger mining companies as an important adjunct to their ordinary, regular operations. The annual report of the Goldfield Consolidated comments on the fact that in the history of every large mine a time comes when a part of its territory can be worked to better advantage by leasers than by any other system. The two principal a-sons for this are, first, the lack of efficiency and the expense of supervision for small operations at points distant from the larger stopes, and, second, the close personal attention required in hunting for small bunches of ore which are always overlooked and left behind in the necessarily rapid mining of large orebodies. The territory which a leaser has to cover in his work is very much smaller than that covered by the mine superintendent, or even the shift boss, and therefore the care which he can give to the details of operation and prospecting is much greater and may be quite as intelligent. In the case of the Goldfield Consolidated, leasing along these lines has proved so profitable both to the leaser and to the company that the system is being gradually extended. Care is taken to weed out those leasers who show lack of industry or intelligence, and the company feels that in this manner it is building up an organization which will be of much advantage to it for years to come.

Somewhat similar considerations have led the Ray Consolidated to adopt leasing as part of its regular mining method. In its system of mining, with the many raises from the haulage drifts to the orebody, the ordinary process of stoping leaves pyramidal sections of unbroken ore between the stope-chutes, which the company has found can be removed to best advantage by leasers.

Leasing under such conditions, where the operations are under the general supervision of the management, and where care is taken that only industrious and intelligent men shall secure leases, is quite different from the old-time method of leasing, where only the best ore was gouged out, and the workings were generally left in such shape that they were not only dangerous, but such that a lot of ore was eventually lost to the company. This is now exactly reversed, and the leasers are recovering ore which the mines would not find it profitable to do under the ordinary, everyday method.

The fact that the Goldfield Consolidated, with gold ore which has for a number of years averaged from $30 to the present $11 per ton, and where small bunches of rich ore are found, finds it advantageous to use a leasing system, and that the Ray Consolidated, mining low-grade copper ore, finds it equally to its advantage to use a leasing system eliminates any doubt of the wide range of applicability of the system as far as grade and character of ore are concerned, and suggests some interesting possibilities in large mining operations which heretofore have been generally overlooked.

Gold Mining in the Southeast

It is a matter of some surprise to the people of the southeastern states that a greater degree of interest is not taken in the mining possibilities of the country by the men who are skilled and interested in mining. As a matter of fact there are several obstacles to mining success in that country, none of which, however, are insuperable. The first and principal objection is that mining law does not apply and the prospector has no claim to what he may discover. Of course no one can expect prospecting to be carried on under such conditions. The second obstacle is that wherever a deposit of gold is known to exist its owner, the proprietor of the farmland, has such an exaggerated idea of its importance that he wishes to sell it for enough to put him in the millionaire class at once. Anyone skilled in mining knows that it is not carried on in that way and that development is necessary to prove the value of the land before a price can be set upon it. The third objection is that mining operations have, for the greater part, resulted in catastrophes. Of course these results have been due to foolish management, wild promotions and, in a measure, to the rebellious character of the ores, which not so long ago were not amenable to the cheaper processes and had to be attacked by such expensive methods as chlorination. Modern metallurgy, however, can remove the treatment obstacle and legitimate promotion can cure some of the others. The state of the law which excludes prospectors is apparently the most serious obstacle, but even this could be overcome by the land owners offering prospectors an interest in whatever they might find, or else the drafting of a law which would secure to the prospector that right. We do not advocate any such law at the present time, since sufficient study has not been given to the matter, but we do believe that before mining in the South is going to progress far the prospector must be given a real opportunity and an incentive to do the hunting. The native farmers have neither the skill nor the imagination to replace the Western type of gold prospector.

Lake Iron Ore Prices

At a date somewhat earlier than expected, the sellers and buyers of Lake Superior iron ore have come together and settled on prices for the season. They ar the same as last year, $3.75 for Old Range and $3.50 fo Mesabi bessemer ores; $3 for Old Range and $2.85 fo Mesabi nonbessemer; the base for bessemer ore bein 55% iron and under 0.45% phosphorus, and for nonbessemer 51.5% iron. The prices are for ore on dock a Lake Erie ports, and from them must be deducted th railroad freight from the mine to the Lake Superior por and the Lake freight to the lower ports. A Mesabi min will receive this season $2.40 for bessemer and $1.7 for nonbessemer ore loaded on cars, which does not seen an extravagant sum from which to pay mining and handling costs and value of the ore in the ground, or, wha is practically the same thing, the royalties with whic most Lake mines are loaded.

The rates, however, apply to only about one-quart of the Lake ore mined, the other three-quarters being us by the steel companies which own mines and the vessel which carry the ore down. For those companies the pri of the ore is its actual cost. In the case of the Steel Co poration this cost is further reduced by the profits derives from its ore-carrying roads in Minnesota. Ev with all the allowances made the mine price of Mesal ores will not be more than $2 to $2.50 per ton.

The furnace buying ore must add to the price at Lal docks the further cost of loading and hauling from tl docks to the furnace yard. For this we have no exa figures, but it will probably average at least $1 per to This would bring the cost of the ores in furnace yar up to 8.64 and 8.18c. per unit of iron for bessemer or 7.77 and 7.47c. per unit for Old Range and Mesabi no bessemers respectively. In good years, when business active and prices high, a fair quantity of Lake ore is s to furnaces east of the Alleghanies, but at the present ti such sales are not probable, as the rail rates would ma the cost too high. Nonbessemer ores could not be d livered in the Lehigh or Schuylkill Valley for less than per unit; while it is understood that New York and New Jersey ores are being offered in the same district at 6¼ to 6¾c. per unit. It does not seem that much Lake ore will be seen east of Buffalo or Johnstown this year.

The season's prices though low are not by any means the lowest on record. A table of rates for 26 years compiled by the *Iron Trade Review* shows that in 16 years prices have been higher than in 1914; in six years they have been lower, and in three years the same. The highest prices for Old Range bessemer in the 26 years were $5.50 in 1890 and 1900; $5 in 1907 and 1910. The lowest price for that grade was $2.60 in 1897; while $2.75 was touched on the declines in 1894 and 1898. In the past 10 years, or since the steel companies so largely became miners of their own ore, prices have been much steadier than before and the variations less from year to year.

BY THE WAY

From a letter recently received: "This management is quite a little of the old-time secretive-keep-it-dark-hedge-hog type. Articles upon conditions and methods used elsewhere are eagerly devoured, but to give anything to the press is strictly *verboten.*" That's not hedge-hog. It's just plain, common hog.

*

There was something doing in Goldfield last week, according to the following press item:

"Atlanta holed through to the 1400-ft. level of the rizzly Bear, and the fresh, free air of heaven swept down hrough the scorching labyrinth of levels to a depth of 750 ft. from the surface and the workmen filled their ungs with the life-giving oxygen which had never been nown in these mephitic caves, where few white men ould breathe with any degree of comfort."

*

The "iron house" at Trenton, N. J., the only one of s kind in the country, will shortly be razed to make room r an addition to the plant of the John E. Thropp's Sons o., says the *Iron Trade Review*. The house has been cupied for many years by Peter D. Thropp, treasurer f the company. In 1850 Bottom, Tiffany & Co. established an iron foundry on the banks of the Delaware canal. ne of the products of the firm was iron fronts for buildgs. and Mr. Tiffany decided that a good advertisement ould be to build a house entirely of iron. Accordingly built it. During the civil war the cupola was painted d, white and blue.

*

A well-known manufacturer of crushing machinery ves it as his opinion that there is but one manufacturer ho has ever produced a perfect pulverizing machine, and at is the Divine Inventor. He continues: "I examined e of His machines in 1882. I was impressed with its agnificent output of a million tons per day, crushed om coarse to slimes or silt, according to figures given a report of the U. S. Geological Survey. I am rerring to the great Colorado River. It generates its n power, with no loss of time for repairs, no slipping tappets, no broken cams, and no dropping of stamp ads—a perfect work from start to finish, and a perfect object-lesson for the inventor. Large irregular rocks are worn into boulders, and from that into cobblestones, and from cobblestones into sand, and from sand into slime, and then delivered to points where the product will do the most good for the human race. The immense Imperial Valley and various other valleys have the finished product from that magnificent pulverizing machine."

*

Hoover has referred in some of his historical writings to the operation of mines with slave labor in ancient times, which might have permitted the exploitation of ore deposits poorer than anything we work now. Not long ago we happened to read a paper by Prof. S. Zaborowski, which threw some light upon the economics of this subject. Xenophon, seeking a way to enrich Athens without the risks of war, insisted on working the silver mines, and for that labor proposed to buy 10,000 slaves, the purchase of which, he said, would be quickly compensated for by the cheap cost of their labor. "An estimate has been made," says Professor Zaborowski, "and we know that Xenophon was entirely right." A free laborer for 360 days' work cost 540 drachmas ($75). A slave whose maintenance cost two or three oboles (5 to 8c.) per day would accomplish the same amount of labor for 180 drachmas ($26). But there remains the purchase price of 300 drachmas. The interest on that amount at 12%, the rate at that period, represented 36 drachmas ($5) a year. The slave could no doubt work 10 years or more. By redeeming his purchase price in five years one could be guaranteed against all risks of sickness for a number of even feeble slaves. This cost for quick redemption would represent only 60 drachmas per year. And incorporating it in the annual revenue from the work of a slave, all this, interest included, would be only 276 drachmas. Take the round sum of 300 drachmas, and we have the advantage over the cost of a free laborer of 240 drachmas ($33.34) the first year. Thus the purchase price of a slave was reimbursed in 15 months. We might pursue the question and consider whether it were cheaper to buy slaves or to go to war to capture them. War probably was not so costly in the fifth century B. C. as it is in A. D. 1915. However, all figures are relative. Niceas, working the mines of Laurium with 1000 slaves, made 100 talents ($115,000)—an enormous return, a colossal fortune for that period.

*

Reported in New York

The shares and bonds of the Chile Copper Co. are now on the market, Daniel Guggenheim having sold a block of each to B. N. Baruch and Eugene Meyer, Jr.

*

The Wall St. tickers on Tuesday printed the yarn that it was reported from Germany that the British government had been buying control of the Amalgamated Copper Co. in order to have its own supply of copper. This was not intended to be taken seriously.

*

Interests prominent in the management of the porphyry coppers say that those companies have sold their output further ahead than ever before in their history.

The porphyry coppers are now producing at the [illegible] of last July. We have not heard from the other [illegible], but probably there is no longer any curtailment anywhere.

PERSONALS

V. C. Eason is the new master mechanic at the Union Basin Mines, Arizona.

Edson S. Bastin of the U. S. Geological Survey was recently in the Mineral Park camp, Arizona, inspecting the silver mines.

John Hays Hammond and Harris Hammond have removed their offices to the new Equitable Building, 120 Broadway, New York.

Hamilton & Hansell have removed their offices as consulting engineers to the Whitehall Building, 17 Battery Place, New York.

L. C. Trent is installing an exhibit in the Palace of Mines of the Panama-Pacific Exposition. He expects to be in San Francisco for some time.

Thomas B. Everett recently inspected the property of the Anozira Mines Co. which recently took over the Flores mine in Mohave County, Arizona.

H. L. Taylor, president of the Porcupine Imperial, is at the Porcupine camp in Ontario overseeing the installation of machinery and the reopening of the mine.

L. L. Moore, formerly with the Calumet & Arizona Copper Co. at Bisbee, is now in charge of the Gold Road Mining & Milling Co. properties at Oatman, Arizona.

John D. Ryan gave a dinner in honor of Daniel C. Jackling at Sherry's in New York, Apr. 21, about 150 friends of the host and the guest of honor being present.

F. H. Holbrook, lately engaged with the Imperial Oil Co. at Fort William, Ont., has accepted a position with the London & Pacific Petroleum Co. at Negritos, Peru.

Milton Hoyt, formerly foreman at the Hayden plant of the Ray Consolidated Copper Co., has accepted the superintendency of the Kelvin-Sultana Copper Co.'s plant.

Dr. Willett G. Miller, provincial geologist of Ontario, and A. G. Burrows of the provincial Department of Mines, are making a visit of inspection to Porcupine camp.

Donald Dyrenforth and James E. Dick, graduates of Colorado School of Mines, 1912, are operating mines at White Pine, Colo. They have been in Denver, recently on business.

Frank A. Shirmer of Boston, president of the Utah Apex Mining Co. and a director in the Utah Copper Co., arrived in Salt Lake City. Apr. 19, and is visiting properties in Bingham, Utah.

Fletcner G. Downs, who has been with the Instituto de Geologia y Perforaciones in Uruguay for the last two years, has returned to the United States. His present address is Chatham, Morris Co., N. J.

Hon. G. Howard Ferguson, Ontario Minister of Lands, Forests and Mines, is making his first visit to the mining districts of northern Ontario, accompanied by Premier W. H. Hearst and Hon. Frank Cochrane, Canadian Minister of Railways.

E. L. Larison has resigned his position as superintendent of the acid department of the Ducktown Sulphur, Copper & Iron Co. at Isabella, Tenn., to take charge of the new acid plant of the Anaconda Copper Mining Co., at Anaconda, Montana.

F. L. Culver and a party of directors of the Beaver and Temiskaming mines were in Cobalt, Ont., recently. Some importance is attached to their visit, as probably foreshadowing operations for exploration in the Keewatin below the diabase, in which the two companies may coöperate.

Bradley Stoughton, secretary of the American Institute of Mining Engineers, will leave New York on Apr. 29 to visit various local sections. His itinerary will include Chicago, St. Louis, Butte, Spokane, Seattle, San Francisco, Los Angeles, Bisbee and Denver. While at San Francisco, Mr. Stoughton will serve on the jury of awards in the department of mines and metallurgy. He will return to New York early in June.

Benjamin Magnus, who has been general manager of the Mount Morgan Gold Mining Co., of Queensland, for several years, has resigned that position, and also his position as consulting engineer to the Electrolytic Refining Co. of Port Kembla. He intends to leave Australia about June 15 and will visit Java, Singapore, China and Japan, expecting to arrive in San Francisco about the middle of October and in New York early in November. In the meanwhile mail matter for Mr. Magnus may be addressed to him in care of the "Engineering & Mining Journal."

S. Le Fevre, who has been with Witherbee, Sherman & Co. for the past nine years, as assistant general manager, general manager, and general mining engineer, announces that his services will be available, after May 1, as consulting mining engineer, with permanent address at Forest Glen, Ulster County, N. Y. Mr. Le Fevre has had a very wide experience in mining, management, and construction of plants, as well as 17 years practical work in the magnetic concentration of ores, and the designing of mills. The extensive plant of Witherbee, Sherman & Co. at Mineville, N. Y., has been largely developed during the period of his work there.

Adelbert L. Weiland, of Fowler, the new state engineer of Colorado appointed by Gov. Carlson to succeed John E. Field, has already taken possession of his office. Mr. Field will be retained as the engineering member of the state land board. The governor has also appointed Fred Carroll, manager of the Atlas Mining & Milling Co., Ouray, to succeed Thomas R. Henahan as state commissioner of mines. Because of Mr. Henahan's appreciated activities in the interests of the Colorado Metal Miners' Association, numerous influential members of that organization are urging his appointment as member of the state public utilities commission to have special function in mining affairs but, contrary to press announcements, his candidacy has not been indorsed by the association officially.

SOCIETIES

University of Utah—By an act of the Legislature of th State of Utah, which became effective July 1, 1913, there wa established in connection with the State School of Mines, a department of the University of Utah, a metallurgical Research Department. The particular purposes for which this department was established are the "finding of ways an methods of profitably treating low-grade ores, of securing a higher percentage of extraction of metals from their ores of obtaining other information that shall have for its objec the benefit of the mining industry and the utilization and con servation of the mineral resources of the state, and to publis and distribute bulletins and articles relating to the depart ment and its work." By an agreement with the United State Bureau of Mines, the work of this department is under th direction of metallurgists of the Bureau, assigned to duty a the University and Salt Lake City. Since January, 1914, D. A Lyon, metallurgist, has been in charge of the work assiste by other members of the metallurgical staff of the Burea assigned to duty of Salt Lake City and with headquarters a the University. Since that time, O. C. Ralston, assistan metallurgist for the Bureau, and J. F. Cullen, chemist, hav also been assigned to the work. In connection with this ne department there have been established five research fellow ships in metallurgy, each having an annual value of $72 These fellowships are open to college graduates who hav had a good training in chemistry and metallurgy and appl cations for them will be received up to May 15th, 1915. Appl cants should send a copy of their records from the registrar office of the college where they have, or will be, graduat and the names and addresses of at least three references wh know their character, ability and attainments.

As was to be expected the first year was largely devote to making a preliminary survey of the state for the purpos of determining the nature and extent of the low-grade or bodies of the state. After this a study was made of th literature and of the processes which it was thought it mig be possible to apply to the solution of the problems wi which the Department has to deal. At this time these pro lems are as follows:

1. A study of the flotation processes in order to dete mine their applicability to the treatment of ores which a not at the present time being treated by such processes.

2. The chloridizing roasting and leaching of ores.

3. The recovery of precious metals in the presence of i terfering elements, such as copper.

4. The separation of lead and zinc ores and the recov and conservation of the terrific amount of zinc that is lost mining, milling and smelting operations.

Holders of these fellowships will be subject to the rul governing employees of the National Bureau of Mines a will report for duty July 1, 1915. They must also regis as students in the University of Utah and become candida for the degree of Master of Science in Metallurgy (unl this or an equivalent degree has been previously earne Their class work will be directed by the heads of the depa ments of instruction and their laboratory work, as previous stated, by metallurgists of the Bureau of Mines. Fellows a appointed for one year, but the appointment may be renew Address applications to Jos. F. Merrill, Director of the U State School of Mines, Salt Lake City.

Editorial Correspondence

DENVER—Apr. 22

Tungsten-Ore Purchasers in this state, principally in Boulder County, announce a 20% advance in the price of 60% WO_3 concentrate. The recent price for this grade of concentrate has been $5.80 per ton; it is now $7. The increase is accounted for by demands for the metal in making projectiles and in tool steel for manufacturing weapons of warfare.

Leadville Is Rejoicing over prospects for another prosperous epoch in its history. This district has played numerous rôles as a metal producer, beginning with gold placering in California gulch. Then it became a rich lead camp, following this very quickly with fame for the silver found associated with the lead. It then produced oxides of iron and manganese, suitable as fluxes in smelting. Twenty years ago, interest centered in remarkable discoveries of gold ore. A few years ago, much of the country rock in the old lead-silver mines was identified as silicate and carbonate of zinc and the mining of zinc became popular. Water has ever been a serious obstacle to Leadville mining, many of the downtown properties having closed down because of this handicap. There are topographic possibilities of drainage to a considerable depth by a long adit but money and nerve have been lacking to finance such a project. Two years ago, ex-Gov. Jesse F. McDonald, who made his money in these mines, began organizing many diverse property interests into a drainage project. The Downtown Mines Pumping Co. now controls options, leases or deeds to a large acreage of mining property which is to be unwatered by one central pumping plant at the shaft of the Penrose mine. Machinery had been ordered from Switzerland just previous to the outbreak of the European war but orders were necessarily canceled. Contracts were then placed with the Providence Engineering Works, Providence, R. I., and pumps should have been delivered two months ago. However, ordinary manufacturing delays occurred so that the pumps only reached Leadville Sunday, Apr. 4. The elation was so general that a local brass band gave an open-air concert on Harrison Ave. Water was discharged by the new machinery for the first time Apr. 19. Most of the territory to be drained by this project has been idle since 1907. One of the duplicate pumps began pumping at the rate of 2200 gal. per minute against a head of 240 ft. Each unit is guaranteed to lift 1500 gal. per minute against a head of 430 ft. Mining operations will probably not begin in the old workings before the early part of next winter.

Purchase of Ore by Cripple Creek Assayers has been permanently enjoined by Judge Little of the district court. A year ago, two large mining companies secured an injunction restraining 27 assayers of the district from purchasing ore. This injunction was appealed to the Supreme Court but supersedeas was denied, thus making possible this recent ruling that aims to prevent highgrading.

Cripple Creek is Active and is drawing back many of its early miners who, some years ago, left for new fields in various parts of the country. Scarcely a mining property within the known mineralized area of the district is idle. Old dormant companies are waking up to the potentialities of their possessions, new companies are being incorporated, lessees are securing every available block of desirable ground, new plants of machinery are being installed and there is every prospect that 1915 will prove the banner year in gold production from this restricted area. Every large company is exploring to new depths and with marked success, while associated operators of the district are again pushing the Roosevelt tunnel to relieve the drainage troubles of the deeper mines. El Paso company has adopted a new policy providing greater attraction to leasers. It has been decided that the company can make most money mining in old workings by granting privileges to practical miners, so, in furtherance of this idea, an unusually low scale of royalties has been established whereby very low-grade ore may hereafter be removed at profit to leasers. This assures a large tonnage from this property in near future. The Golden Cycle stockholders of record during first quarter of this year have received magnificent returns on their investments. The January dividend was 15%, while the regular February and March dividends were each 5%. Then, during March, upon the sale of the Golden Cycle mine to the Vindicator company, there was distributed an extra dividend amounting to 190%, thus making the profits to stockholders during three months 215%; representing a distribution of $3,225,000. While it might seem that disposal of the mining property would terminate dividends, this view is upset by statements of officials that the reorganized company will continue dividends at the rate of at least 2% per month.

SALT LAKE CITY—Apr. 22

Many New Mining Companies have been incorporated as a result of the increased activity in the Alta and Big Cottonwood districts, and 13 new issues have been listed on the Salt Lake Stock & Mining Exchange since the first of the year, this exceeding all recent records. Various claims have been taken under option. The interest which is being shown in these camps should have the effect of bringing about much development work, with the probable opening of new orebodies.

GOLDFIELD—Apr. 21

The Booth-Jumbo Ex Apex Litigation has been compromised. All of the Booth work being done to afford data to the experts for proof of their apex contention has been discontinued and the geologists who were retained have left camp. The basis of the settlement has not been officially stated, but it is reported on apparently good authority that the Booth apex contention is conceded, that a vertical sideline agreement will be consummated and that the Jumbo Ex will increase its capitalization to 2,000,000 shares, give the Booth company 300,000, and place 450,000 shares in the Jumbo-Ex treasury. The Jumbo company announces a call for a special stockholders' meeting to be held at Phoenix, Ariz., on May 20, to ratify the Booth agreement. The Booth sued the Jumbo Ex for an accounting for $900,000 worth of ore, from the rich Jumbo ore shoot, to which the Booth claimed the apex.

SEATTLE—Apr. 22

Despite the Early Break-up of ice in the Yukon River, navigation on that stream will not open until June 1. Officers of the White Pass & Yukon company, operating steamboats from the headwaters at White Horse to the mouth of the river at St. Michael, say the low stage of the water along the 50-mile stretch between White Horse and Lake Labarge make it inadvisable to start the river boats ahead of the usual time.

An Impending Stampede of labor to Seward to find employment on the new railroad to be built by the Government has called forth warning from official sources. No construction work is going on at present, nor is there any possibility of work being started for several weeks. Most of the work will be let out to station men, who will do their own work and who will require a little capital to begin with. Not more than a few hundred men will be needed this season, and it is probable there are sufficient numbers there now. In this column in the issue of Apr. 17 comment was made on the number of unemployed men in Alaska even before the temptation of this new piece of work set a tide of unemployed from this country in that direction. No man should go to Alaska without money enough to return to the States in case he does not find work. At present the opportunities for employment in Alaska are very few.

The Fairbanks District is almost as much stirred up over the announcement of the selection of the tidewater terminal for the Government railroad as is that portion of Alaska adjacent to the Matanuska coal fields, Seward, and Sheep Creek, even though, according to Washington reports, the road will not be built to the interior for possibly two or three years yet. The area of the known gold-bearing gravel deposits in the Fairbanks district consists of approximately 150,350,000 bedrock feet, of which about one-third, or 50,000,000 bedrock feet, has been mined, producing $64,200,000, or $1.28 per bedrock foot for the entire area worked, which includes the richest portions of the pay channels. The unworked ground could not be mined to average more than 60c. per ft., which, under the [illegible] conditions, would permit of profitable working only in exceptional cases, where means other than [illegible] be employed or where rich pay streaks are [illegible]. There are probably 50,000,000 ft. of ground in Fish Creek and trib utary creeks, which will yield, according to the best information, an average of 60c. or more. The advent of the Government railroad will be a large factor in reducing the cost of operations to a basis allowing the working of these low-grade deposits, as coal of a good grade can then be delivered at the plant for a cost not to exceed $7.50 per ton. This alone, it is estimated, will cut the cost of working from 7 to 8c. per ft., as the average plant under present conditions pays $25 for an amount of fuel equivalent to one ton of coal which will hoist and thaw an average of 250 bedrock feet. The railroad will further reduce the cost of labor and supplies so as to permit the operation of 60c. gravel at a profit. Improved methods of mining will make ground of a much lower value than this available for working. With the low-grade ground opened up the output from the district will be enormously increased, since scarcely one-half of the placer gold of the district has been mined. Those who know the Fairbanks district well are confident that the coming of the railroad will reduce costs to such an extent as to permit the operation of the low-grade ground at a profit. It now costs from 28 to 36c. per bedrock foot to operate by the open-cut method in the district.

In the Tolovana District new discoveries of pay are being made with gratifying frequency. The latest discoveries reported are on No. 3 below Discovery, bench claim, and on No. 12 above Discovery. Lynch, Stone & Verdi, who recently found good pay on Olive Creek, have taken advantage of an unexpected cold snap to freight in a complete mining outfit, including two 16-hp. boilers, a 10-hp. hoist, a 12-hp. pumping engine, a 6-in. centrifugal pump, cables, bucket, points, etc., and will work as many men as possible this summer. J. C. Kinney is also taking in a 16-hp. boiler but does not expect to hoist much pay. It is now claimed that shallow-draft boats can ascend the Tolovana at high water to the mouth of Livengood Creek, and an attempt will be made after the breakup to put machinery on some of the claims where pay has been found.

KINGMAN, ARIZ.—Apr. 22

The Greatest Mining Boom in its history is being entered upon by Mohave County and is founded upon ore discoveries of sufficient importance to encourage legitimate mine exploitation in preference to stock manipulation. Focus of the present activity is at Oatman, the site of the famous Tom Reed mine, which has produced about $6,000,000 in the last six or seven years, but the scope of operations is gradually extending over the entire county. The Tom Reed, with the latest find of the ore chute on the 1000-ft. level, is responsible for proving that large orebodies exist in the Oatman district. The recent discoveries of the United Eastern show that rich ore is of wider occurrence than might be suspected from the Tom Reed workings and are immediately responsible for the impetus which has been given to mining development in the district. Long and McIver deserve praise for their plan of development; work having been based upon a careful study of the geology of the district and no ore encountered until the shaft had reached a depth of 100 ft. and the first strike of importance at 300 ft. The work was carried on rapidly and economically and a record for speed in shaft sinking established for the district and their example should have an influence on the standard of efficiency and economy of mining operations throughout the district.

In the Cerbat Range and Chloride District, the prevailing high price of zinc is the chief factor in stimulating activity, the Golconda mine, the property of the Union Basin company, being the largest producer. Exploitation of several other properties for zinc ore is under way. Kingman, the county seat, is profiting greatly by the mining activity. It was expected that the recent closing of the saloons on account of State Prohibition would be a severe, although temporary, blow to the fortunes of the town but the present mining boom has far more than offset the anticipated loss of revenue. A Chamber of Commerce has been organized and is working in conjunction with the newly organized Oatman Gold Road Association which was formed for the purpose of advertising the Oatman district. Any inquiries sent to the Kingman Chamber of Commerce will be referred to the proper committee and answered in an intelligent and conservative manner. The Chamber of Commerce has just considered the improvement of the road between Kingman and the Oatman Gold Road District, and has made a strong recommendation to the Board of Supervisors that an election be called to vote bonds in the amount of $100,000. At the present time there are grades on this road as high as 20 and 25 per cent. It is considered possible to cut these grades to 6 or 8 per cent. This work will probably entail an expenditure of $50,000 for six or eight miles of road. The boom has come at what may be considered the psychological moment on account of the volume of tourist travel expected to traverse the county this year en route to and from the two California fairs

DOUGLAS, ARIZ.—Apr. 18

The Railroad between Cananea and Naco is again open and has been in operation for about three weeks but no ore has been taken out and only supplies have been allowed to go to Cananea. About 400 men are now working around Cananea keeping the buildings and smeltery in repair and keeping the ground "caught up" in the mine. There is very little development work being done in Cananea and nothing being done outside. A large amount of supplies have been sent in and at the present time there are plenty of provisions of all kinds but the prices are so high the poorer class of Mexicans cannot buy very much as they have no money and it is next to impossible for them to live on the ordinary wages. Mexican paper pesos are worth 7c. each U. S. currency. The peso at the present time is made by all the different factions and there are many kinds both Villista and Carranzista; each side has issued several different kinds and none is good with the other side.

The Railroad between Agua Prieta and Nacozari is again open, both places being in the hands of the Carranza factions. The first train in six weeks went to Nacozari on Apr. 8 and took in three cars of flour besides much other provisions. Flour has been selling in Nacozari for $7 per 100 lb., and it has been almost impossible to buy it at that price because there was none to be had. There were no frijoles, the staff of life of the Mexicans, in the country. The train arrived in Agua Prieta on the 10th bringing 146 cars of concentrates from the Moctezuma Copper Co.

DULUTH—Apr. 24

Navigation is Now Open on the Great Lakes and a number of freighters have already left Duluth for lower lake ports. A large fleet loaded with grain left on Apr. 17, and ore carriers will start moving this week. There is now considerable ore on the docks and a number of trains are arriving from the Mesabi daily. On Apr. 22 the Duluth, Missabe & Northern Ry. resumed operations over its double-track system. The ore season is opening up far better on the Mesabi than it did a year ago and it is believed by many mining men that the year will be a better one for the iron-ore trade.

Conditions on the Minnesota Ranges are far better than they were a year ago this time and it looks as though the tonnage would exceed that of 1914. An official of the Duluth, Missabe & Northern road stated this week that his road had contracts already to move 12,000,000 tons of iron ore to the docks. The Duluth & Iron Range road is also busy and will move a considerable tonnage from the Vermilion. The Great Northern and Soo lines are also preparing for an active season. The first ore buying of the year started in Cleveland this week, when 750,000 tons were contracted for. The 1914 prices still prevail. Conditions look far better than they did two weeks ago.

TORONTO—Apr. 24

The Electric Power Shortage difficulty at Cobalt and Porcupine has been overcome for the time being; the situation is not regarded as satisfactory, as with the present limited sources of supply and the steadily increasing demand the trouble is likely to recur at any time. The operators are looking to the Provincial Hydro-Electric Commission for relief. On Apr. 22 the Cobalt Town Council passed a unanimous resolution requesting the commisison to send its engineers to investigate the power situation and the rates charged by the company.

STOCKHOLM—Mar. 30

A New Company, The Norske Spitzbergen Co., in which Vavasour Earle, of London, is a director, was incorporated in Christiania on Jan. 9. The capital is 455,000 kroner ($121,940), of which 145,000 kroner ($38,860) is cash. The object of the flotation is the exploitation of several mineral deposits on the island. The international conference, which at the outbreak of the war was postponed till Feb. 1 of this year, has not resumed its sittings.

The Helsingborg Refinery in Sweden, which treats the purple ore from the Sulitjelma mines in Norway, has since 1903 turned out 29,520 tons of refined copper, 4178 tons of "cement" copper, 5321 kg. of silver, 12.21 kg. of gold, 447,515 tons of briquetted iron ore and 114,294 tons of ore unbriquetted. This year the output will be about 4500 tons of refined copper, 800 kg. of silver, 1.4 kg. of gold, 65,000 tons of briquetted iron ore, and 25,000 tons of unbriquetted ore.

The Swedish Nickel Mines of Aedelfors and Kleva are again to be taken up and a number of the old slag heaps resmelted. A concentrator and smeltery are being erected, together with a power station. Formerly the sulphur content of the ores was roasted off, instead of using it as fuel, as it is now intended to do. There is a lively foreign inquiry at present for Scandinavian nickel.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—At mill results from first month's operations, applying to treatment of about 40,000 tons, show recoveries in excess of $1.50 per ton from ore containing about $1.85 per ton in gold and silver. Second section of mill will be in operation about June 1, and third section about month later. Entire mill, with addition of little more machinery, will have ultimate capacity of 12,000 tons per day. Additional water-power development is contemplated to take care of this increased tonnage.

ALABAMA

TENNESSEE COAL IRON & RAILROAD CO.—(Birmingham)—Announcement by president that construction will begin at once on new benzol plant to be erected by company at Fairfield, where wire mill of American Steel & Wire Co. is located. The plant will have a capacity to recover from byproduct gases 15,000 gal. of benzol every 24 hours.

ARIZONA

Gila County

INTERNATIONAL SMELTING (Globe)—New smeltery nearing completion to handle high-grade concentrate from Miami and Inspiration mills, will have unique distinction of turning out more copper than any other smeltery in state, although not treating largest tonnage. This on account of fact that plant will treat concentrates which are of high grade instead of ore. Plant contains no startling innovations in construction although including all up-to-date improvements in smeltery building.

SUPERIOR & BOSTON (Globe)—Smelting contract for three years has been closed with American Smelting and Refining Co.

Maricopa County

PITTSBURGH TUNGSTEN (Cave Creek)—Shipment of several tons of tungsten ore has been made to Denver from property of company seven miles north of here.

ORO FINO (Phœnix)—Mine in Winnifred district 18 miles north of here is making preparations to ship some high-grade ore to smeltery. Lower grade ore will be milled at later date.

VULTURE (Wickenburg)—Continues shipment of concentrates. More than 200 men at present employed in mine and mill. Sinking in new shaft has recently opened up some good ore.

Mohave County

UNION BASIN (Golconda)—Installation of new equipment including hoist of large capacity, compressor and engine completed. Shipments resumed on larger scale.

COPPER MOUNTAIN (Chloride)—Copper mine in Grand Gulch district recently leased and regular shipments via Grand Gulch have been begun.

NEVADA-ARIZONA (Kingman)—Recently shipped its second bar of bullion. Mill giving excellent results.

BRANNOCK (Union Pass)—Mill at Meyers Well put in condition and will resume operations early in May.

GOLD REED (Oatman)—Mayflower shaft has been unwatered and will be sunk an additional 500 ft. as soon as new hoist is installed.

TENNESSEE (Chloride)—Mine shipping 200 tons daily to the mill at Needles. Champion mine also ships a car.

UNITED WESTERN (Oatman)—Shaft to be straightened and sunk an additional 400 ft. New equipment to be installed.

GOLD ORE (Oatman)—Shaft is to be sunk an additional 200 ft. and crosscut be made to vein which left shaft at 150-ft.

Pima County

YUMA (Tucson)—Col. Epes Randolf and associates have aken over old Yuma mine, 14 miles west of Tucson Work s under direction of Courtenay DeKalb. Gold is principal netal though ores carry vanadium and molybdenum.

CAVILLO (Tucson)—New working shaft being sunk by rank and Warren Allison on this copper property.

LAS FLORES (Tucson)—Small shipments being made to ouglas.

LAS GUIJAS (Tucson)—Charles Bent has completed conentrating plant at his tungsten property.

TORTILLITA (Tucson) Main shaft is to be sunk by conract. New compressor, drills and sinking pump recently nstalled. F B. Work, of Tucson, has contract. Nott E. uild is manager.

Pinal County

CONSTRUCTION OF SUPERIOR & ARIZONA R.R. which ill be finished about May 1 has stimulated mining developent in Superior district. Work has been started on number f claims and prospects are favorable for large ore output hortly after road is placed in operation.

Yavapai County

UNITED VERDE EXTENSION (Jerome)—From drift on 200 level, 10 tons of ore, averaging 22% copper from vein 7 $19\frac{1}{2}$ ft. wide, is being shipped to smeltery daily.

NELSON (Crown King)—If electro-chemical process of eating ores proves successful at Mayer plant now under nstruction, similar kind of plant will be built immediately by this company George P. Harrington, general [illegible] quoted for above statement.

BUFFALO-ARIZONA (Hot Springs Junction)—Fire of unknown origin destroyed mill and several other buildings. Plant built eight years ago has been idle for long time No insurance carried Will rebuild.

GOLDEN IDOL (Cherry Creek)—Some improvements have been made in mill and after test run it was decided to resume operations. Owned by Loper & Guttry.

Yuma County

GEORGE W. NORTON (Yuma)—Is developing large deposit of baryte few miles east of Yuma. Plans to ship 200 tons per week to Los Angeles.

CALIFORNIA

Calaveras County

ROYAL GOLD (Hodson)—Has completed two storage bins on 500 level, total capacity 1000 tons. Mill finished with exception of laying down balance of plates.

Inyo County

MINNIETTA (Johannesburg)—Several hundred tons of ore on dump ready for shipment; will be hauled by auto truck to Trona and shipped by Trona Railroad to Southern Pacific at Searles. Ore reported to assay about 50% zinc, some lead and silver.

CERRO GORDO (Keeler)—Permission has been granted by state to issue stock should it become necessary. Mine has within past year been brought again into productive class.

Kern County

BUTTE (Randsburg)—Good ore reported in the drift on 250 level; 40 tons extracted and extensive operation contemplated.

STANFORD (Randsburg)—Good returns reported from placer operation. Pay gravel contains gold and tungsten. A jig has been installed by Buys & Truman. The Varney property has same installation, which is also successful.

Madera County

ENTERPRISE (Grubgulch)—Recent extraction of several thousand dollars from a 30-ft. ledge warrants renewed development. The mine is equipped with 10-stamp mill; 5 stamps are dropping. Power is furnished by 70-hp. waterwheel for mine and mill. L. R. Johnson is manager.

Shasta County

PITTSBURG MT. SHASTA GOLD (Redding)—Will erect plant to cost $100,000 to handle copper ore at its mine. T. V. Scott is Secretary.

UNCLE SAM (Kennett)—Ore extracted by leasers, being crushed in 10-stamp mill which recently went into commission after being idle for two years.

Nevada County

GIUSEPPI DAMIANO VS. BIRCHVILLE MINING CO.—Jury awarded plaintiff $12,000 for injuries sustained in defendant mine in 1913. Suit was for $25,000.

Siskiyou County

HYDRAULIC MINING COMPANIES endeavoring to purchase ground occupied by Roman Catholic Cemetery at Sawyers Bar. Estimated that the cemetery ground contains $40,000 worth of gold. Mining has been conducted on all sides and right up to cemetery lines. Cemetery was laid out in 1857 and church officials declare that they will not take up bodies and will not sell at any price.

ISABELLA COPPER (Etna Mills)—Work resumed. Tunnel will be advanced 100 ft.

Tuolumne County

McCORMICK (Jacksonville)—Tunnel will be advanced 1200 ft. farther to the west end line of property which produced large amount of gold at a depth of 40 ft. several years ago. At the 2200-ft. point the floor of the tunnel will have vertical depth of 1100 ft below surface. Andrew McCormick, of Stockton, is owner.

COLORADO

Boulder County

POTATO PATCH (Boulder) Horry & Co. have contract to drive 400 ft. of adit expected to tap Livingston shoot from which $200,000 in gold was mined in workings above. K[illegible] & Co. have contract for drifting in adit No. 1 to exploit [illegible] body of low-grade gold ore.

Clear Creek County

SANTIAGO (Georgetown)—Maintains small shipments of complex ore averaging about $60 per ton.

IDAHO BRIDE (Idaho Springs) Remodeled [illegible] on steady supply of custom ores, handling about [illegible] day. Bids being received for contracts to sin[illegible] and to extend levels.

WALDORF (Georgetown)—Imperial Mining Co [illegible] Commonwealth vein 3 ft. thick, almost solid sulp[illegible] ty-ton test lot ran 1.53 oz. Au, 67.1 oz. Ag, 12.8% Cu, and 8.1% Pb. Shortage of water prevents milling of considerable ore that might be produced by numerous leases.

Gilpin County

INGALLS (Central City)—Pool of local business men is developing this property and has installed small hoisting plant.

IRON CITY MILL (Black Hawk)—Capacity will be increased from 75 to 100 tons per day by addition of more concentrating tables. This custom mill does concentration only.

QUARTZ HILL RADIUM & GOLD MINES CO. is title of new incorporation, controlled by Eastern people, promoted by Charles Gage of Central City. Old well-known mines held by this company are Egyptian, Kent County and Ralls County, all of which have good records of production.

GILPIN-EUREKA (Central City)—John Jenkins, who acquired this mine several months ago, has property in producing shape and is treating about 20 tons daily in his stamp mill at mine.

OLD TOWN (Russell Gulch)—From foot of 100-ft. winze sunk below the 1200 level, Roberts & Hutchins, leasers, have drifted 70 ft. in shoot of rich ore, 12 ft. thick. The 1000 level is being pushed toward this shoot by Bray & Co., leasers. Development being done also on 1400 and 1500 levels.

Lake County

HAYDEN (Leadville)—Leasers Harris & Madsen ship 20 tons carbonate ore per day to Iola, Kan., smelting plants. Ore averages 22% zinc.

IRON-SILVER (Leadville)—During 1914, mine produced 41,812 tons ore that was sorted down to 37,979 tons yielding $10.48 per ton. Leasers mined 14,512 tons on which average return per ton was $4.25, with royalty averaging 45c. per ton. Year's production was 9689 tons less than in 1913, but net earnings showed increase of $50,702, due to better markets for metals.

Teller County

STRATTON'S INDEPENDENCE (Victor)—Supt. Eric Johnson announces discovery of large shoot of high-grade ore in new workings that extend further south than any previous workings. This find is in the Washington claim, in granite, a distance of approximately 1000 ft. from the wall of the Cripple Creek crater.

VINDICATOR (Independence)—Large compressor has been removed from Hull City shaft plant and erected at No. 2 Vindicator shaft. Shatz lease outputs heavy tonnage from block of ground between 600 and 800 levels. Beard lease has struck 20 ft. of good ore that was left alongside workings by former operators. Bruner lease on 1100 level has 3 ft. of high-grade ore.

Ouray County

ATLAS M. & M. (Ouray)—Treating ore containing principally copper glance by flotation method, said to be first commercial flotation plant in this country, is making recovery of about 90%. Manager Carroll is quoted as saying that a recovery of 95% on San Juan ores is possible.

KANSAS

O. W. SPARKS (Galena)—Will erect two new concentrating plants. Mr. Sparks is associated with Dick Turpin in one mill proposition and company will be known as Dick Turpin Mining Co.; mill will be located on Riseling ground; mines are well developed on this tract of land with good mines all around them. Other mill will be at Tom Cat Mines on Taylor and Glover land near Chitwood. Mr. Sparks has drilled 25 holes and encountered ore in all of them runing from 15 to 25 ft. thick and assaying from 15 to 25% zinc. Mills will be modern in every respect and will have daily capacity of 300 tons each.

R. E. P. (Galena)—Is installing large centrifugal pump on Parks city lots east of Main St. At depth of 110 ft. water came in so strong that it required heavier machinery to sink further; is company's intention to sink to 175 ft., at which they expect to encounter good run of zinc ore that has been traced on this ground at about this depth.

OLD TROY MILL (Galena)—Tailing company has taken lease on mill and tailings and will re-run them. Tailings have already been retreated once since they were piled by original company.

PEACOCK (Galena)—Have their ground drained on the Illinois Lead & Zinc land southwest of Galena and are taking out good ore, which they are running through their mill steadily. They expect to lease part of ground to miners and mill dirt on shares.

MICHIGAN

Copper

HANCOCK CONSOLIDATED (Hancock)—Sending about 600 to 800 tons of rock weekly to Franklin mill, where one head is devoted to Hancock rock. Has 14 drills working.

SOUTH LAKE (Houghton)—Will make no mill test for some time. Is obtaining splendid results in its exploration and development of four lodes opened.

NORTH LAKE (Houghton)—Has driven its crosscut 800 ft. to reach the Evergreen series of lodes.

MASS (Mass)—Has opened lode of Evergreen series, believed to be one of those tapped by South Lake, and good showing of commercial ore is being developed. All four lodes are believed to pass through Adventure property, which lies between Mass and South Lake. Mass is steadily increasing output.

NORTH KEARSARGE (Kearsarge)—No. 3 shaft will resume during May, or as soon as boiler plant can be put into shape. Two of boilers have been repaired and replaced and other three will be in place within two weeks. A permanent stack will begin building this week. The plant was put out of commission by an explosion of one boiler in January.

BOHEMIA (Houghton)—Resumption of operations will likely produce some interesting results. Diamond drilling will be conducted this summer, justified by cores already secured and by results obtained in development upon other properties in immediate vicinity. Bohemia has for 3000 ft., on strike the Mayflower-Baltic amygdaloid lode as well as felsite beds which Indiana cores and shaft work developed. Commercial rock was disclosed by some cores.

CALUMET & HECLA (Calumet)—Has refused offer of $700,000 for site of its old smeltery at Buffalo, N. Y. This is 20 times the cost. Its location at entrance to international bridge, with dockage for canal and lake on either side, make it highly desirable for railroad yards or grain elevator.

ARCADIAN (Houghton)—Arcadian lode has widened to 16 ft. and improves in character as it approaches New Baltic.

ISLE ROYALE (Houghton)—Can resume shipping from No. 1 shaft on Grand Portage lode within few days. Reconstruction work on surface and in shaft proper is completed, except some work in getting tramway and cars in shaft dumps in proper shape. Rock is richer than any Isle Royale has ever produced before and comes mostly from Nos. 2, 4, 5 and 6 shafts.

MASS CONS. (Greenland)—Mass is shipping at present 1200 tons of copper rock daily. This does not include mass stuff that goes direct to smeltery.

Iron

NEWPORT MINING (Ironwood)—New American record for shaft sinking made in March at new Newport shaft being put down 300 ft. away from present shaft. Shaft is vertical, 14x24 ft., and was put down 190 ft. in 31 days. Rock broken and hoisted in the 31 days was 63,840 cu.ft. Shaft will have five compartments, three skip roads, one cage road and one compartment for pipes and ladders. Will be sunk below 2000 level. Small hammer drills are used in sinking.

MINNESOTA

Cuyuna Range

ROWE (Riverton)—Two steam shovels and one hydraulic unit working. Preliminary work on concentrator is progressing. This will be Cuyuna Range's first concentrating plant.

BRAINERD-CUYUNA (Brainerd)—Shaft down 140 ft. will be bottomed at 160 ft. Ore can be shipped this season if market is found. Northern Pacific gets traffic.

DULUTH-BRAINERD (Manganese)—W. B. Cook appointed receiver for this company Apr. 15. Company has manganiferous iron deposit of possible value, shaft, and crude surface plant. Stock company dominated, until recently, by Locker-Donahue interests.

HILL CREST (Ironton)—Actual stripping operations now under way with one hydraulic unit, electrically operated, sluicing overburden. Twenty-five men employed.

Mesabi Range

COMMODORE (Virginia)—Operations started Apr. 19 with one shovel in ore. New headframe being constructed at mine and other minor improvements made.

ELBA (McKinley)—Owing to indications of caving around old shaft, necessary to move surface plant distance of 600 ft. As operators planned to begin producing Apr. 26 indications of caving were exceedingly embarrassing and record-breaking "moving" was conducted. At new location has been erected one of the highest stacks on Mesabi; is equipped with Murphy economizer.

HAWKINS (Nashwauk)—Addition to be built to present washing plant. Steel has been ordered.

QUINN-HARRISON (Nashwauk)—Steel for new concentrator is being put in place. Hoped to have plant ready for us by June 1. One shovel is stripping in pit, dirt being used fo dam to hold tailings from concentrator. Mining will star as soon as mill is ready.

CROSBY (Nashwauk)—Is to have concentrator. Steel ha been ordered. Plant will be located one mile north of mine

NEVADA

Clark County

YELLOW PINE (Goodsprings)—Mill resumed operation i March, and has been running continuously since. Monthl production 200 tons of lead concentrate, 1500 tons of zin concentrate and 300 tons of crude zinc carbonate ore maintained. Sinking the two-compartment shaft discontinued temporarily. Crosscut being driven from the 800 level to intersect in vein.

BOSS (Goodsprings)—Platinum-Gold Mining Co., operatin this property under bond, has increased force of men. Vei has been intersected on third level. It is reported that mone is on hand for second payment on property, due June 1, and a experimental plant will soon be constructed for treatment o the gold-platinum ore. At present, only copper carbonat ore is being shipped, pending completion of tests on platinum ore.

FREDRICKSON (Goodsprings)—Dry concentrating plan recently erected now in full operation, using rolls and Plum pneumatic jigs. Consignment of Sutton, Steele & Steel tables on way, and will be used for the treatment of th finer sizes not suited to jigs. Ore is lead carbonate, carryin high silver values, in silicious limestone gangue. Process i proving very successful. Mr. F. C. O'Kelly is manager.

Esmeralda County

SANDSTORM & KENDALL (Goldfield)—Formulating pla for working considerable area of placer ground lying o either side of ridge, partly on Sandstorm and partly on Ke dall.

NEVADA GOLDFIELD REDUCTION (Goldfield)—S months' lease granted to association of Tonopah men Champ d'Or French mining company, present owners of mil who own also mining properties at Hornsilver and Go Mountain. Lessees intend to carry on tests in plant on trea ment of slimes from Tonopah ores. Plant has capacity of 3 tons per day.

Humboldt County

HONEY BEE (Willard)—Gold ore being sacked on th claim, scene of original strike at this new camp. Other sho discovered and preparations being made to ship high-gra ore from surface. Townsite surveyed on Apr. 7; 300 peop now in camp and many buildings and houses being built.

NEW GOLD STRIKE NEAR ROCHESTER, between Weaver and Rochester cañons, one mile from Short Line R.R., made recently; oreshoot 4 ft. wide, assaying $50 in gold opened; sinking now under way.

Lander County

SILVER STRIKE ON BIRCH CREEK made recently. Fifty-foot shaft opened 4-ft. shoot, 8 in. of which assays $200 per ton in silver. Shipment being mined.

Lyon County

MASON VALLEY (Thompson)—Smeltery still closed but crew working at plant testing leaching process. Company has just purchased two wedge roasters.

NEVADA PROGRESSIVE CO. (Yerington)—Shaft now down 272 ft. Station will be cut and drifting done on 300 level. Lateral development work under way on 60, 100 and 200 levels. Ore changed from oxide to sulphide at depth of 250 ft. Mill may be built this summer.

Mineral County

AURORA CONSOLIDATED (Aurora)—Goldfield Consolidated owns 87% of stock of this company for which it paid $763,011, equivalent to $1.288 per share. Forty-stamp mill started up and running to capacity, 700 tons per day.

Nye County

TONOPAH ORE PRODUCTION for week ended Apr. 17 was 10,760 tons estimated value $219,640 compared with 10,913 tons last week. Shippers were: Tonopah Belmont, 3681; Tonopah Mining, 2800; Tonopah Extension, 1760; West End, 805; Jim Butler, 1150; Tonopah Merger, 150; North Star, 50; and Halifax, 364 tons.

TONOPAH BONANZA (Tonopah)—Power will be supplied and mining operations started at once.

TONOPAH MIDWAY (Tonopah)—Shaft sinking suspended while preparations for installation of new compressor are being made.

VICTOR (Tonopah) Water being lowered at rate of 3½ ft. per day. Entire mine will be unwatered in 30 or 40 days.

Washoe County

RED METAL COPPER (Reno)—This company situated at base of Peavine Mountain about 10 miles from Reno, has been sold to Charles B. Bills, of Sacramento, who plans to install leaching plant for reduction of his ores.

MONITOR BELMONT (Belmont)—Ten-stamp mill, using 1650 stamps will be placed in commission July 4 with big celebration. In addition to stamps and tube mill, milling method will include oil flotation. Mill building will be constructed of brick obtained from razing of old combination mill built more than 40 years ago, about one mile from present mill site.

White Pine County

NEVADA STAR (Cherry Creek)—Has just paid out $12,000 to 40 lien claimants and freed this old time silver property from legal complications. Dominant parties in Star company at Leeds, England, have cabled that operations will be resumed shortly at Cherry Creek.

NEVADA CONSOLIDATED (Ely)—Is running full time, handling more than 10,000 tons daily. Having installed agitators and flotation machines in six sections of mill will require so much power that it has had to order more electrical equipment, which will cost quarter of a million dollars.

OHIO

Mahoning County

CARBON LIMESTONE CO. (Youngstown)—Has recently expended about $125,000 on its properties at Hillsville, Penn., putting in large crushers, steam shovels, etc. Output approximates 1,000,000 tons a year. It owns in fee in its quaries about 30,000,000 tons of limestone and has under lease 600 acres of additional limestone territory. Has five miles of its own railroad tracks. Plant has just been installed for crushing limestone to degree of fineness suitable for agricultural purposes. Robert Bentley is president.

OREGON

Baker County

IMPERIAL MINE (Cable Cove District)—Ore being hauled for shipment to smeltery till mill is in operation.

POWDER RIVER GOLD DREDGING (Sumpter)—Dredging, introduced in Baker County two years ago by this company, branch of Keystone Dredging Co. of San Francisco which operates many dredges in California and Alaska, will, within next year, be one of principal methods of extracting gold in this section. Many old placer grounds will be scenes of activity. This company is to install another dredge; above Sumpter is Gold Center dredge, on Pine Creek, below Underwood placers another dredge will be installed. Besides these several others are contemplated.

Josephine County

ORIOLE MINE (Galice District) Action has been filed in circuit court, W. C. Boyd, plaintiff, in which appointment of receiver is asked. Suit brought to protect interests of holders of claims against the company and to maintain property without impairment for its stockholders.

DEL NORTE CLAIM HOLDERS' ASSOC. (Illinois River)—Dr. Chas. H. Parke, of Chicago, vice-president of this company, in company with B. F. Sanford, of Grants Pass are making investigations at mine where wagon road is being built and other improvements made with view to re-opening. This is a high-grade copper property.

M. J. ANDERSON AND COREY MATTISON (Grants Pass)—Are developing promising antimony property near Watkins post office. The vein is 5 ft. in width and ore assays 60% antimony.

UTAH

Beaver County

MAJESTIC (Milford) Operations are to be resumed

CROFT (Milford) This property, 11 miles from Milford, has been examined for Eastern people. [illegible] ore has been shipped in past. Development consists of shallow workings Main shaft down 125 feet.

ROB ROY (Newhouse)—Arrangements for resumption of work have been completed. Property five miles north of Sheep Rock.

FORTUNA GOLD QUEEN (Beaver City)—High-grade ore is reported to have been opened in a tunnel 60 ft. from surface. Stock to be listed on Salt Lake Exchange.

Juab County

TINTIC ORE SHIPMENTS for week ended Apr. 16 largest for months, 123 cars, estimated 6150 tons, value $150,000, compared with 106 cars week previous and 103 cars second week previous.

BULLION BECK (Eureka)—Concentrates are being produced by jigging ore from old stopes leased to Goodwin, Anderson & Watkins. Two cars shipped week ended Apr. 16.

YANKEE (Eureka)—Work being done in western part of property in search of continuation of recently developed orebody in May Day. In southern end prospecting is being done for Beck Tunnel vein.

EAGLE & BLUE BELL (Eureka)—New orebody on 1750 level has been opened 200 ft. along strike. Prospecting downward from 1750 has been started, and if body is found to extend to much greater depth main shaft will be deepened.

KNIGHT-CHRISTENSEN MILL (Silver City)—New mill to have same capacity as old, 100 tons daily, and to be built as unit, so capacity can be increased easily. Steel from Knight smeltery to be used in construction, as precaution against fire. Machinery remaining from destroyed mill is being overhauled; new equipment to be ordered immediately Expected to have mill ready for operation in three months

Salt Lake County

MONTANA-BINGHAM (Bingham)—Surface survey being made of ground to be served by this company's development and transportation tunnel. The tunnel is at present in about 3360 ft. and daily progress of 3 to 4 ft. is being made.

UTAH KARNS TUNNELING MACHINE CO. (Salt Lake City)—J. R. Belcher, president, states that company has just entered into contract with City of Chicago for installation of one heading machine to operate on eight-mile channel to be driven under city. Machine is to bore relief holes 12 in. in diameter and 15 ft deep, to be used in connection with round of air drill holes put in as usual. He states that actual tests made by firing to this big centre relief hole have shown that speed of tunneling is increased about 50%. In Hercules tunnel at Wallace, Idaho, Karns machine bored three 15-ft. holes at a rate of 2½ ft. per hour.

Summit County

PARK CITY SHIPMENTS of ore and concentrates for week ended Apr. 17 amounted to 1300 tons, valued at $52,000, compared with 1218 tons week previous and 1505 tons second week previous.

NEW QUINCY (Park City)—Articles of incorporation have been filed, new company taking over rights and obligations of Thompson-Quincy. Ground comprises 140 acres, patented. Company owns rights of way and easements with Ontario, Daly and Daly-West mines. Capitalization is 1,250,000 shares, par value 10c., with 205,065 shares in treasury. Within next 90 days old stockholders will receive 1,045,035 shares of new stock share for share, or may sell their stock to the company at 10c. a share, to be deposited in the treasury. Debts of the company amount to about $44,000. Not more than 3c. may be levied in assessments the first year, 1c. at a time, the second assessment five months after the first, and the third, 10 months. W. Mont Ferry is president.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTEING (Trail)—During week ended Apr. 10, ore from 11 mines was treated by smeltery at Trail amounting to 7741 tons. Largest individual shipper was Centre Star.

GRANBY CONSOLIDATED (Grand Forks)—Blister copper from Anyox and Granby smelteries will hereafter be shipped to eastern refineries via Panama Canal. This will take longer for product to reach destination, but saving of more than 50% in freight, compared with all-rail haul across continent, more than compensates.

Ontario

NIPISSING During March mined ore estimated net value $169,079.

TOUGH OAKES (Kirkland Lake) Has been running at about half capacity owing to power shortage First clean-up in mill showed extraction of about 95%.

KRIST-THOMPSON (Porcupine)—Formerly Krist Porcupine Mining Co. has taken over South Thompson property. Diamond drilling is to be started shortly.

BEAVER (Cobalt) At annual meeting held this week Mr Culver announced that Beaver and Temiskaming mines would jointly build power plant to cost about $150,000.

McINTYRE (Porcupine)—A Toronto broker is asking shareholders to give him their proxies in order to oust present directorate, whom it is claimed do not take proper interest in property.

VIPOND (Porcupine)—Mill will shortly be in shape to handle 150 tons per day. In March with daily [illegible] of 87 tons, ore of value of $32,000 was milled an[illegible] April output is estimated at $40,000, while for year total production will probably be about $500,000.

The Market Report

METAL MARKETS

NEW YORK—Apr. 28

Copper and spelter both experienced phenomenal advances. On the other hand, the markets for tin and lead were quiet and stationary.

Copper, Tin, Lead and Zinc

Copper—The performance of copper during the last week substantially repeated that of the week immediately preceding. During each day there was a sharp advance from the opening to the closing of business. On Apr. 27 a large business was done upon the basis of 18½c., regular terms, equivalent to about 18.30, net cash, New York, but toward the end of the day, small sales were made at 18¾c., while there were still sellers at 18½c. On April 28 the market opened at 18⅝c., and at 3 p.m., our closing time, was at 18¾@18⅞c., regular terms, with indications, however, that a higher price might be made before the end of the day.

The volume of business was fairly large, there being numerous million-pound transactions and larger. While the bulk of business continued to be for military purposes, there was a further increase in the demand for domestic peaceful purposes.

The great and extraordinary rapid advance in the price for copper is deplored by all who have the best interests of the industry at heart, but it has been impossible to check it. Although the mines are increasing their output, the increase is not yet reflected in the working of the refineries which are still being operated at below normal capacity. The recent advance is adequately explained by the statement that the refiners have not been able to sell freely enough to check it.

Copper Exports for the week ended Apr. 17 are reported by the Department of Commerce at 10,098,634 lb. The larger items were 5,797,634 lb. to Great Britain; 2,298,596 lb. to France; 1,360,329 lb. to Italy and 560,335 lb. to Russia. Imports were 2,528,000 lb. metal and 9,645,000 lb. in ore and matte; 12,173,000 lb. in all. The larger imports were from Cuba, Venezuela and Japan.

Copper Sheets base price was advanced ½c. per lb. on Apr. 22, and is now 23c. per lb. for hot rolled and 24c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 19@19¼c. per lb. carload lots at mill.

Tin—This metal has been quiet with only a small volume of business transacted. It is satisfactory that the recent excitement has practically passed away.

Tin shipments from the Straits in March were 5250 long tons. For the three months ended Mar. 31 the total was 15,972 tons in 1914 and 15,905 in 1915, a decrease of 67 tons.

Lead—The bulk of the business last week was apparently taken by the largest producer. Some large foreign orders were in the market and also some large orders from domestic manufacturers who are making ammunition. While the St. Louis quotation remains unchanged the bulk of the business there appears to have been done at about 4.10c., while there were reports of small sales a little lower than that.

Spelter—Inspired by the spectacular rise in the price for spot spelter at London, which price was £51 at the beginning of the week and £64½ at the end, dealers, traders and speculators ran away with the market. There is practically no spot spelter in London, and practically no prompt spelter here. The transactions in this market, on St. Louis basis, during the last week, were of extraordinary character, being in the main for deliveries ranging all over the remainder of this year, and being at phenomenal variations in price. The only way of quoting the market is by giving the range, including all reported transactions of magnitude, although such a range in quotations is quite unprecedented. The total volume of business was large, amounting without any doubt to upward of [illegible] tons, and to a large extent was for export. The amount of business done with consumers, domestic and foreign, was relatively small, probably not more than [illegible] of the total. The business in prompt and May spelter amounted to only a few hundred tons, mostly in 25- and 50-ton lots.

Zinc sheets, base price was advanced ¼c. Apr. 22; ¾c. Apr. 23, again on Apr. 25, and is now $16 per 100 lb., f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The demand is reported good.

G. D. Delprat, general manager of the Broken Hill Proprietary Co., is reported as saying, Feb. 5: "We are producing spelter as fast as we can. We have nine furnaces at work, and a tenth is being blown in. We are producing over 100 tons a week of spelter. All of this is being disposed of in Australia. I cannot say much about zinc concentrates, but we are looking for a market in America and have someone traveling there at the present time."

At the annual meeting of the directors of the Edgar Zinc Co., held Apr. 6, the following officers were elected for the ensuing year: S. C. Edgar, Jr., president; A. S. McMillan, vice-president and auditor; W. B. Edgar, secretary and treasurer. From Apr. 19 the general offices of the company are in Suite 910, Boatmen's Bank Building, Broadway and Olive St., St. Louis.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Sterling Exchange	Silver, Cts. per Oz	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
22	4.7887	50½	17.55 @17.70	42	4.20 @4.25	4.10 @4.15	9.42½ @11.67½	9.25 @11.50
23	4.7894	50⅝	17.55 @17.70	42	4.20 @4.25	4.10 @4.15	9.67½ @12.17½	9.50 @12.00
24	4.7887	50⅝	17.70 @17.80	42	4.20 @4.25	4.10 @4.15	9.67½ @12.17½	9.50 @12.00
26	4.7913	50¾	17.75 @18.05	42	4.20 @4.25	4.10 @4.15	10.17½ @12.67½	10.00 @12.50
27	4.7944	50½	18.10 @18.50	42	4.20 @4.25	4.10 @4.15	10.67½ @13.17½	10.50 @13.00
28	4.7919	50⅝	18.45 @18.70	42	4.20 @4.25	4.10 @4.15	11.17½ @13.17½	11.00 @13.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Apr.	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
22	23 11/16	77½	16.84	78¼	.	163¼	164	20⅞	4.54	51	11.08
23	23⅝	78¾	17.11	79¼	..	165	165¾	21⅛	4.59	53½	11.62
24	23⅝	-			..			.			..
26	23 11/16	79¾	17.33	81	....	165¼	166	21½	4.67	57¾	12.55
27	23 13/16	81¼	17.65	82½	....	164½	165¼	20⅞ @21¼	4.54 @4.62	59	12.82
28	23⅞	80⅝	17.52	82		163½	164½	21¼	4.62	64½	14.01

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Apr. 28

Aluminum has been a little more active but steady and with no change to be noted. Quotations are 18¾@19c. per lb. for No. 1 ingots, New York.—**Antimony** has advanced sharply on limited business. Stocks are small and no increase in supply is in sight. Ordinary brands are 26@27c. per lb.; while 34c. per lb. is asked for Cookson's.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is in better demand in a small way. The New York price is $65@70 per flask of 75 lb. for large lots. A round lot was sold at $70 on Apr. 26. Small lots are sold at $70@80 per flask, according to size of order. San Francisco price is telegraphed at $62.50@65 for domestic orders, large lots. Some dealers hold for $75, but without sales. London price is £12 per flask, with £11 17s. 6d. named from second hands.

Minor Metals—Current sales of **Bismuth** have been at $2.75@3 per lb., New York.—**Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.—**Cadmium** is quoted in London at 6s.—$1.44—per lb.—**Tellurium** is reported sold at 80s.—$19.20—per lb. in London.

Gold, Silver and Platinum

Gold and Sliver Movement in the United States, three months ended Mar. 31, is reported by the Department of Commerce as below:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$18,624,883	$2,669,279	$11,483,600	$11,768,105
Imports	21,493,475	45,243,357	6,799,568	7,163,929
Excess	I.$2,868,592	I. $42,574,078	E. $4,684,032	E. $4,604,176

Exports of merchandise for the three months are valued at $866,694,745; imports, $405,311,924; excess of exports, $461,382,821. Adding gold and silver gives $367,342,022 as the net export balance.

Gold imports into Great Britain, three months ended Mar. 31, were £3,789,201; exports, £2,339,832; excess of imports, £1,449,369, against £1,733,296 last year.

Silver has been steady with slight advancing tendency the past week, having touched 23⅞d. There are no new features to the market.

Platinum—The market continues quiet and with very small movement. Quotations remain about the same, $38@40 per oz. for refined platinum and $43@47 per oz. for hard metal, according to grade.

Our Russian correspondent writes that the market is dull and inactive as is usually the case before the Easter holidays. In Petrograd there are no quotations, owing to the absence of sales. At Ekaterinburg the price is 8 rubles per zolotnik—$30.08 per oz.—for crude metal, 83% platinum, but this is largely nominal. The Russian government now permits the export of platinum under special conditions. In accordance with the new regulations a platinum refinery is to be erected in the Urals next summer.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Apr. 24

The base price paid this week for 60% zinc ore was $58 per ton. Lead ore, 80%, was sold at a base price of $51 per ton.

SHIPMENTS WEEK ENDED APR. 24

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,752,390	90,000	654,120
Year	62,169,150	1,639,190	6,470,410

Shipped during week to separating plants, 4,387,760 lb. zinc ore.

JOPLIN, MO.—Apr. 24

Blende, high price, $68; assay base 60% zinc, premium grades, $65@66; medium grades, $63@58, and lower grades down to $54 per ton. Calamine, base, $42@38 per ton of 40% zinc; average, all grades of zinc, $51.40 per ton. Lead, high price $52.50; base, $51 per ton of 80% metal content.

SHIPMENTS WEEK ENDED APR. 24

	Blende	Calamine	Lead	Values
Totals this week	11,802,860	1,367,750	1,115,610	$387,390
Totals this year	172,110,310	15,388,800	25,576,680	6,071,550

Blende value, the week, $332,700; four months, $5,162,100.

Calamine value, the week, $26,400; four months, $279,980.

Lead value, the week, $28,290; four months, $609,470.

Purchases were as heavy or heavier than the previous week, and prices advanced from $5 to $10 per ton for ore for next week's delivery.

Iron Trade Review

The reported tone of the iron and steel markets is still good. While domestic business improves gradually, foreign orders are large.

The condition of the trade changes slowly, but there seems to be no recession, and the mills hold their own and gain a little from day to day.

Pig iron shows some gain and the increasing production is taken up. There has been a fair demand for basic and foundry iron. Southern furnaces have made sales of something like 200,000 tons of those grades at prices running up to $9.50 and $9.75 for No. 2 foundry at furnace

Imports at Baltimore for the past week included 325 tons ferromanganese from Liverpool.

Among the exports from Baltimore for the week was an unusual item 12,965,300 lb. pipe for Abadan, Persian Gulf.

United States Steel Corporation reports for the quarter ended March 31 an increase of $1,522,639 in net earnings over the December quarter of 1914. The net earnings below include balance after payment of all operating expenses, ordinary renewals and repairs:

	1914	1915
January	$4,941,337	$1,687,150
February	5,655,611	3,638,578
March	7,397,433	7,132,081
Net earnings for quarter	$17,994,381	$12,457,809
Depreciation and sinking funds		$5,773,236
Bond interest, etc		5,769,515
Total charges		$11,542,758
Surplus for the quarter		$915,051

The usual dividend of 1¾% on preferred stock was declared, amounting to $6,304,919, leaving a deficit of $5,389,861. The notable point is the large increase in net earnings in March.

PITTSBURGH—Apr. 27

The steel mills continue to operate at about 70% of capacity, but there has been no disposition to increase the rate in the past two or three weeks, and there is a question even whether the rate can be maintained. Current bookings are not as heavy as in March, but as consumers having low-priced contracts expiring Apr. 1 specified heavily in March there is a possibility that buying will shortly be heavier.

Shipments of wire products are decreasing, as they always do at this season, but the season is considered a backward one and it is expected that May and June shipments will therefore be fairly large. Shipments to agricultural implement makers have decerased, but are still fairly large, and the implement makers have already begun to figure on material for the new season. Shipments to the automobile trade have also decreased, but some of the car builders have already bought some material to apply to 1916 models. In all three of these classes of material the between-seasons lull is expected to be less pronounced than usual.

Railroads are specifying more heavily against their contracts for rails and track material. The Western Maryland is inquiring for 1000 steel hopper cars, while the Chicago & Northwestern's order for 2500 box cars is likely to be placed shortly. The Pennsylvania R.R. has inquired for a fair volume of material for cars and locomotives to be built at its Altoona shops, but has not inquired against the larger number of cars and locomotives it stated recently it might buy this season on the outside

War orders for steel are making up a round tonnage. To date the Steel Corporation is understood to have taken orders for 50,000 tons of bars for making shrapnel, and the Lackawanna Steel Co. 15,000 tons, orders placed with other mills being relatively small.

Steel prices are well maintained, but are subject to no severe tests. The wire mills are insisting on 60c. per 100 lb. differential for galvanized wire, while most of the independent mills have withdrawn the 3.40c. price on galvanized sheets, a price the leading interest still quotes, as it has spelter bought at prices lower than the present market

Pig Iron The Youngstown Sheet & Tube Co. has bought about 40,000 tons of basic pig iron, 17,500 tons of gray forge and 5000 tons of foundry iron, over 60,000 tons in all, for delivery up to Oct. 1. It is operating its four blast furnaces, but is running its steel departments practically full and therefore needs outside pig iron No statement is made [illegible] to prices paid, and the trade generally seems to assume that current quotations were shaded W. P. Snyder & [illegible] terday sold 10,000 tons of bessemer for export to [illegible] curing $16, seaboard, or $13.86 at furnace, 26 [illegible] domestic market as lately quoted. There is [illegible] in foundry iron. We continue to quote: [illegible] basic, $12.50, No. 2 foundry, $12.75@13; forge, [illegible]; malelable, $12.75, f.o.b. Valley Furnaces, 95c. higher delivered Pittsburgh

IRON ORE

NEW YORK—Apr. 28

The prices of Lake Superior iron ore to buyers for this season have been fixed by large sales made at Cleveland and in the Mahoning Valley. The prices made are the same as those for 1914, being $3.75 per ton for Old Range bessemer; $3.50 for Mesabi bessemer; $3 for Old Range nonbessemer; $2.85 for Mesabi nonbessemer; all on docks at Lake Erie ports. The basis remains the same, 55% iron and under 0.45% phosphorus for bessemer ores; 51.5% iron for nonbessemers. It is understood that the Lake rate will be unchanged at 50c. from Duluth to Lake Erie ports, including unloading charges.

Some good sales of Lake Champlain lump ore to openhearth steel furnaces in the United States and Canada are reported made recently.

The water level on the Lakes this year is reported unusually low. The first boats down will be loaded on 19-ft. draft, and it is possible the limit may be reduced to 18½ ft. This means that there will be no record ore cargoes this season. Navigation is reported clear and shipments will begin early.

British Iron Ore Imports three months ended Mar. 31 were 1,557,320 long tons in 1914, and 1,295,132 in 1915; decrease, 262,188 tons. Imports of Manganese ore were 128,775 tons in 1914, and 86,605 in 1915; decrease, 42,170 tons.

FOREIGN IRON NOTES

The German Iron & Steel Union reports the production of pig iron in the German Empire in February at 803,623 metric tons, which is 70,510 tons less than in January and 874,133 tons less than in February 1914. For the two months ended Feb. 28 the total make was 3,012,365 tons in 1914, and 1,445,670 in 1915; a decrease of 1,566,695 tons, or 52%, this year.

The German Iron & Steel Union reports the make of steel in February at 946,015 tons, or 17,775 tons less than in January. For the two months ended Feb. 28 the total was, in metric tons:

	Basic	Acid	Total
Converter	972,278	20,908	993,186
Openhearth	785,841	32,128	817,969
Direct castings	50,077	15,119	65,196
Crucible steel		17,074	17,014
Electric steel	.	16,440	16,440
Total	1,808,196	101,609	1,909,805

The total make in January and February, 1914, was 3,112,265 tons, showing a decrease this year of 1,202,460 tons, or 38.6%. There were 229 steel plants in operation in February.

Foreign Trade of Great Britain in Iron and Steel, two months ended Feb. 28, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£4,907,375	£999,454	Exp. £3,907,921
Machinery, hardware, etc.	4,380,705	1,915,849	Exp. 2,464,856
Totals	£9,288,080	£2,915,303	Exp. £6,372,777
Totals, 1914	18,250,533	4,987,793	Exp. 13,262,740

Actual tonnage of iron and steel exported was 801,097 tons in 1914, and 418,570 tons in 1915; imported, 360,523 tons in 1914 and 117,733 tons this year.

COKE

Connellsville—The coke market continues to grow in strength, at least sentimentally, and it is said that only a little more buying for early delivery would serve to stiffen prices materially. Two inquiries are now out for second half, totaling about 20,000 tons a month, from consumers who are already covered to July 1. There is an unconfirmed rumor that a contract for 20,000 tons monthly for the twelvemonth beginning July has been made at $1.95. We quote: Prompt furnace, $1.55@1.60; contract furnace to July 1, $1.60@1.65; contract furnace, second half, $1.75; prompt foundry, $2@2.35; contract foundry, $2.20@2.30, per net ton at ovens.

The "Courier" reports production in the Connellsville and lower Connellsville region in the week ended Apr. 17 at 298,222 tons, an increase of 6007 tons, and shipments at 294,995 tons, an increase of 7166 tons.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, three months ended Mar. 31, in short tons:

	1914	1915	Changes
Anthracite	2,655,435	2,480,729	D. 174,706
Bituminous	11,530,144	9,845,684	D. 1,684,460
Coke	2,682,470	2,303,835	D. 378,635
Total	16,868,049	14,630,248	D. 2,237,801

The total decrease this year from 1914 was 13.3%. The lightest tonnage reported was in March, when the total was 14% less than in March a year ago.

Fuel Exports and Imports in the United States, two months ended Feb. 28, as reported by the Department of Commerce, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	404,228	368,539	107	11
Bituminous	1,690,069	1,218,033	229,476	252,997
Coke	128,412	101,756	13,131	6,718
Bunker coal	1,143,181	1,030,867	.....	.....
Total	3,365,890	2,719,195	242,714	259,726

The bunker coal, or coal furnished to steamships in foreign trades, is practically all bituminous. The greater part of the trade, both imports and exports, is with Canada.

Coal Production in South Africa in 1914, as reported by the Mines Department of the Union of South Africa, was: Transvaal, 5,157,268; Orange Free State, 699,217; Natal, 2,567,817; Cape, 53,621; total, 8,477,923 tons, being 323,293 tons less than in 1913. The decrease was in Natal chiefly. In December there were 58 collieries producing coal in the Union: Transvaal, 25; Cape, 8; Orange Free State, 4; Natal, 21. At these collieries there were employed 1212 whites and 23,805 colored workmen.

Consular reports say that from a recent report of the Ministry of Agriculture & Commerce at Peking it appears that the output in coal in the various provinces of China in 1914 was 9,272,000 tons, divided as follows: Manchuria, 840,000; Hupeh, 100,000; Chihli, 2,160,000; Anhuei, 60,000; Shansi, 2,500,000; Shantung, 932,000; Honan, 900,000; Szechwan, 300,000; Kiangsi, 800,000; Hunan, 500,000; Shensi, 50,000; Kwangtung, 50,000; Kansu, 50,000; Yunnan, 30,000 tons.

Chemicals

NEW YORK—Apr. 28

The general market shows a little more activity in places, but is still inclined to be variable.

Arsenic—Business is improving, but is not more than moderately active. Prices are steady at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is good. The price has been advanced 50c. and is now $6.75 per 100 lb. for carload lots and $7 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is firm and steady on a moderate business. Quotations remain 2.30c. per lb. for all positions this year.

Potash Salts—The American steamship "L. V. Stoddard" is reported at Wilmington, N. C., from Rotterdam with a cargo of 2200 tons of muriate of potash. This is the first cargo of German potash received there since August last.

Imports and Exports of Chemicals in the United States, two months ended Feb. 28, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	754,613	1,035,675	....	660
Bleach	8,311,243	8,521,327	8,600	.....
Potash salts	6,461,135	9,558,906	186,798	42,645
Acetate of lime			7,470,670	3,316,740
Calcium carbide	..	.	6,909,960	6,457,816

Exports include reëports of foreign material. Imports of soda salts not given in quantities; values were $109,070 in 1914 and $150,012 in 1915. Potash salts do not include the crude salts used in fertilizer manufacture.

Imports and Exports of Raw Material for chemical manufacture, two months ended Feb. 28, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	3,126	1,764	15,916	1,008
Pyrites	140,887	82,672		..
Chrome ore	22,780	5,000		.
Magnesite	25,454	6,141	434	337

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported this years was 34,832 tons.

Imports and Exports of Fertilizing Chemicals, two months ended Feb. 28, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Kalnit	140,508	2,158		....
Manure salts	38,145	1,839	....	.....
Other potash salts	54,592	52,108	600	398
Nitrate of soda	57,213	48,092	1,174	5,225
Sulphate of ammonia	17,802	14,286	...	21
Phosphates	..		173,757	4,750

Exports include reëxports of foreign material. Some phosphates are imported, but are not given separately in the returns.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	May 1	June 1	$0.005
Andes Silver, Nev.	May 4	May 25	0.03
Belcher, Nev.	May 15	June 8	0.15
Best & Belcher, Nev.	May 12	June 1	0.05
Big Elk, Ida	Apr 15	May 15	0.001
Bobby Anderson, Ida	Apr 12	May 3	0.0025
Caledonia, Nev	May 11	June 1	0.05
Cedar Creek, Ida.	May 5	June 5	0.005
Consolidated Imperial, Nev	Apr 27	May 18	0.01
Con. Virginia, Nev	May 4	May 25	0.10
Contact Copper, Mich	May 15		0.50
Crown Point, Nev	May 17	June 8	0.15
Diam'field Black Butte, Nev	Apr 30	June 3	0.01
East Hercules, Ida., (post.)		May 15	0.001
Emerald, Utah (three instal.)		June 9	0.01
Exchequer, Nev	May 11	June 1	0.03
Florence, Ida	Apr 15	May 4	0.001
Gethin Le Roy, Utah	Apr. 21	May 6	0.01
Giant, Ida	Apr. 9	May 14	0.002
Houghton, Mich	May 25		1.00
Idaho-Los Angeles, Ida	Apr. 24	May 15	0.005
Idaho-Nevada, Ida	May 10	June 5	0.002
Ivanhoe, Ida	Apr. 10	May 10	0.002
Knight Christensen, Utah			0.13
Majestic-Idol, Nev	Dec 15	Jul 20	0.005
Mullan, Ida.	Apr. 24	May 21	0.002
Mountain Rose, Ida	Apr. 19	May 19	0.001
Nevada-Douglas, Nev.	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Hope, Ida	May 5	June 2	0.002
Pandora, Ida	Apr. 15	May 7	0.003
Raven, Ida.	May 15	June 14	0.0006
Samson, Ida (post.)		June 3	0.002
Sandstorm Kendall, Nev	Apr 1	May 6	0.01
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida.	May 15	June 15	0.002
Smuggler	Apr. 17	May 17	0.0025
Sunset, M. & D., Nev	Mar 27	May 3	0.015
Tarbox, Ida.	Apr. 26	May 28	0.0025
Virginia, Ida	May 10	May 29	0.02
Yellow Jacket, Nev	May 14	June 8	0.15

Stock Quotations

Sales at auction: 100 shares Victoria Gold, $27 lot; 5000 shares Victoria Extension, $50 lot; 2978 shares Yaqui Copper Co., $45 lot; 11,000 shares California Consolidated Oil Co., and 6000 shares Donaldson Mountain Mining Co., $10 lot.

OLO. SPRINGS Apr. 26		SALT LAKE Apr. 26	
Name of Comp.	Bid	Name of Comp.	Bid
ela	.05	Beck Tunnel	.06¼
anner	.01	Black Jack	.10
ipple Cr'k Con	.01¼	Colorado Mining	.11½
K. & N.	.05	Crown Point	.01¾
eter Jack Pot	.08¾	Daly-Judge	5.25
ton Con	.43¼	Gold Chain	.09¾
l Paso	1.10	Grand Central	.61
ndlay	.03¾	Iron Blossom	.76
ld Dollar	.02¾	Little Bell	.15
old Sovereign	.04½	Lower Mammoth	.05
abella	.19¾	Mason Valley	3.50
ck Pot	.06	May Day	.14
ale Sample	.02	Opohongo	.01½
rry Johnson	.05½	Prince Con	.43
exington	.008	**Seven Troughs**	.02
lary McKinney	.32	Silver King Coal'n	3.37½
armacist	.008	Silver King Con	1.85
rtland	1.18	Sioux Con	.03
ven B. H.	.03¼	Uncle Sam	.04
dicator	1.62	Yankee	[illegible]

TORONTO			Apr. 26
ile.	.02	Dome Exten.	.10
nagas	4.75	Foley-O'Brien	.24
erson Lake	.25	Hollinger	24.00
ht of Way	.05	**Imperial**	.06¼
neca Superior	1.37	**Jupiter**	.13
lver Queen	.01	McIntyre	.34
& Hudson Bay	7.00	Pearl Lake	.01
iskaming	.38	Porcu. Gold	‡.25
etlaufer-Lor.	.01	Preston E. D.	.02½
Dome	13.50	Rea	.12

SAN FRANCISCO			Apr. 26
nstock St.		Misc. Nev. & Cal.	
a	‡.04	Belmont	4.50
des	.02	Jim Butler	.90
lcher	.08	Lone Star	.08
t & Belcher	.04	MacNamara	.03
ledonia	.15	Midway	.18
llenge Con	‡.06	Mont.-Tonopah	.25
nfidence	‡.15	North Star	.17
n. Virginia	.03	Rescue Eula	.13
ld & Curry	.02	West End Con	.82
e & Norcross	.03	Atlanta	.11
n	‡.01	**Booth**	.14
ican	.31	C. O. D. Con	.05
idental	.79	Comb. Frac.	.13
ir	.05	Jumbo Extension	1.55
rman	‡.10	Pitts-Silver Peak	.12
osi	.01	Round Mountain	.11
age	.03	Sandstorm Kendall	.11
ra Nevada	.06	Silver Pick	.11
n Con	.20	Central Eureka	.19
llow Jacket	.19	So. Eureka	12.[illegible]

N. Y. EXCH. Apr. 26	
Name of Comp.	Clg.
Amalgamated	78½
Am. Sm. & Ref., com.	74½
Am. Sm. & Ref., pf.	106¼
Am. Sm. Sec., pf. B	82
Anaconda.	38¾
Batopilas Min.	1¼
Bethlehem Steel	144¼
Bethlehem Steel, pf.	114
Chino	48¼
Colo. Fuel & Iron	31½
Federal M. & S., pf.	34
Great Nor., ore., ctf.	37¼
Guggen. Exp.	64
Homestake.	116
Inspiration Con.	34¾
Mex. Petroleum	90¾
Miami Copper	28¾
Nat. Lead, com.	64
National Lead, pf.	109¼
Nev. Consol.	16¼
Ontario Min.	3
Quicksilver, pf.	1
Ray Con.	24¾
Republic I&S, com.	28½
Republic I&S, pf.	85½
Sloss-Sheff'd, com.	37
Tennessee Copper	35
Utah Copper	71¼
U. S. Steel, com.	7¾
U. S. Steel, pf.	108¾

BOSTON EXCH. Apr. 26	
Name of Comp.	Clg.
Adventure	4
Ahmeek	275
Alaska Gold M.	39
Algomah	¾
Allouez	57½
Am. Zinc	30¼
Ariz. Com., ctfs.	8¾
Bonanza	.65
Butte-Balaklava	4
Butte & Superior	65½
Calumet & Ariz.	77
Calumet & Hecla	540
Centennial	14
Cliff	14
Copper Range	51½
Daly West	3¾
East Butte	14½
Franklin	12
Granby	92¼
Hancock	21
Hedley	‡26½
Helvetia	.50
Indiana	8½
Island Cr'k, com.	‡46¼
Island Cr'k, pfd.	90¼
Isle Royale	30½
Keweenaw	4½
Lake	16¼
La Salle.	8¼
Mass	11¼
Mayflower	7½
Michigan	2½
Mohawk	81
New Arcadian	12½
North Butte.	37½
North Lake	3¼
Ojibway	3
Old Colony	6½
Old Dominion	57½
Osceola	90
Quincy.	92
Santa Fe	‡1½
Shannon	11
Shattuck-Ariz.	32
Superior	39½
Superior & Bost.	3½
Tamarack.	44
Trinity	6
Tuolumne.	.58
U. S. Smelting	37½
U. S. Smelt'g, pf.	46
Utah Apex	3¼
Utah Con	14
Victoria.	3¼
Winona	4½
Wolverine	68
Wyandot	2 3/16

N. Y. CURB Apr. 26	
Name of Comp.	Clg.
Alaska Juneau, w. i.	15¼
Alta Con	.87
Beaver Con	.40
Big Four	.05
Blue Bell	.04
Braden Copper	8½
Buffalo Mines	.50
Can. Cop. Corpn.	1⅛
Can. G. & S.	.04
Carbon	‡.50
Cashboy	.09
Chambers Ferland	.23
Con. Ariz. Sm.	1
Con. Coppermines	2½
Davis Daly	1½
Diam'field-Daisy	.08
Dia. Black B.	.03
Florence	.59
Goldfield Con.	1 9/16
Goldfield Merger.	.30
Greene Cananea	35¼
Kerr Lake	5
La Rose	9/16
McKinley-Dar-Sa.	.32
Mines of Am.	2¼
Nevada Hills	.25
New Utah Bingham	1¼
Nipissing Mines	6
Ohio Copper.	.26
Oro	.11
Pacific Smelt	‡.09¼
South Utah	¾
Stand'd Oil of N. J.	404
Standard S. L.	1.68¾
Stewart	1¼
Tonopah	7½
Tonopah Ex	3¼
Tonopah Merger	.41
Tularosa	3/16
West End Ex	.07
Yukon Gold	2¼

BOSTON CURB Apr. 26	
Name of Comp.	Bid
Alvarado	60
Bingham Mines	6¾
Boston Ely.	.40
Butte & Lon'n Dev.	.26
Calaveras	2
Calumet-Corbin	.13
Chief Con.	.95
Corbin	.90
Cortez	.30
Crown Reserve	.90
Eagle & Blue Bell	1 7/16
First Nat. Cop.	2¼
Houghton Copper.	4¼
Iron Cap Cop., pf.	5½
Majestic	.35
Mexican Metals	20
Nevada-Douglas	.90
New Baltic	4½
Oneco	2½
Raven Copper	‡.07
Smokey Dev.	.25
So. Lake	8¼
Tonopah Victor	‡.17
Tretheway	.12
United Verde Ext.	¾

LONDON	Apr. 15		
Alaska Tre'dwell	£7	7s	6d
Camp Bird	0	6	3
El Oro	0	7	10
Esperanza	0	9	0
Mexico Mines	3	16	3
Oroville	0	11	6
Philippine Dr	1	0	0
Santa Gert'dis	0	7	6
Tomboy	1	4	6
Tough Oakes	0	14	3

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519		27.416	26.958	
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		[illegible]		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	[illegible]	[illegible]	65.719
February	14.491	14.394	65.259	[illegible]	[illegible]	[illegible]
March	14.131	14.787	64.276	[illegible]	[illegible]	[illegible]
April	14.211		64.747		[illegible]	
May	13.990		63.182		[illegible]	
June	13.603		61.336		[illegible]	
July	13.223		60.540		[illegible]	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		‡	
December	12.801		56.841		‡	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154		163.963	
May	33.360		150.702	
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.30			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810		3.688		18.225	
May	3.900		3.808		18.503	
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.2[illegible]	21.413	39.819
March	5.250	8.541	5.100	8.3[illegible]	21.460	44.141
April	5.113		4.9[illegible]		21.569	
May	5.074		4.924		21.393	
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.770		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90		13.90		14.1[illegible]	
May	14.90		13.90		14.[illegible]	
June	14.90		13.90		[illegible]	
July	14.90		13.90		[illegible]	
August	14.90		13.90		[illegible]	
September	14.90		13.90		[illegible]	
October	14.84		13.75		[illegible]	
November	14.59		13.15		[illegible]	
December	14.70		13.1[illegible]		[illegible]	
Year	$14.88		$13.78		$14.01	

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Prospecting Methods at Fairbanks

By Hubert I. Ellis*

SYNOPSIS—Mining and prospecting appliances in the placer camps of Alaska and the Yukon are often identical, due to the fact that low-grade gravel is the rule and exists almost everywhere, success now depending more on close management than mining technique. The methods and devices used are described in detail.

The crucial point in mining is the finding of the orebody, and this is especially true of placer mining as carried on at Fairbanks. Once pay has been found, an ingenious man, with or without previous mining experience, is able to extract the pay-dirt with the aid of competent foreman. His surface plant is usually sim- ar to that of his neighbor, and his methods of opening and mining follow well-defined practice. There are riations in details to meet special conditions and to it the operator's individual preferences, but these are s important than in other branches of mining. One an will do the same work much more cheaply than other, but this is as much a matter of executive as mining ability.

Appliances Required for Prospecting

At the present time much prospecting is done with gular working plants, since the decrease in the number of mines has released a large amount of machinery that can be rented or purchased cheaply. Many of the smaller outfits, or "prospecting rigs," have been taken to Iditarod, Ruby, Shushana and other of the newer camps, so that now there are comparatively few of these available at Fairbanks, and such as there are sell for a relatively much higher rate than the more numerous rigs suitable for actual mining.

In the early days pioneer methods of prospecting were the rule, and although these have now largely gone out of use they will be described first, since they still find application in many outlying districts.

The equipment of the first prospectors to test the Fairbanks placers was far from elaborate. Aside from cooking utensils, sleigh, etc., the essential tools were an axe, saw, claw hammer, blacksmith hammer, wood chisel, brace and bit, nails, pick, shovel and gold pan. Where the depth to bedrock was such as to preclude the possibility of throwing the material from the hole, about 14 ft. or more—depending on the strength and awkwardness of the shoveler—a coil of ¾- or 1-in. rope and a windlass hook were included.

At the surface in the valleys of this district th almost invariably a layer of muck, consisting chiefly of decomposed vegetal matter and ice, and this in thickness from a few inches to as much on Vault Creek. If the muck is comparat

Panning, the Original Prospecting Method from sand and undecomposed roots and limbs, it is brittle and yields readily to the pick. With a shaft 20 in. wide and 5 ft. long—about the smallest in which a man can use pick and shovel to advantage—sinking can be done at the rate of 4 to 6 ft. per day. As the top of the gravel is approached, the proportion of sand and pebbles in the muck increases until the material requires thawing. For this purpose wood fires may be used where boilers for steam thawing are not at hand. Coal has been used by prospectors in the Nenana district and elsewhere and is said to be much superior to wood, which burns up too quickly to give the best results.

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Wood Fires for Thawing Ground

Wood fires for thawing, by means of which the heat generated by the combustion of the fuel is applied directly to the material to be thawed, and not indirectly through the medium of steam, are rarely used at present except in outlying districts. The steampoint, which was invented at Dawson, is now universally used, and will be described later.

Wood fires underground generate large quantities of poisonous gases, including the deadly carbon-monoxide. Many miners have been "knocked out" by them, but few deaths have resulted. Efficient ventilation is difficult to obtain, especially in summer, when the surface air is warmer than the air underground. In winter, conditions are reversed and the colder and heavier surface air readily replaces the warmer mine air. During the warm season the disagreeable odor of the wood fire is evident months afterward, although the gases do not remain so long in poisonous quantities. The usual practice when wood fires were used on an extensive scale, as they were at Dawson prior to the invention of the steampoint, was to work from two shafts, which might or might not be connected underground. Mining was carried on at one face while the face in the other shaft was being thawed.

In laying the fire it is arranged to be lighted quickly to facilitate a quick getaway. Kindling and shavings are first placed at convenient intervals along the face and the coarse fuel is piled around and on these so as to leave openings for lighting them. The whole is then "blanketed" with wet moss, large rocks or other suitable material and the kindlings lighted by candle. If the fire is properly laid the lighting need consume no more time than "spitting" a round of holes in hard rock mining.

The depth to which a fire will thaw depends on the composition of the material—that is, whether it is loose gravel such as commonly occurs in river beds, or whether it contains a large proportion of the clay or "sediment" characteristic of the paystreak in Alaska and the Yukon. Other factors influencing the depth of a single thaw depend on the opportunity for confining the heat and on the skill with which the fire is laid. Six to 10 in. is probably a fair average in the "tight" pay gravel, although much more is possible in looser material.

While wood fires, in the absence of anything better, were a fairly serviceable means of thawing at the face where the water from the frost in the gravel had an opportunity to drain away, they were inefficient in shaft sinking. The water would collect at the extreme bottom of the shaft and tend to quench the fire and at the same time to inhibit thawing in a downward direction by acting as an insulating material. In one instance the writer found that an advance of 8 in. a day was the best that could be made, and that in fairly loose gravel. A substitute method that has found some application in shaft sinking consists in heating large rocks in an open fire at the surface and dropping them down the shaft; but since all the rocks have to be hoisted by windlass each time, this method has never attained wide popularity, especially with the windlass operator.

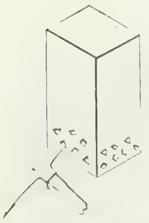

FIG 1
HEATING PICK IN EMPTY KEROSENE CAN

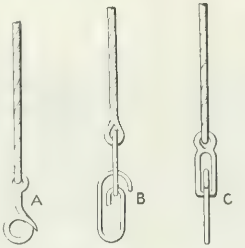

FIG. 2
A-PIG TAIL WINDLASS HOOK
B & C-AUSTRALIAN "TUMBLING" HOOK

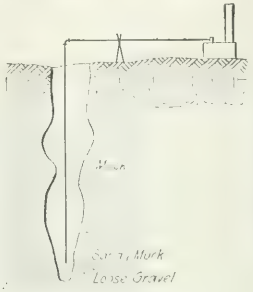

FIG. 3
CONTOUR OF SHAFT THAWED IN MUCK, USING SINGLE STEAM PIPE

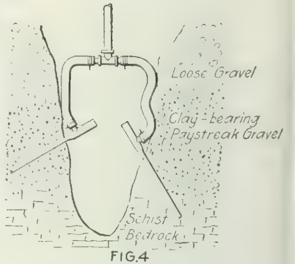

FIG. 4
METHOD OF STARTING DRIFTS AT BOTTOM OF SHAFT

Various Methods of Testing Gravel Value

When the shaft has passed through the upper gravel which is loose and usually barren, and the heavy, sticky stratum next to bedrock is reached, the gold pan i brought into play for testing purposes. The gold is estimated by eye or is weighed on a pair of simple balances such as may be held in the hand. Grain, pennyweight, and ounce weights are used, but weights stampe with the value in cents of an equal weight of gold o an average fineness are also employed. The latter hav the advantage of reading directly, but they have th disadvantage of failing to allow for any variation i the value of the gold. For most of the gold mined a Fairbanks a grain is worth about $3\frac{1}{2}$ to $3\frac{3}{4}$c. Th average prospector becomes so familiar with the gol from a particular claim that he can estimate the valu of a pan to the fraction of a cent without weighing.

The rocker and the "long tom" are little used by th prospector for testing, although resort is frequently ha to them to obtain "grubstake money" during winter, whe sluicing is impossible. Sometimes a piece of sheet iro properly punched with round holes is included in th outfit, but frequently a joint of stovepipe is remove and rolled out to do the duty as rocker plate. Details of construction of the rocker may vary considerably, but Fig. 5 shows the essential features of a popular type. At *A* is shown a vertical-longitudinal section. The canvas strips are sewed so as to form a series of small tucks or pockets opening upward, designed so as to catch the gold and concentrates. Each strip, of which there are usually three, is tacked to a light wooden frame and can be removed quickly for washing the concentrates into the gold pan. The bottom sluice may or may not be equipped with gold-saving devices, depending on whether the rocker is used only for testing an occasional wheelbarrow of dirt or as a gold-saving machine in actual mining. Riffles, blankets or amalgamated plates may be used, but these are rarely employed at Fairbanks in prospecting. At *B*, Fig. 5, is shown the removable hopper and screen. The size of hole varies with the material to be rocked, but is usually ¼ to ½ in. The bailer employed in connection with the rocker is shown at *C*, and consists of a half-gallon or gallon pail with wooden handle inserted as illustrated.

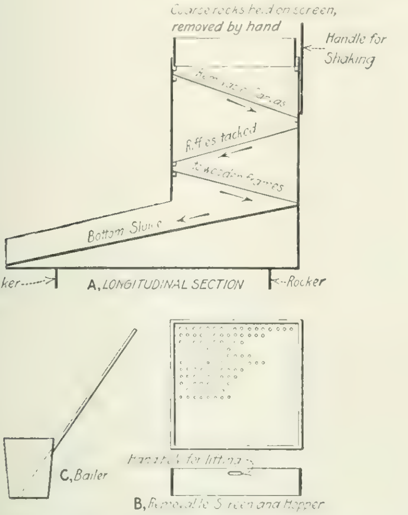

FIG. 5 ROCKER USED FOR TESTING AT FAIRBANKS

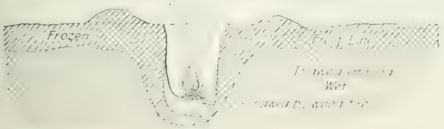

FIG. 6 FREEZING METHOD OF SINKING IN THAWED GROUND

AN IMPROVISED FORGE

Picks require frequent sharpening for either muck or gravel. For muck a large, square point is preferred, since this gives a better breaking effect on the brittle material than the sharper point used for gravel. In the absence of forge and anvil the steel may be heated in a tin can punched with holes in and around the bottom to give a good draft, and a smooth, flat rock may be substituted for the anvil. A strong fire of fine wood and chips is built in the can and when a good bed of coals has been obtained the picks are stuck in through the sides as shown in Fig. 1.

The windlass is simply but strongly made and is set on a cribbing of poles to give dumping room. In driving, after bedrock has been reached, hoisting may be done in balance, or two men may be used on the windlass. The bucket is usually constructed of 1-in. rough lumber and is shaped like the inverted frustum of a pyramid, its capacity being 7 to 10 pans, or about 1 to 1½ cu.ft. of material in place. Two types of windlass hook are used—the "pigtail," *A*, Fig. 2, and the Australian or "tumbling hook," shown at *B* and *C*. The Australian hook never comes unhooked and has the merit of safety, which is an important point in sinking, but the pigtail is better known and is more frequently used. For deep holes ¼-in. steel cable is used instead of hemp.

BOILERS FOR PROSPECTORS

A prospecting outfit slightly more elaborate than the one described in the foregoing includes a small portable boiler, pipe-line, hose and steampoints. The lightest and most convenient boilers from the standpoint of transportation are of the pipe or of the porcupine type. The pipe boiler used consists of a framework of pipes and fittings inclosed in a light sheet-iron box to confine the flames. The porcupine has a vertical central tube about 5 or 6 in. in diameter, with shorter and smaller pipes radiating in all directions, like "quills upon the fretful porcupine," the whole being inclosed in a sheet-iron box like that of pipe boilers. Both types are equipped with steam gage, water gage and ½-in. injector. The pipes carry the water and steam, and the play of the flames around them gives large heating surface and quick action.

These boilers are so light that they can be carried around with ease by two men, or even by one man, and they can be set up in an instant. The water must be drained each night in winter to prevent freezing and bursting of pipes, but the capacity of the pipes is so small that only 10 or 12 gal. are required for refilling—an amount that, in the absence of running water, can be thawed in the cabin while breakfast is preparing. After the fire is started it takes only a few minutes to get steam to a working pressure of 90 or 100 lb. Their greatest drawback is the constant attention required, owing to the limited amount of steam and water they can hold. At best the pressure fluctuates violently and in a manner calculated to alarm one unaccustomed to such vagaries; but in spite of the rough usage accorded them, they stand the strain well and serious accidents are almost unknown. Pressures of 200 or 300 lb. without disaster are reported, and the story is told of one "chechako" who, when asked by his partner in the shaft how much pressure there was, replied, referring to the pointer on the steam gage: "This thing's gone clear around once and half way around again. Is that enough?"

Boilers of the upright type, of 1-hp. capacity, are sometimes used for thawing, but they weigh about [illegible] lb. and are too cumbersome to move, especially in summer. None of these small boilers can be used to advantage with a steam hoist, since all the steam is blown out before the bucket reaches the surface. They will run about two points successfully and may be used with four. They are set up in the open, and it is only rarely that other shelter than a brush windbreak is constructed.

Mining in Thawed or Frozen Ground

When steam is available the muck may be thawed, or it may be picked. Each method has its advantages, depending largely on the proportion of ice in the muck and the readiness with which it yields to the pick. If it is to be thawed, a pipe carrying live steam is dropped down, thawing its way rapidly through the muck until it reaches gravel, unless the depth is too great. Two or more 16-ft. lengths of pipe have been joined in some instances where there was an unusual depth of muck, but this practice is of doubtful advantage in sinking a prospect shaft.

The steam, working outward and upward, thaws the surrounding material for a variable distance around the pipe. Since it usually passes through strata of varying composition, it thaws a hole of rather uneven contour, but larger toward the top than toward the bottom, as shown in Fig. 3. At one point it may have a diameter of 10 ft., while a few feet one way or the other it may be so small as to require enlargement by picking to permit the passage of the bucket. By using four or more pipes, as is done in sinking a working shaft, this tendency to inequality is largely obviated. Muck containing a large proportion of ice, when thawed becomes a thin mud with an odor reminiscent of the farm pigsty. After standing for some time much of the water collects on top and is removed by bailing with butter barrels holding 12 to 25 gal. When the muck has been cleaned out, the gravel is thawed by means of one or more points, one being commonly used where hoisting is done by windlass.

Use of the Complete Outfit

A complete prospecting outfit such as is now largely used at Fairbanks includes most of the tools that are required in actual mining, such as boiler, friction hoist, ginpole, guys, trolley cable, trip-line, hoisting cable, overhead carrier, complete blacksmith outfit, pipe dies, steamfitter's tools, blocks and sheaves, bucket, pump, headframe, wheelbarrows, six or more steampoints, crossheads, steam-hose, picks, shovels, point hammers, turning bars, and other less important articles. A circular saw for cutting wood and cribbing is a part of almost every outfit. Such a "plant" could probably be purchased at Fairbanks for from $600 to $1200, depending on terms and state of preservation, and could be used for actual mining as well as for prospecting.

The procedure with a plant of this kind is slightly different from that with the smaller outfits described in the preceding. The site for the shaft having been chosen, the boiler and engine are placed in position, the boilerhouse is built, and the shaft is sunk a few feet by picking to get a start. Then the headframe is constructed, the ginpole erected and sinking commenced again. The muck may be picked, but it is usually thawed; sometimes it is shattered by blasting and then picked. If it is summer the upper 10 or 15 ft. of the shaft is lagged with round-pole cribbing and filled with moss and gravel between the timber and the frozen wall; but if it is winter no timber at all is required.

The shaft is sunk several feet into bedrock to give a bucket hole and sump and to insure its being low enough to drain the tunnels driven over the uneven bedrock surface. The station is not elaborate but consists simply of a slight enlargement of the shaft. If intended for use in summer, a square set may be put in at the bottom and cribbing carried from this to the top of the gravel, to avoid danger from rocks thawing loose and dropping on the workmen below.

Water from ice in the gravel and from condensed steam used in thawing usually drains by gravity to the sump at the shaft, from which it is pumped to the surface. In case bedrock dips unexpectedly in any direction, usually downstream—and water will not drain from the face to the shaft—a ¾- or 1-in. siphon may be used to remove the water from a temporary sump near the face to the shaft. In working on a small scale, siphons or injectors are sometimes used to raise the water to the surface; but these require so much steam for the work done that they are rarely used for this purpose except for shallow ground.

Drifts are run across the creek and up- and downstream as far as prospects indicate is desirable. The ground is carefully tested, as work proceeds, by panning, samples being taken at intervals up and down the face, or a single pan representing the entire face. Bedrock and roof are tested with special care to insure that no pay is overlooked. When the prospector is uncertain as to the value of the ground, he takes a wheelbarrow sample from the face and rocks it, panning down the concentrates and weighing the gold recovered. In some instances the gravel is sluiced as hoisted or is dumped in a pile separate from the known waste and sluiced in the spring. This procedure gives results that are far more accurate in the mass than those obtained by panning and rocking and is useful in connection with them; but it has the disadvantage of lumping together everything from several faces of varying character and richness.

Calculating Panning Results

Different prospectors figure the results of their panning differently. Most miners at Fairbanks compute on a basis of seven pans to the cubic foot of material in place, but this is only an approximation, five pans being used as the factor by others. The gold pan is not heaped up as much as at Dawson and elsewhere, one heaping load on a No. 2 round-pointed shovel being considered a panful; and seven pans to the cubic foot fits this practice closely. Knowing the depth of pay and the value per pan, the prospector computes the value of his ground to the square foot of bedrock. A 5-ft paystreak running 3c. to the pan is therefore said to go 3 × 7 × 5 = $1.05 to the square foot, which is very good ground at Fairbanks at the present time, but was considered low grade a few years ago. The bedrock square foot is always used in computing returns at Fairbanks and at most other placer camps in Alaska, since it costs little more to mine a 6-ft. paystreak than it does to mine one only 2 ft. in depth. More material mus be handled in the former case, but the cost of developing and equipping the mine is the same in both instances, and it is impracticable to work a crew in a space less than 3½ or 4 ft. high, and of doubtful advantage to carry the roof less than 5 ft. above the floor. Hence it is of more importance for the mine to know the amount of gold over a square foot of bedrock than to know the amount in a cubic yard of grave without knowing the depth of the paystreak.

A wheelbarrow load contains 11 to 13 pans or shovelfuls, or from 1½ to 2 cu.ft. of material in place. It is usually assumed for comparative purposes that three wheelbarrow loads are required to strip 1 sq.ft. of bedrock, which assumes that the paystreak is 5 to 6 ft. thick. A record is kept of the number of wheelbarrows hoisted daily in stoping the pay, and this figure divided by three gives the number of square feet of bedrock stripped. When the cleanup is made it is therefore possible to compute the average value of the ground. In practice this method probably gives high results in many instances, since it frequently takes less than three wheelbarrows to strip a square foot, and this decreases the computed number of square feet entering into the cleanup and correspondingly raises the value per foot.

It is found in working that the value of a given block of ground varies greatly in short distances, that the amount of material in the pan varies, that the size of the wheelbarrow load varies and that few miners can estimate their pay within the narrow limits possible with other branches of mining and methods of sampling. It could undoubtedly be done were it desirable to expend the requisite time and money, but it is not commercially practicable. If he is an experienced man, however, the prospector can usually tell hether he has ground that will yield a profit; but the any failures each year indicate the prevalence of over-timating. Sometimes the value of the ground is unerestimated; but this is much more common with rich ay than with low grade, the operator feeling that here is little need for careful testing as long as he nows he has pay. Winter dumps have been known to uice three or four times as much as expected.

Using the Rocker

Sinking a Prospect Shaft

Concentration of Gold in Spots

One feature of the Fairbanks deposits that has been e cause of many disappointments is the concentration gold on spots of high bedrock. The bedrock surface often irregular over considerable areas, and it is a le that the spots where bedrock is abnormally high e richer than the surrounding lower areas. This is pecially true of isolated knobs of resistant bedrock here most of the surface is fairly regular, and it frequently happens that such spots indicate pay where the st of the deposit is too low to yield a profit.

In numerous instances the prospector, on finding one of these rich spots by accidentally sinking the shaft squarely on top of it, has installed an expensive and unjustified surface plant, usually on credit, and opened up the ground on an elaborate scale for summer mining. Only a few cleanups are needed to show him his error, but he is already thousands of dollars in debt to merchants, banks and laborers. Similar disasters have occurred with more excuse where the main tunnels, parallel with the boundaries of the paystreak, follow a narrow rich streak. Several cases are known where a single thaw on either side of a drift showing rich pay has run into material too low grade to work at a profit.

Thorough prospecting before installing a plant and opening the ground for actual mining operations would prevent such failures as these, but would require duplication of workings, since a shaft once sunk through frozen material cannot be economically enlarged, and, what is usually regarded as more serious, it would involve loss of time. It takes at least three or four months to put a block of ground in proper shape for summer mining and practically all of the sluicing season to work out the ground around a single shaft. If everything is not ready when water runs in the spring, valuable time is lost, and some of the block, usually the portion that is nearest the shaft, and therefore most cheaply mined, must be left. During the winter the plant must be moved to a new area or else lie idle; so a small amount of pay left at several isolated faces is often lost beyond redemption. It is, of course, possible to mine this as a winter dump after sluicing ceases, or to sublease it to two or three men to be worked on a small scale from the same shaft; but in either case the profit to the operator is much less than if he were able to mine and sluice it along with the rest of the block. On this account there is some justification for the man who, when he finds at a later date than Feb. 1 what appears to be good pay, blindly puts on a working plant and trusts to luck. Usually he will win; but sometimes dismal failure is the result.

So much prospecting has been done and paystreaks have been so well lined up that in many cases it is now less a matter of finding pay than of winning a profit from known low-grade material. Consequently it is necessary to save every dollar possible, and prospecting is carried on with full working equipment, every step being taken as if pay were actually known to exist. The work then proceeds exactly as in opening the ground for extraction.

CHURN DRILLS COMING INTO FAVOR

Churn drills for prospecting placer ground have never been popular with the miners at Fairbanks, but they are coming into use more and more every year. They are particularly valuable where it is impossible to sink a shaft on account of water—which is usually the case with thawed ground. The methods have been described so often with regard to other fields that it is unnecessary to do so here.

Practically all the gravel that has been mined at Fairbanks was permanently frozen, but thawed ground occurs in the paystreak in some places, and various attempts have been made to work it. Even though the heavy item of expense for thawing frozen material is avoided in working thawed ground, it has been found on Ester Creek that the cost of pumping and timbering is so great that it is easier to work $1 ground that is frozen than $3 ground that is thawed.

Shallow deposits are frequently thawed all the way to bedrock in summer, and the lower portion may remain thawed throughout the winter. In prospecting these in summer, and sometimes in winter, it is necessary to drive a "bedrock drain"—that is, a tunnel of less grade than the bedrock surface, started at such a point downstream that it reaches bedrock about where it is desired to prospect.

In sinking through thawed ground in winter, a freezing method may be employed. The gravel is allowed to freeze ahead of the shaft and is then re-thawed with wood fires, care being taken not to break through the frozen shell into wet, or thawed, material. The method is illustrated in Fig. 6. By using great care shafts may be sunk in this manner in the middle of a stream of running water; but resort is rarely had to the freezing method of sinking at Fairbanks, probably because most of the shallow deposits are permanently frozen except where the insulating covering of moss and muck has been removed by ground-sluicing or otherwise. This insulation is so perfect that the writer, in staking claims when the thawed layer had reached its maximum depth, about the first of September, has frequently found it impossible to drive the stakes down in muck far enough to make them stand upright—and it will be remembered that temperatures of 85° to 90° F. in the shade are not uncommon during the summer.

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Liberty Bell Mine's Safety-First Dinner

DENVER CORRESPONDENCE

A "Safety-First" dinner to 135 of his mine and mill crew was recently given by Manager Charles A. Chase of the Liberty Bell mine at Telluride, Colo. Several experienced employees and mining men and the company physician talked to the guests, warning them against thoughtlessness and carelessness in connection with mining operations. The motto on the menu card was "Good food is a start towards health and safety." On the back of the menu were printed these words: "Liberty Bell Gold Mine Creed. What I will do for the New Year: I will think before I act. I will pick down loose ground before starting other work. I will sprag dangerous ground, to hold it until I can permanently timber it. I will keep the chute holes properly closed. I will keep my ladder in repair and clean. I will keep my station clean and safe. I will keep my part of the track clean and not leave powder and caps exposed in the drifts. I will remember that my life and health are worth everything to me. I will remember that my carelessness may endanger other men besides me, and may make widows and orphans. I will remember that I cannot be counted a good miner if careless. I will complain loudly if someone else endangers me. I will talk freely to the boss about bad places and get his advice. I will do all I can to make Liberty Bell the safest and best mine to work in." It is the intention of the management to make this dinner an annual event.

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Sudan Gold Field Co., Ltd.

The Sudan has entered the list of dividend-paying mining districts. We do not know how long it took the ancients who worked this gold field to secure a dividend, but it has taken the moderns about 10 years to reach this point. On Mar. 9 the Sudan Gold Field Co., Ltd., declared a 10% dividend and at the annual meeting the chairman announced that the ore reserves at the end of 1914 were sufficient to show a total profit equivalent to the issued capital of the company. In 1914 a profit of approximately £20,000 was obtained from the crushing of 16,456 tons of ore, yielding 14,691 oz of gold. The modern exploitation of the Sudan began about 1904, when the Sudan Gold Field, Ltd., wa organized. This company was reconstructed in 1908 and had a prospecting license over about 22,000 sq.mi of country embraced between 20° and 22° north latitude and 32° and 34° east longitude. A mining lease for 21 years was taken on the Om Nabardi section and development work begun. A 10-stamp mill with a cyanide adjunct was built and 30 miles of light railway constructed to connect the mine with the Sudan Government Ry. Portions of the Om Nabardi mine, although at times highly encouraging, have not realized the hope that were entertained regarding them, but in the Garland and Glenconner sections the results have been more satisfactory. The deepest workings are at the 700-ft. level west of the Llewellyn shaft, but results here were disappointing. Some rich ore was encountered during prospecting above the 240-ft. level of the Robert Taylo section, some of the assays being as high as 5½ oz. o gold. The mining work is complicated by repeated foldings of the "reef"; but a vigorous program of development has been under way, and the superintendent, H B. Williams, wrote on Feb. 25 that the "present developments were adding a large tonnage to the availabl supply, and prospects were more encouraging as to th permanency of the reefs." The Sudan company contemplates a reorganization of its milling plant and i preparing to treat about 11,000 tons of old slimes. I is extremely gratifying to record that the Sudan Gol Field Co., Ltd., has been able to make a return to i shareholders from their investment in this ancient gol field.

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Quicksilver Produced in Italy in 1914 amounted to 1,072 640 kg., according to "Rassegna Mineraria." The Monte Amiata company was the largest producer, being credited wit 740,025 kilograms.

The Chilean Nitrate Industry

By Mark R. Lamb

SYNOPSIS—The nitrate beds are thin and irregular and much judgment is required in prospecting and mining. The nitrate is extracted cheaply by series leaching and crystallization; but the recovery is not high. Improvement may be effected by slime treatment and more economical evaporators.

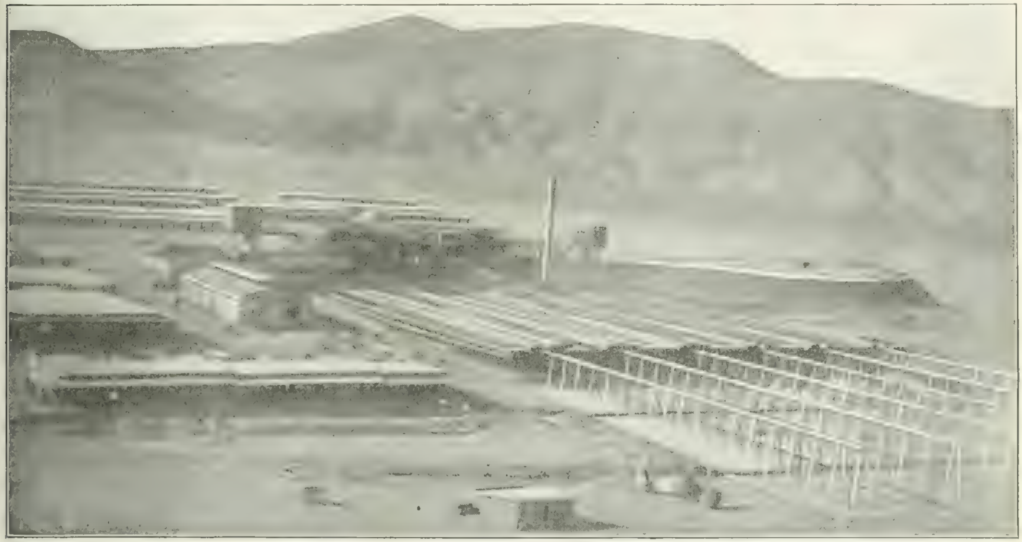
The principal industry of the west coast of Chile is the mining of nitrate. The war has paralyzed this industry in some of the districts, Germany having been one of the important markets. Now that nitrate has been declared a contraband of war it will become increasingly difficult to maintain the shipments, particularly to neutral countries near Germany and Austria. Lately a few of the manufacturers and exporting houses have begun to arrange for shipping direct to the United States.

Nitrate Production about 3,000,000 Tons Annually

The total annual production of nitrate was 3,000,000 tons. Nitrate is worth in the United States $40 per ton. There is but one American company among the 170 producers. This is a fine record for a mining nation!

Nitrate occurs as an impure deposit of the salt of sodium mixed with various other salts and with rock and earth. The salts are dissolved in hot solutions, and by crystallization the nitrate is separated 95% pure. The process is not expensive, and attempts to reduce costs under the present process will not meet with much success. But the process is wasteful, so that improvements must come along the line of attempting a higher recovery.

Lately the larger companies have become interested in the application of modern methods of reduction and handling of materials, so that conveyor belts, large Gate crushers and Diesel engines are being introduced. The latest step has been the trial of a Butters vacuum filter. This filter will make as big a saving in the nitrate industry as it did in gold and silver, and it will do it more rapidly, as the development is already done.



A New Nitrate Oficina in the Chilean Desert

Series Leaching Practiced

As at present operated, the nitrate plant extracts the salt by series leaching, in this respect differing from the multiple leaching of the cyanide process. Briefly, the cold saturated solution which is recovered from the crystallizing tanks is leached through further quantities of the raw ore while heated, being sent from one leaching tank to the next until it is saturated at boiling point, when it is delivered to the cooling and crystallizing tanks. The flow of the solution through the series is from treated to untreated ore, so that as the solution approaches saturation it has increasingly rich material to work upon.

The ore is crushed coarse to avoid slime, and it is this coarse crushing and the slime formed that carry the present losses. A finer crushing will permit a better extraction, and if the slime is separated it will give up its nitrate more readily even than will the coarse material. The present way is to crush to 2 or 3 in. The [illegible] leaching tanks are 9 ft. deep and wide and [illegible]. The steam coils are placed around the sides of the tank, which allows a clear space in the center for [illegible]. The loading and emptying of these boiling tanks are done by contract, and cheaply, considering that it is all hand work, and the digging of the caked mud from around the steampipes is hard and slow work.

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*Mining engineer, Huerfanos 1157, Santiago, Chile.

Finer Crushing Involves Leaching Changes

Any new process aiming at a higher extraction will crush more finely, and since fine-crushed material could not be leached by the present method, the present type of boiling tanks will be unavailable. The difficulty is to find the substitute. The first thought is to adopt a continuous-leaching system, using any of the well-known classifiers. The problem is to operate in such a way that no excess of water is added. For example, assume an ore having 20% of nitrate. The desired result is a saturated boiling solution at one end of the series and a washed sand at the other. With plenty of time, a pencil and paper this is an interesting problem for a week-end in Jersey.

There is the alternative of making—not a saturated solution, but one as near saturation as possible, evaporating the excess of water in highly efficient quadruple-effect evaporators or in Prache & Bouillon single-effect systems.

A test is now being made along the line of screening out the finer material, sliming it and filtering, using warm solutions and getting the concentrated solutions by evaporation. If crushing freed all the slime, the problem would not be difficult, since a simple screening would make a clean separation; but the nature of the material is such that even after careful dry screening the addition of water instantly forms mud with material which has been cemented together with salts. No amount of screening will separate all the slime.

With the present system, due to the loss in the tailings of 50% of the nitrate, it is necessary to sort and treat only the higher-grade material; so that it is difficult to suggest better methods of mining. But when, because of improvements in the system of dissolving and washing, it becomes possible to extract practically all the nitrate, and therefore treat lower-grade material, some of the companies will be able to use steam shovels and abandon hand sorting. One of the heavy losses of nitrate occurs in mining, where none of the fines are saved. With soft ore this is a large and serious loss that will be changed to an important gain.

Poor Crushing Arrangements

The present system of crushing consists of a series of Blake crushers—10 or more, measuring 12x24 in.—which are placed below an inclined platform where the ore is dumped and stored. Note that it is the uncrushed material that is stored. This ore is brought to the plant during the day, and is crushed as required in the boiling tanks. With 10 crushers are required 10 crusher feeders, and where no conveyors are used, 10 trammers for the crushed ore. All this will be avoided when a single gyratory crusher is used to take all the ore as fast as it can be hauled by mules and locomotives, whence the crushed material will be stored and drawn as required. These changes are being made even in plants where there is no present intention of changing the usual system of extraction.

A curious sidelight is thrown on the crushing end of the plant when it is known that the Blake crushers, though provided with steel jaw plates, are frequently found of too light section, even if they were made of steel, while the material actually is cast iron. The result is constant breakage of pitmans and frames while crushing ore that should be classed with limestone as a rule, though there are occasional hard rocks. As the nitrate ore reaches the crushers in pieces not larger than 12 in., a large feed opening is not required; but as an average capacity of the plants is 1000 tons of ore per day, which should be crushed in 10 hr., the crusher should be moderately large. As operated at present, the dumping of the ore on the incline and the handling to the crusher and into the cars make so much dust that it is the practice to sprinkle the ore before crushing. This sprinkling is never sufficient to cause packing in the crushers, and would not be required with a gyratory crusher.

Deposits Irregular

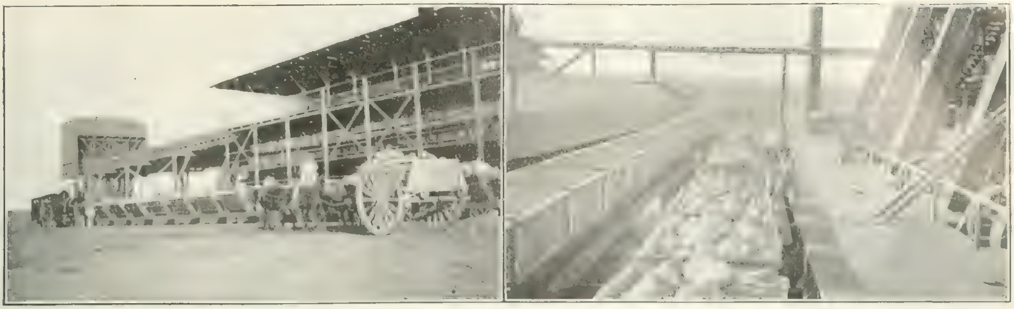
The ore occurs in thin beds spread over large areas. Sometimes it is within a foot or two of the surface, and at other times it is 20 ft. deep. There is nothing regular or systematic in the occurrence of the profitable nitrate-bearing material, so that each small area must be examined and worked with little relation to other deposits. Contracts are let to the miners, who have to blast the ground and sort and cord up the ore. Other contractors load and transport the material. Thus it is, since all are paid on a basis of the value of the material, that a contractor may run into lean ground and abandon that particular working, perhaps covering up the unworked ground with the waste and fines from another working face.

Mining is a precarious business at best and requires more constant care and attention than any other part of the business. Before the mining of any particular area can be decided upon it is necessary to sample it thoroughly, and the question always arises as to how thoroughly the sampling is to be done—that is, how close together the sample pits shall be dug. With shallow deposits it is easy to decide that the pits should be no further apart than 100 ft., but with deep-lying deposits, where the sampling should be, if anything, more accurate, the temptation is to space the holes farther apart. As these holes are dug by hand the cost is rather high, so that the success of the sampling depends largely on the good judgment of the man in charge of the field work. Of late air drills have been tried for the sampling, and also for the breaking of the ground in mining. When the work is done by hand the holes are made large enough to contain a good charge of black, home-made powder near the bottom of the hole. When air drills are used it is necessary to spring the hole first, after which the ground is loosened with powder or low-power dynamite. The idea is merely to break the ground enough so that the nitrate ore can be dug out by the workmen, but not enough to pulverize the material. As the ore is easily broken with hammers, the larger the pieces resulting from the blast, the less the loss in fines.

At present the transportation of the ore from the pampa to the plant is mainly done in mule carts, though occasionally it is possible to use locomotives and side-tipping and side-discharging cars. One or two plants have found occasions to use aërial tramways, but these cases are exceptional.

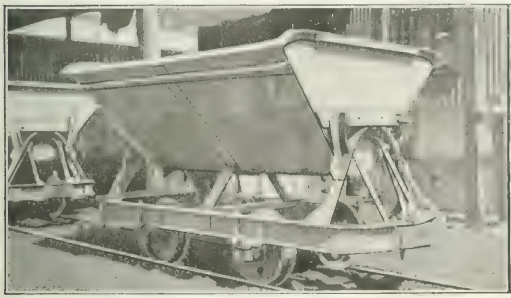
Heat Losses

The fuel used has heretofore been coal, brought from Australia and Europe. Lately the change has gradually

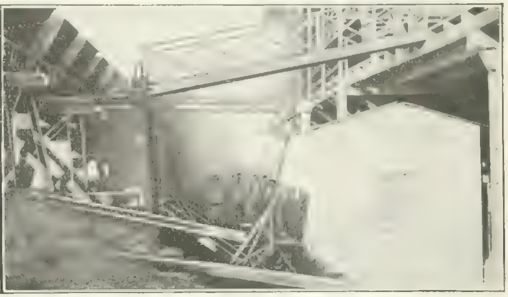


Bringing the Caliche to the Jaw Crushers

Both carts and cars are used for transporting caliche from mines to works



One Type of Nitrate Car



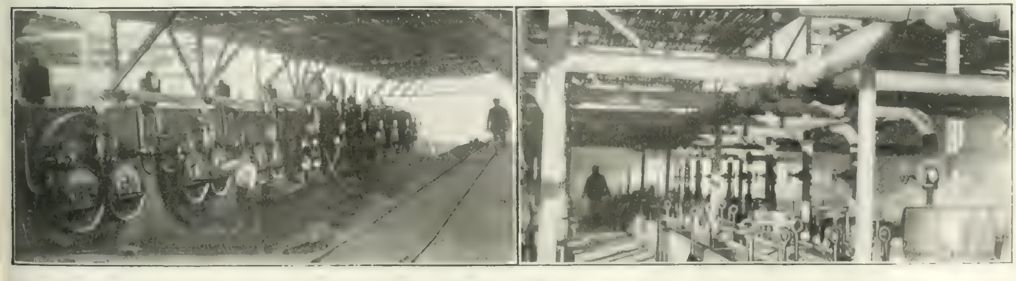
Feeding the Blake Crushers

In these cars, coupled in trains of 20, the caliche is transported to the oficina by small locomotives over wobbly tracks that are frequently shifted. The caliche is crushed dry and there is a constant cloud of dust over the crusher feeders

Transporting Crushed Ore to Boiling Tanks

Structural Supports of Boiling Tanks

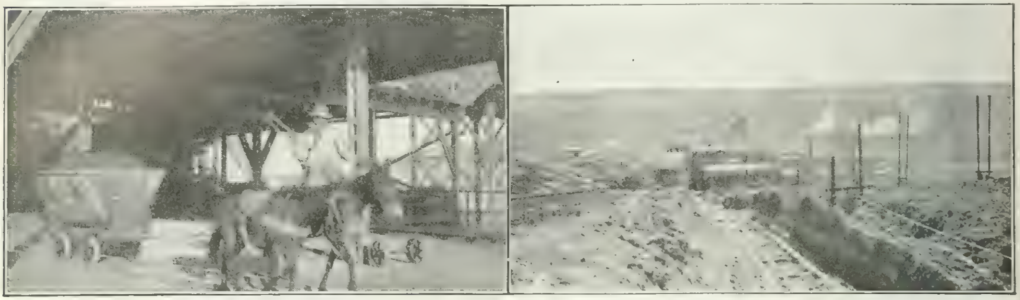
About 1000 tons per day are transported to the boiling tanks in this manner



In the Boiling Department

A line of 30-ft. boilers and a view in the tank room, showing working platform, steam piping and valve handles for controlling the transfer of solutions been made from coal to oil, much of which is shipped from California; some is sent from Peru; but the Peruvian oil is so much more valuable as a source of gasoline that it is shipped to California, is refined and the residue returned as fuel for the boilers. Some of the plants have installed Diesel engines, which are showing a marked economy in power costs.

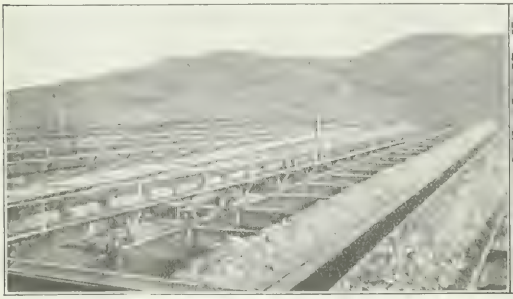
The first glimpse of a boiling plant gives the impression of a great waste of heat and steam. The 9x9x30-ft. tanks are maintained at boiling point constantly, and to do this, much water is boiled away. The sides of the tanks are unprotected except in a few instances, and the loss of heat by radiation must be enormous and worth preventing. Sometimes a solution does not reach the required specific gravity when it should, due to slow circulation or poor ores, and then it is raised in gravity simply by being circulated around and around in the boiling tanks. Such evaporation could be done much more cheaply in economical evaporators. But as stated at the beginning of this article, if the losses of nitrate in the tailings be ignored, the present process is extremely cheap and will be improved upon with difficulty.



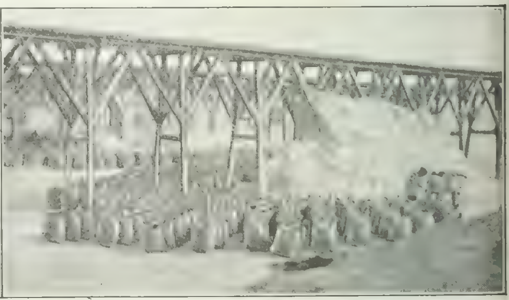
Transporting Tailings to the Dump at the Pisis Nitrate Oficina

Shoveling Crystallized Nitrate to Drying Platform

Emptying a Car of Sticky Tailings



Crystallizing Tanks and Drying Platforms



Sacking Nitrate for Export

Heavy Loss in Tailings

I have taken samples of a part of the tailings, called the *borra,* which varies in quantity, being the mud which accumulates under the false bottom of the boiling tanks, and have found 28% of nitrate in it—more than in the original ore. Some lumps of porous rock go into the boiling tanks containing perhaps 10% and go out with 15% of nitrate. These are losses which with the present process can not be reduced, because there is no way to reduce the slime loss, and crushing can not be carried further without a greater loss in slimes than gain in leaching.

As the slimes are not real slimes, in the cyaniding sense of the word, but simply 25% of slimes mixed with 75% of sands, the problem does not seem difficult. But it is. The difficulty is to do the washing and dissolving with the minimum of water. I think I can make this clear by a comparison. Assume pure nitrate with no dirt or rock mixed. Water at the boiling point will dissolve a certain quantity (220 of nitrate to 100 of water by weight). Upon cooling, the nitrate crystallizes out, leaving 60 parts to 100 of water; and if no water were evaporated, this process could go on indefinitely, the only heat required being that necessary to heat the water and nitrate as the latter dissolved.

Now assume a small percentage of sands which must be washed each cycle of operations, the wash water being added to the main solution. This wash water must be evaporated each time in order to maintain the amount of solution in circulation at the same point. All water added to the system must be evaporated. Any new process must keep this point in view. In copper leaching and precipitation the quantity of water used is almost immaterial, as the copper is obtained by precipitation. In cyaniding, there are solutions which can be wasted after precipitation, which contain little cyanide. In the nitrate plant there are no solutions to throw away; therefore all water added must be evaporated.

SUGGESTED PROCESSES

There are two "schools" of new processes. One suggests dissolving with hot solutions, using as little wash water as possible and boiling it away in the open air, as at present. The other school proposes to dissolve at ordinary temperatures and evaporate in the most economical and efficient way possible. It is dangerous to prophesy, especially during war times, but quite likely a happy medium will be found. The ore will be crushed more finely, classified wet and then treated separately as sands and slimes, or it will all be slimed and filtered. The filtering will have to be done cold, or nearly so, and more wash water will be required than if the washing were done at the boiling point. The additional expense involved in the increased amount of evaporation necessitated will have to be offset by more efficient evaporation and higher percentage of extraction.

When ample means of evaporation are available it will be a constant temptation to carry the evaporation to the point of recovering the nitrate without recourse to the immense equipment of crystallizing tanks. This evaporation will greatly decrease the first cost of the plant. The amount of nitrate tied up in the plant will be reduced 90%. The nitrate will be drawn from the evaporators, dried in centrifugals and sacked mechanically, doing away with a small army of laborers and saving interest on the thousands of tons of nitrate which are now heaped up and shoveled over on the sacking yards.

As a result of the war many of the plants are closed down, the labor is scattered and even the mules are sent south. Many of these laborers and mules will find other jobs, and when the war is over and nitrate is again in demand the lack of men will be greater even than before the war. This will make the plant manager look with more favor on any mechanical improvement which will replace labor and mules.

It will be noted that all the way through this article I have had no difficulty in criticizing and suggesting improvements. This is a trait peculiar to all who visit the nitrate fields. Another peculiar and pleasant custom among the nitrate managers is to listen to any and all suggestions. I suppose some suggestions have been made to them many times. It is easy to suppose that. It is also easy to suppose that these suggestions have been given at least some consideration. The [illegible] manager is almost invariably the most hospitable and entertaining of hosts. It is a tradition in the nitrate industry that the employees must live well, in exchange for being willing to live on the desert, and the visitor is treated as one of the force.

Great Cobar, Ltd.

Great Cobar, Ltd., which went into the hands of a receiver about a year ago, appears to have a ray of hope in sight, the chairman announcing at the recent meeting of debenture holders that an orebody hitherto unrecognized had been discovered in the western portion of the property. The engineer in charge in Australia has reported: "As the result of prospecting during November and December, we have determined the existence of bodies of basic ore of considerable extent not within the area of any estimates of ore reserves." It was proposed last year to place the properties on a basis to treat daily 650 tons of Cobar copper ore, 200 tons of Cobar gold ore and 50 tons of Chesney ore, or a total of 900 tons per day. It will be recalled that the ore available at the Cobar copper mine, exclusive of ore above No. 4 level, was estimated at about 871,000 tons; in addition, there were reserves in the Chesney mine of 550,000 tons and in the Cobar gold mine of 280,000 tons. A resolution was passed by the debenture holders authorizing the receiver to borrow upon receiver's certificates, on the best terms available, an amount not exceeding £102,000; and the receiver was authorized to carry on such mining operations as might be deemed advisable and to make all necessary arrangements therefor. At the time of the appointment of the receiver the mine manager cabled that the mine was in a dangerous condition and should no longer be worked unless more filling were done. Mr. Pellew Harvey was sent to Australia to make an investigation, but his report did not show that it was possible to entertain any extravagant hopes. The chairman reported that there would only be a return to the debenture holders from available ore and machinery of from

of debenture holders that an orebody hitherto unrecog-

23 to 38%. There appears little hope for ordinary shareholders except in the possibilities of the new orebodies.

Nickel-Tantalum Alloy

An addition of 5-10% tantalum to nickel considerably increases the metal's acid resistance. An alloy with 30% tantalum can be boiled in *aqua regia* or any other acid without undergoing alteration. The alloy is tough, is easily rolled, hammered or drawn to wire. Combined with tantalum nickel loses its magnetic quality. Nickel-tantalum has the advantage over pure tantalum in that it can be heated in open air to a high temperature without oxidizing. To produce the alloy the two metals are mixed in powder form, compressed to one [illegible] under great pressure, and brought to a white heat in a [illegible] or quartz tube *in vacuo*, according to our [illegible] correspondent.

New Scotch Radium Factory

Dalvait, on Loch Lomondside, is to be the home of a new radium industry in Scotland, says the London *Times*, Mar. 16, 1915. An old sawmill has been adapted for use as a factory for the extraction of radium and other rare metals from their ores, and within the next few weeks a start will be made.

The promoter of the scheme is John S. MacArthur, a Scottish metallurgist, whose attention was directed to the problem of radium extraction about two years ago, when he began to experiment with ores from which the uranium and vanadium had already been extracted. He was soon successful, and before long had established a small factory at Runcorn, where he ultimately employed about two dozen assistants.

Already Mr. MacArthur has placed upon the market about 1500 mg. of radium, part of which was purchased, for use by the medical profession in the district, by the Glasgow and West of Scotland Radium Committee. In the new establishment at Dalvait he expects to be able to extract about five or six grams a year. In addition to the radium he will be able to extract uranium and vanadium, while there will be other byproducts, chief among which is a radium fertilizer.

The factory will be the first of the kind in Scotland. So far as is known, the only similar enterprise in this country is being worked by a London concern which depends for its supplies upon Cornwall.

Granby Consolidated Water-Power Plant

An interesting example of a water-power plant is that of the Granby Consolidated Mining, Smelting & Power Co. on Granby Bay, British Columbia. It is situated at tide level, the floor being only 20 ft. above high tide. The water for driving more than 6000 hp. of Pelton-Doble wheels is taken from Falls Creek, a small stream flowing through a heavily timbered cañon opening into Granby Bay. A mile and a quarter from the stream mouth a rock and timber dam was built across Falls Creek. Twenty feet below the crest of the dam a short tunnel is driven through a rock ledge which forms part of the dam foundation. A wood-stave pipe line runs through this tunnel, thence on the hydraulic gradient to a point on the cañon wall back of the power house. Here it connects to a riveted-steel pipe line, which carries the water to the manifolds outside the power-house foundation wall.

Ten Pelton-Doble tangential wheels, ranging in size from 3 to 24 ft. in diameter, drive air compressors and blow engines for mine and smeltery operation and the hydro-electric plant for supplying electric energy to all parts of the workings.

An Attempt at Tin Concentration

By Jesse Simmons*

Using due endeavor to keep the cassiterite as coarse as possible in the crushing department, McNish & Mills, at Hill City, S. D., have recently completed what may be considered a successful test mill-run on tin ores from mines in that district. The ore is coarsely crystalline, the cassiterite occurring in grains and crystals varying from the size of a pinhead to several times larger. The gangue is quartz and mica. The quartz is clear and white and the mica is a fair quality of muscovite, occasionally showing an amber tint, but for the most part clear and transparent. It occurs in plates and books rarely larger than one's thumbnail.

Tin-Concentrating Plant in South Dakota

Crushing is comparatively easy with ore of this character, as has been proved by the test run. Ore from the mine is fed to a 7x9-in. jaw crusher and broken to about 1-in. cubes. This is readily done, as a slight blow serves to break each lump of ore into hundreds of pieces. Next the ore passes to rolls, where it is crushed dry, and thence to trommels, where a large proportion of the mica is removed. In crushing, the mica books are liberated from the quartz and pass through the rolls, but still are not fine enough to pass through the trommels. The books evidently, for the most part, pass through the rolls "flatwise." The oversize from the first trommel is a merchantable scrap mica, worth from $12 to $15 per ton.

Water is added in the second trommel and the oversize fed to a No. 1 Wilfley. The fine pulp from this trommel is again screened and its oversize fed to a second Wilfley. The undersize is roughly classified in a hydraulic sizer, the sand going to a Frue vanner and the fines to a Simplex slimer. It is worth mentioning that the latter machine, in the run made, had almost no work to perform. This was probably due to two causes—first, the coarse crushing gave a minimum of slime, and, second, the concentrating effect of the sizer must have been nearly perfect, or at least perfect enough to send to the vanner practically all of the cassiterite in the pulp that reached it.

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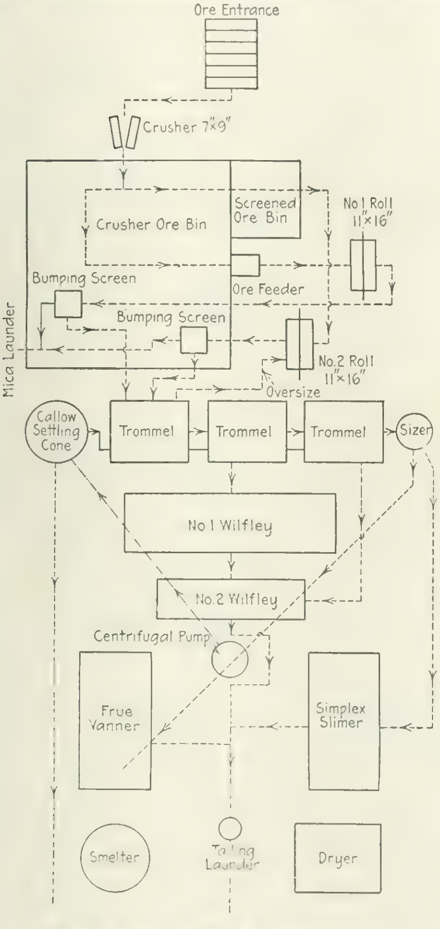
*Deadwood, S. D.

In the accompanying flow sheet are included some minor changes that are to be made in the plant before work is resumed in the spring. No. 2 roll will be used as a finishing roll and will take care of the product from No. 1 trommel and that portion of the crusher product screened out. The first screening after the rolls will be done on a new type of bumping screen developed at the property and considered more efficient for screening the micaceous material than the trommels. Another change which will be made is that all of the trommels will work on wet pulp, and the oversize from No. 1 will be returned to the finishing rolls.



Flow Sheet of Tin Concentrator

By saving most of the mica content of the ore, which may be all the way from one-quarter to one-half of the crude material, the operators believe that they will be able to make this product pay for the costs of milling. They will also have another valuable byproduct—clean quartz sand in the tailing. Containing no iron, or other coloring matter, it should find ready sale with concrete workers.

In the power plant of the mill are two boilers and two engines to which are belted 30-kw. and 10-kw., 220-volt, d.-c. generators. The motors in the mill are: Crusher, 7½ hp.; rolls, 15 hp.; concentrators, 7½ hp. During the test run, at a capacity of 1 ton per hr., the power consumption was exactly 16 hp. for the entire plant.

Ore to supply the plant seems to be abundant and within a reasonable distance. As it must all be hauled by wagon to the mill, for the present no attempt will be made to bring ore more than 2½ miles, and preference will be given to openings from which the road is downhill to the mill. Fully a dozen such showings are now opened, any one of which could supply several tons daily.

The veins occur on the walls of pegmatite dikes, thrust to the surface through Algonkian schists. Probably the average width of the veins, or shoots, is 2 ft. They have a length of 50, 100 and sometimes 400 ft. At one property worked under lease McNish & Mills have 40 in. of ore that will average more than 2% tin and fully 25% mica. The length of the shoot has not been determined. In spite of the comparatively small size of the ore shoots, it would appear that such a plant as the one discussed should be able to earn a profit and afford a market for the tin ores of the district near by. Those undertaking the work expect to be able to keep the mill busy on their own ores, but will handle custom ore to some extent. It is their intention to keep the mill grade at a minimum of 2% tin, hand-sorting at the mines where necessary. As soon as the snow leaves the ground in the spring the mill will be started. Meanwhile the proposed improvements are being made in the plant and the mine development is being continued.

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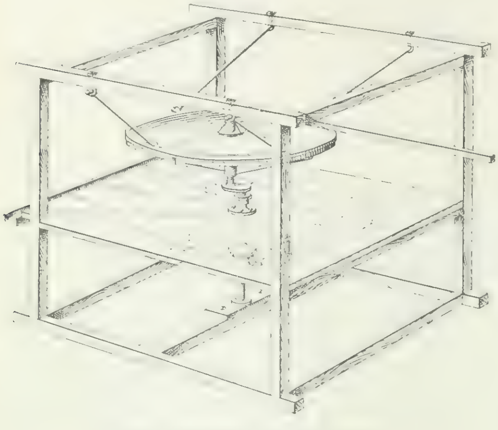
Calcite Phosphorescent on Heating

A specimen of calcite, consisting of yellow and colorless crystals, exhibited distinct fluorescence when heated to about 150° C., according to F. Pisani, *Comptes rendus*, 194, p. 1121; abstr. *Journ. Soc. Chem. Ind.*, Nov. 30, 1914. The mineral was free from iron; the yellow crystals contained MnO, 0.06 to 0.07%, and oxides of the ceria and yttria group, 0.008 to 0.12%; the colorless crystals contained MnO, 0.15% and oxides of the ceria and yttria group, 0.005%. Both the colored and the colorless crystals showed phosphorescence, and the phenomenon does not appear to be due to the cerium-yttrium content, since it is noticed in calcite free from rare earths. Fluorescent calcite is of rare occurrence; of numerous specimens from various sources examined, only three were decidedly phosphorescent, namely, calcite from Mayenne (France), Harz (Germany), and Derbyshire (England). [The similar phenomenon when certain samples of fluorspar are heated is said to be due to the oxidation of traces of arsenious sulphide.—Editor.]

Details of Practical Mining

The Farmer Amalgamator

A new claimant for honors in the field of mechanical amalgamation has appeared in the invention of C. H. Farmer, which has received U. S. pat. 1,132,317. This device is essentially an ordinary miner's pan with connections to suit the purposes for which it was designed. It is operated mechanically so as to reproduce the motions given in the ordinary system of hand-panning. The accompanying sketch shows clearly just how the motion is applied. The center of the pan, underneath, is fastened to a crank, which is moved by gearing below. Pulp entry is through a pipe which deposits into an auxiliary dish or bowl, from which the pulp overflows into the amalgamating pan itself. The object of the auxiliary bowl is to reduce the head, deposit the pulp gently into the pan, and also to avoid dropping it in one spot. The uses of the machine will be apparent to those familiar with amalgamation.



The Farmer Amalgamator

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Comparative Strength of Detonators

By L. B. Riessneider*

In endeavoring to ascertain the relative merits of No. 6 and No. 8 Du Pont blasting caps the following experiments were made, using 40 and 60% semi-gelatin dynamites:

A half stick of either dynamite was laid on a flat steel sheet and a cap pointed at right angles to the dynamite placed at a measured distance from it, the cap being pointed toward the dynamite and held firmly in position by a heavy iron casting which had been grooved to fit snugly over the cap and fuse.

The maximum distance at which complete detonation of the dynamite was certain was as follows:

Size of Cap	40% Dynamite	60% Dynamite
No. 6	18 in.	26 in.
No. 8	46 in.	52 in.

The above-cited averages were established after 60 trials. One shot with a No. 6 cap at 40% dynamite caused incomplete detonation at 27 in., particles of unexploded dynamite adhering to the plate.

With the cap pointed parallel to the dynamite the results were as follows:

Size of Cap	40% Dynamite	60% Dynamite
No. 6	8 in.	10 in.
No. 8	12 in.	16 in.

On a 1/8-in. steel plate supported on the edges the No. 8 cap made a deep indentation, but the No. 6 caused no noticeable depression. It will be noticed that the 60% semi-gelatin seems to be very much more sensitive to concussion than the 40%. Both the dynamite and the caps used in the tests were about six months old.

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Timbering Stopes for Safety

By H. H. Hodgkinson*

Where ore is mined by overhand stoping and the stope is later to be emptied of the ore by drawing through chutes below, it is often found necessary to timber the back before the ore is drawn, after breaking has ceased.

The object is quite obvious. The miners working in the stope, cleaning the sides and pulling the ore down into the chutes must be protected from any falls of ground. As the ore is drawn down, these men are continually getting farther from the ground over their heads.

In order to obtain the maximum strength and protection from the least amount of timbering it is necessary to frame the timbers in such a manner that each set conforms as nearly as possible to the shape of the ground and is placed as close to the back as conditions will permit. A space of at least 10 in. must always be left between the ground and these sets in order to place the lagging and the blocking. A greater space only adds to the expense in having to place the extra blocking, for as a general rule this space must be blocked up tight to hold loose ground in place.

The manner in which a stope is finished will materially affect the cost of timbering. If the ore is mined in such a way that the back forms an arch, there will be much less weight upon the timbers to support the ground and the sets can be placed much farther apart, which saves both timber and labor. The more the back of a stope is arched, the less weight there is apt to be upon the timbers.

In putting up a set, the main timber is placed in two hitches if horizontal and in one hitch if it is a stull with a good head-board at the upper end. It is always best to cut the timbers to fit the hitches and face a timber off at the point where another timber rests upon it, for the more perfectly the joints and bevels fit, the stronger is the set. Considerable time and labor will be saved in cutting the miter of two timbers by bisecting the angle formed by them and cutting each timber at a bevel of that angle. This will insure a much better fit and a stronger job. Both time and labor can be wasted by cutting the bevel on one timber and then cutting the bevel on the other to fit. When the bevels on the timbers are cut by the hit-and-miss method each timber may not carry its due portion of the load at the miter and the set is liable to fail under stress.

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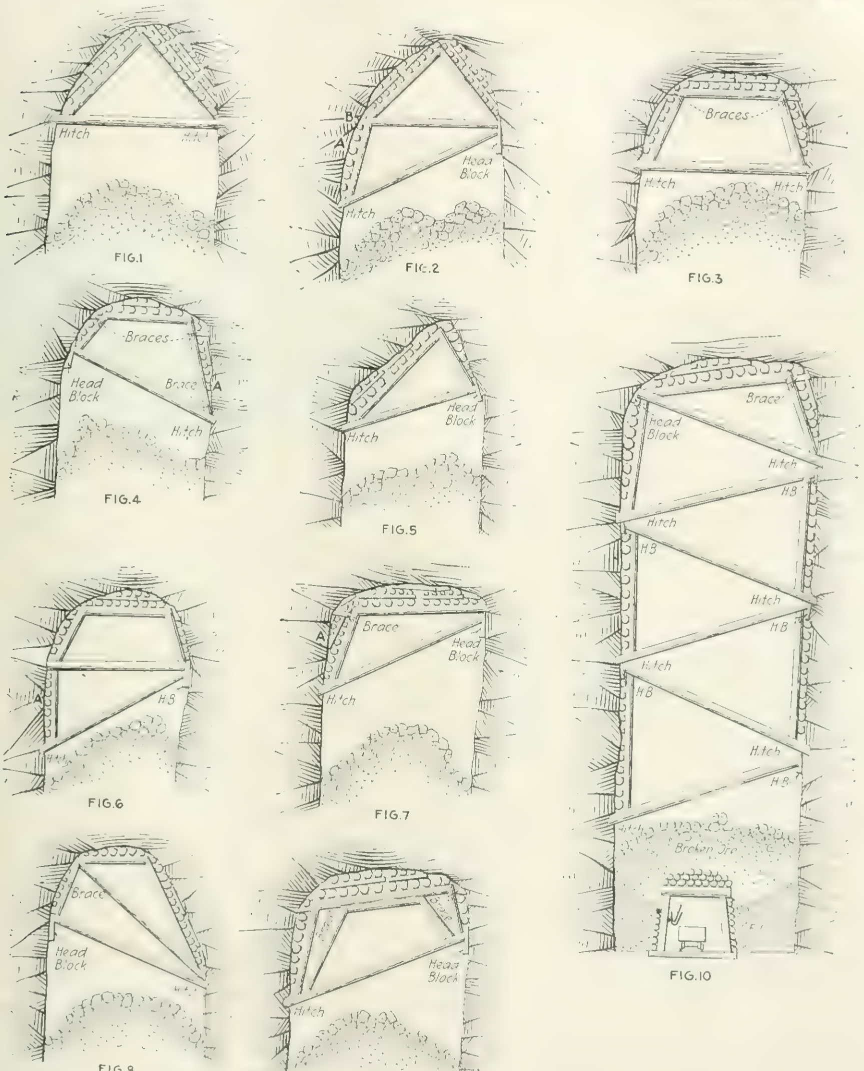
*Mine superintendent, Spanish-American Iron Co., Daiquiri, Santiago de Cuba.

*Mining engineer, Franklin Furnace, N. J.



Different Methods of Stope Timbering at Franklin Furnace

The sets are placed from 1½- to 8-ft. centers, depending on the condition at hand, and are braced against the ground. To keep the miters from pulling apart, they are also spiked with 8-in. spikes.

The style shown in Fig. 1 is the most desirable, because of the highly arched back, which permits placing the sets at a greater distance apart. Three timbers are used to make the set, which conforms nicely to the shape of the roof and requires a small amount of blocking. The horizontal timber is placed in a hitch at each end. In this figure, as in the succeeding ones, it is to be observed that the miters are cut so that the angles between the two timbers are bisected.

Fig. 2 shows the back highly arched as in the preceding case, but with the side *A* in bad ground. Only one hitch is required in this instance, with a good head-board at the upper end of the stull. A short block or wedge is always placed against a timber to keep the miter from pulling apart, as shown at *B*.

In Fig. 3 is shown a stope whose back is only slightly arched. Two hitches are required for the timbering.

In Fig. 4 the back is only slightly arched, and the side wall at *A* is assumed to be bad and needs more timbering, although only one hitch is used.

The back may be highly arched, but due to irregularities in the ground the peak of the arch is not in the center of the stope. The style shown in Fig. 5 suggests itself.

Fig. 6 shows a stope the back of which is only slightly arched and whose side at *A* is loose. Fig. 7 shows a style of timbering for a stope with a very flat back and a bad side at *A*. Timbers placed as shown in Fig. 8 not only conform to the shape of the ground, but will support heavy ground. The style shown in Fig. 9 will support excessively heavy ground and is so framed that the miters bear their proper share of the burden. As a rule, if the miters and hitches are properly cut, timbers for this kind of work need little bracing. It is poor practice to brace one timber so that the weight is concentrated on another timber, unless the second timber can be directly supported at the point where the load is concentrated.

The sides of a stope may be so bad as to require timbering almost all the way down to the floor below. The style used in Fig. 10 will accomplish this effectively, each successive stull and lagging with upright piece being placed as the broken ore is drawn down. Each stull is placed in a hitch and has a head-board at the upper end.

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Sensitiveness of Dynamite

A question having arisen recently between a mining company and a powder company regarding the quality of the gelatin furnished, the manufacturer sent a representative to investigate. A test of the sensitiveness of the powder was conducted as follows: A stick of the gelatin was cut in halves and into one half was inserted a cap and fuse. A paper tube was made by rolling a piece of ordinary letter paper about the stick so that the two halves were 12 in. apart end to end, after which the fuse was lighted. The explosion of the primer-half did not explode the other half of the stick but blew it about 15 or 20 ft. away and left it frayed up and looking like a sponge. A second stick was similarly cut, rolled and fired, the distance between the two ends being 5 in. The result was practically the same. A third stick was cut and similarly fired, the two ends of the cut stick being 2 in. apart, and in this instance the primer half exploded the other half of the stick.

This test proved to the mining company that the gelatin was no good, inasmuch as it was so insensitive to shock that half a stick of the powder with a strong detonating cap would not shoot off another stick of the same gelatin until it was within 2 in. of it. The test proved to the powder representative that the powder was all right, because if it would explode a stick 2 in. away from it, it certainly would explode a stick touching it, which would be the case in a loaded drill hole. Thus was demonstrated the sensitiveness of the powder to detonation, the sensitiveness of the manufacturing company to criticism, and the sensitiveness of the mining company to conviction.

A Mine Fire-Engine

A portable apparatus for directing by means of air pressure a jet of water or fire-extinguishing chemical on fires occurring in mines has just been placed on the market by James Boyd & Bro., Philadelphia, Penn. The apparatus is mounted on a steel frame which can be placed on a mine car or other vehicle. It consists of a chemical tank and two separate cylinders containing compressed air at 1000 lb. per sq.in., which are connected to the chemical tank. By opening a valve the air enters the chemical tank (through an automatic regulator or pressure-reducing valve which reduces the pressure to a determined amount) and forces the water or chemical solution out through the nozzle.

Empty air-cylinders can be recharged by means of a compact air compressor operated by a 3-hp. motor, which is furnished with the outfit. A gage recessed in the end of each air cylinder shows the pressure available at all times. An automatic pressure-relief valve makes excess pressure in the chemical tank impossible.

Compressed-Air Chemical Fire-Engine

For wetting-down purposes a perforated pipe is placed over the top of the chemical tank. With this arrangement the mine haulageways and other dry and dusty places can be sprayed with a dust-allaying solution.

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Emergency Grate Bars for Small Boiler

By Harold A. Linke*

"Necessity is the mother of invention"; but if the invention be not produced with reasonably proper dispatch then Necessity becomes the "thief of time." The following description shows how Necessity was, in one case saved the latter ignominy.

In southwestern New Mexico, during a churn-drillin development campaign, a careless fireman allowed th ashes to accumulate beneath his grate bars. The usua result followed: The bars were burnt out and one dril was *hors de combat*. Extra bars had been ordered som time previously, but were delayed somewhere en route.

Temporary grate bars were made of pieces of 2-in wrought-iron pipe, sawed the same length as the old bar The ends were flattened on the anvil, thus furnishing flat bearing surface. In flattening the ends, the widt was increased sufficiently to keep the pipes far enoug apart to afford ample air space between the makeshi bars when placed side by side in the firebox. The dri was running again in about an hour.

These temporary bars were in good condition after two weeks' run and were then carefully laid away f future emergency.

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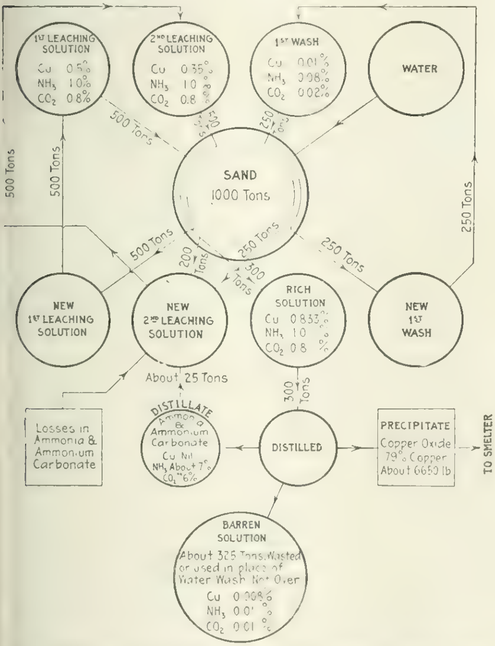
*401 Sixth St., Calumet, Mich.

Details of Milling and Smelting

Leaching at the Calumet & Hecla

The method of leaching tailings to recover their contained copper at the Calumet & Hecla, in Michigan, has been a subject of considerable interest to the metallurgical fraternity; but since it was understood that some new principles were involved in the process no public mention has been expected as to just how the work was to be done. While as yet there has been no public discussion of the matter and no articles have been written about it by those concerned in its development, U. S. Pat. 1,131,986, under date of Mar. 16, 1913, granted to C. H. Benédict, chief metallurgist for the Calumet & Hecla, gives an explanation of the method followed and the aims of the process.



Flow Sheet of New Calumet & Hecla Treatment

Mr. Benedict prefaces the explanation of his process by the statement that it is well known that copper oxide will dissolve in ammoniacal solutions, forming copper-ammonium compounds, that solutions of cupric-ammonium alts are capable of dissolving native copper, yielding uprous-ammonia salts, and that these cuprous-ammonia alts may be oxidized, either by air or other oxidizing gents, to cupric-ammonium salts. It is also known that copper-ammonium solutions subjected to distillation are decomposed with separation of copper oxide, ammonia being volatilized. As a matter of fact, these reactions have been known and even practiced, since they have formed the basis of Bertram Hunt's and D. Mosher's patents for treating copper-bearing gold or silver ores with ammonia-cyanide solutions. In the Mosher process distillation was resorted to to precipitate the metals and recover the ammonia.

The difficulties attending ammonia treatment, according to Mr. Benedict, were due primarily to the heavy losses of the expensive and highly volatile ammonia and to the high cost of the installation necessary to minimize the loss of ammonia due to the volatilization from the solutions used. The method now followed by the Calumet & Hecla is designed to overcome these objections.

The accompanying illustration, taken from Mr. Benedict's patent application, shows clearly the scheme of the process, and little explanation is needed to assist in a proper understanding of it. The claim is made that the ammonia losses met in previous attempts to utilize that chemical as a copper solvent have been due not altogether to volatilization but, to a larger extent, to adsorption of ammonia by the ore particles, particularly the fine slimes. These adsorption losses increase with the strength of solution used, so that by using a very weak solution, as Mr. Benedict does, and treating only sands, such losses are reduced to a minimum. To allow the use of the weak ammonia solutions, the cycle of operations is so arranged that an amount of copper equal to that extracted from a given batch of ore will be found concentrated in a relatively small proportion of the total volume of solution brought into contact with the ore. Then a proper volume of this stronger solution is distilled to precipitate its copper content and to recover the free ammonia and any volatile ammonium salts present, the latter being restored to the cycle at an appropriate point.

The first percolations from the leaching tank, after adding the first leaching solution, are low in ammonia and copper, due to diffusion and adsorption, and this is added to a second leaching solution. When the percolating solution begins to come off rich in copper and high in ammonia, it is diverted to another department, where it is distilled. The whole operation, as carried out, is sufficiently illustrated in the flow sheet, and the strength and proportion of solutions used are shown. Those familiar with leaching will readily understand its operations. It is to be hoped that as soon as operations have been carried far enough to provide satisfactory data the inventor of the process will make public all the facts and figures concerning it.

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Precipitation on Zinc Shavings

In a description of the Bullfinch Proprietary, West Australia, A. L. Hay and R. B. Williamson[1] describe the precipitation apparatus, which consists of an installation of wooden boxes of the well-known type. They have a total capacity of $87\frac{1}{2}$ cu.ft. of zinc shavings. Head solutions assay 12s. 10d. per ton, and after passing the third compartment the value is reduced to 2s. Tailings average 7.3d. per ton of solution. During the treatment of a ton of ore 1.3 tons of solution pass through the box, and 0.22 ton of zinc shavings is consumed. Copper appears in the end compartments of the boxes after the addition of fresh zinc. Lead acetate is used in the form of a drip when required, this system having proved better than dipping the shavings.

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[1] "Journ. W. A. Chamber of Mines."

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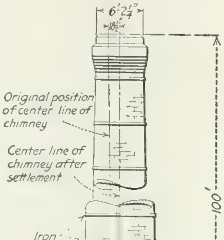
Straightening a Tall Leaning Chimney

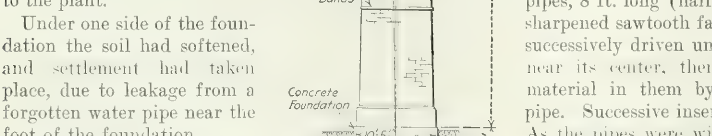
Many methods have been employed to bring back to a vertical position tall columns, such as chimneys, which after construction have leaned or settled out of plumb, according to Thomas S. Clark, in *Engineering News*, Feb. 11, 1915. The procedure has often been expensive and hazardous, as well as slow. In the case of chimneys it has necessitated shutting down the boilers, which entailed a loss in output. A unique and inexpensive method was recently employed to straighten quickly a 100-ft. factory chimney in Brooklyn, N. Y., without interruption to the plant.


6'2¼"
18½"
Original position of center line of chimney
Center line of chimney after settlement
Iron Bands
Concrete Foundation
100'
4'
10'5"
13'6"
2⅜"

100-FT. LEANING CHIMNEY IN BROOKLYN

Under one side of the foundation the soil had softened, and settlement had taken place, due to leakage from a forgotten water pipe near the foot of the foundation.

To excavate on the low side of the foundation to the depth of the footing course, crib under it, and attempt to jack the structure back plumb would have involved large cost, loss of time and not a little risk. The great weight of the 100-ft. column and the additional pressure due to the leaning would have required powerful jacks and a substantial footing to jack against. There would have been danger also of cracking the unreinforced spread foundation, and additional foundation would have had to be placed before the jacks and cribbing could have been removed to safety.


Iron Band
Center Line of Chimney
Plumb line used for watching progress of work
Concrete Foundation
Pipe used to abstract earth from beneath high side of foundation
Holes bored beneath high side of foundation
Center Line of Chimney

REMOVING EARTH TO BRING THE CHIMNEY BACK TO PLUMB

Another method to straighten a leaning chimney, employed to some extent in Europe, is to saw out a course—or a portion of a course—of brickwork on the side away from the direction of lean, in wedge-shape, with an ordinary two-man crosscut saw, and allow the portion of the chimney above the cut to settle back. This method is, to say the least, not entirely satisfactory, nor does it remedy the defect entirely, as the portion below is still out of plumb and the bearing surface of the foundation footing is not brought to the horizontal. For these reasons neither of these two methods was used.

The deviation from the vertical was determined with a transit by triangulation; it was found to be 18½ in. From this figure and the height of the chimney it was determined that the toe of the footing on the high side must be settled 2⅜ in. The problem was to remove just enough earth between the center of the foundation and the toe of the high side gradually to settle the foundation back 2⅜ in. at the toe. Levels were taken on the high side and an indicating plumbline was fastened to the side of the chimney.

A trench was excavated on the high side to the depth of the foundation, about 4 ft., the length of the trench equal to the square side, and its width equal to half the width of the foundation, or about 8 ft. Four 2-in. wrought-iron pipes, 8 ft. long (half the width of the foundation), were sharpened sawtooth fashion at one end. These pipes were successively driven under the high side of the foundation near its center, then withdrawn, and emptied of the material in them by driving a steel rod through the pipe. Successive insertions were made about a foot apart. As the pipes were withdrawn, the earth adjacent to the pipes crushed into the holes left by the withdrawn pipes.

In this way but a small quantity of earth was removed at a time and but a small quantity gave way at a time; the yielding occurred just where wanted. Th chimney settled back gradually with no shock or danger. Th amount of settlement, its direction and the rapidity of settlement were always in absolute control. The telltale plumb-bob gav the direction as well as the amoun of movement.

At one period of the operatio the chimney began to settle slightly out of line. It was only necessary to drive the pipes more ofte at certain points to bring th shaft back to line.

When the column was agai plumb the trench was filled up The leak in the drain pipe ha been previously stopped to prevent further softening of the earth on one side. Th chimney has since remained plumb.

The work was done by the Alphons Custodis Chimne Construction Co., of New York. The method was devise by the writer, who is in that company's employ.

Company Reports

United States Smelting

The United States Smelting, Refining & Mining Co. for 1914 reports a profit of $2,265,641, after charging off $666,877 for depreciation. This profit added to the surplus carried forward from 1913 made the total undistributed surplus $6,744,481, which was applied as follows: For 7% dividends on preferred stock, $1,702,221; for two dividends of 1½% each on common stock, $526,671; and balance of undistributed surplus, $4,515,591. The metals produced by the company were: 17,946,659 lb. of copper, 64,443,260 lb. of lead, 9,936,237 oz. of silver and 124,719 oz. of gold. The average price received for copper was 13.404c. per lb.; for lead, 3.827c. per lb., and for silver, 55.564c. per oz. The tonnage of ore produced from the company's mines amounted to 1,011,532 tons, in which the proportionate metal values were: 32% copper, 5% lead, 37% silver and 26% gold.

The company spent $778,620 for capital expenditures, which it charged to capital accounts as follows: $197,499 for stock and bonds of coal companies in Utah, $165,336 for stocks in other companies, $340,521 for additions to plants and $75,263 for mine properties and other charges to capital accounts. A credit of $316,048 for receipts from miscellaneous sources was made to this account, so that the net charge to capital accounts was only $462,572 during the year. The company closed the year with a balance of $10,242,629 in current assets, of which the greater part consisted of metals on hand and notes receivable from subsidiary companies. The report states hat the difficulty of obtaining supplies for its properties n Pachuca, Mexico, still remains serious, but that the staff has shown great resourcefulness, and at the date of he report the production had reached 1400 tons a day, as compared with a capacity of 2000 tons a day. It is also noted that during all the unsettled conditions of Mexico he properties and the employees have always been repected, so that there has never been any property damage or interference with the employees. [It is to be remembered that this report is under date of Dec. 31, 1914.—EDITOR.]

The Bingham mines extracted 101,655 tons of copper ore, and it is said that both the present ore reserves and he future possibilities of the mine are promising. The Utah smelting plant operated through the year without material interruption, and improvements were made in lmost every department of the smelter. The lime quarry hipped 116,209 tons of rock, of which 67,629 tons were used at Midvale and the remainder was sold to outside parties. The Centennial-Eureka Mining Co. showed a further decline in tonnage and grade of ore. It produced 68,365 tons from old orebodies, and development work ailed to disclose new oreshoots. New territory will be prospected in this mine. The Mammoth Copper Co. hipped 235,146 tons, and the ore reserves were larger at the end of the year than at the beginning. In the vicinity of the Mammoth property development work is being carried on at the Stowell mine, the Spread Eagle mine and the Anderson claims. The Grasselli lead refinery treated a larger tonnage of bullion at reduced cost on account of recent improvements, but the Chrome copper refinery had a reduced output owing to the curtailment of production of copper ores. The Gold Road Mines Co. produced 107,846 tons of ore; the operations of the Needles Mining & Smelting Co. were intermittent owing to an insufficient ore supply. The Richmond-Eureka Mining Co. remained idle owing to the failure to obtain satisfactory freight rates for the transportation of its ores to the smelters.

During the year 639 properties were presented to the company for its consideration. Of these, 538 were rejected after an office examination of the reports and the data submitted. A preliminary examination was made of 82 properties and 19 were completely examined. There were 8660 preferred stockholders and 2816 common stockholders at the close of the year.

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Calumet & Arizona

The Calumet & Arizona Mining Co.'s (Warren, Ariz.) report for 1914 shows a net income of $3,058,536 from all sources, including subsidiary companies. Total receipts were $8,518,998, of which $14,984 came from miscellaneous sources and the remainder from metals produced. Expenditures were $5,303,375 for operations and $130,089 for outside properties. Dividends aggregated $1,851,008. The net cost of refined copper after deducting the value of precious metals was 8.19c. per lb. The value of precious metals was $28.35 per ton of refined copper. The production of refined copper, gold and silver follows:

	Produced from		
	Domestic Ore	Purchased Ore	Total
Pounds copper.......	49,992,909	2,675,020	52,667,929
Ounces silver.......	573,606	348,537	922,143
Ounces gold..........	19,745	4,377	24,122

During the year the company bought 65 acres of patented mining claims, and it exercised its option on the stock of the New Cornelia Copper Co. In regard to the Cornelia property, it is stated that if the results obtained in the future at this property equal those which have previously been obtained a plant of 4000 tons daily capacity will be designed which will require from $4,000,000 to $5,000,000. No plans have yet been made for raising this additional capital.

The Calumet & Arizona mine produced 66,467 dry tons of ore and performed 6328 ft. of development work, which is about 1 ft. for 10.7 tons of ore mined, as compared with 6.8 tons in 1913. The Superior & Pittsburgh mine produced 505,001 tons of ore and performed 66,165 ft. of development work, or about 1 ft. for 8 tons of ore.

The smeltery treated 668.776 dry tons of ore, of which 138,725 tons were custom ores. The blast furnaces handled 103,269 tons of ore and 31,299 tons of slag and cleanings. The reverberatory department handled 238,095 tons of charge and the roasting department, with an average of seven furnaces operating, roasted 209,138 wet tons of ore. The average sulphur contents of the ore treated were 27.5% and the calcines produced contained 9% sulphur. The converters produced 32,058 tons of blister copper. Siliceous material to the amount of 24,823 tons was treated in the converters.

Utah Copper in 1914

The report of the Utah Copper Co., Bingham, Utah, for 1914 shows a production of 115,690,445 lb. of copper, 34,729 oz. of gold and 325,351 oz. of silver. The net yield of the ore milled was about 17.8 lb. of refined copper per ton. The total value of gold and silver contents was $875,303. Dividends amounting to $4,827,885 were paid during the year, which brings the total dividend payments of the company up to $25,817,815. The report shows a net profit of $6,789,532 from the year's operations and income from investments; but of this amount only $5,379,637 was actually available for dividends, as will be seen by the analysis of the financial statements which follow. The yield of the ore in 1914 was higher than for the previous year, as is shown by the accompanying statement of production for the last five years:

UTAH COPPER CO. PRODUCTION FOR LAST FIVE YEARS

Year	Tons of Ore Treated	Yield, Lb. Cu per Ton	Total Copper Produced, Lb.	Total Value of Gold and Silver Produced
1910	4,340,245	19.46	84,502,475	$1,001,089
1911	4,680,801	19.95	93,514,419	999,622
1912	5,315,321	17.2	91,366,337	873,995
1913	7,519,392	15.2	113,942,834	732,583
1914	6,470,166	17.8	115,690,445	875,303

The total outstanding stock of the company now amounts to 1,624,490 shares. There was an increase of 40,810 shares, which were exchanged for the bonds of the Bingham & Garfield Railroad. A stock dividend was received from the railroad amounting to 15,055 shares; so that now the Utah Copper Co. owns the entire capital stock of the railroad company. The financial operations of the company will be better understood by a study of the tables given herewith, which were compiled from the statements given in the annual report.

TOTAL RECEIPTS AND TOTAL EXPENDITURES OF THE UTAH COPPER CO. FOR 1914

Receipts:		
From sale of metals and miscellaneous receipts		$16,222,456
From investments and railroad, etc		2,738,259
From capital stock		408,100
From premiums on capital stock		1,632,400
Total receipts from all sources		$21,001,215
Expenditures.		
Charges to current operations	$10,230,293	
Interest paid	51,931	
Property account	275,934	
Investments	3,450,395	
Deferred charges	1,613,025	
Total expenditures	$15,621,578	
Increase in quick assets.	551,752	
Dividends paid	4,827,885	
To balance with total receipts	$21,001,215	
Balance of quick assets at end of 1913		$3,415,902
Balance of quick assets at end of 1914		3,967,654
Increase in quick assets in 1914		$551,752
Dividends paid		4,827,885
Amount actually available from 1914		$5,379,637

From data obtained in 1914 it was estimated that the capping over the orebody averaged 115 ft. in thickness. A total of 5,708,836 cu.yd. of stripping was removed during the year, making a total of 27,831,013 cu.yd. of capping removed to date. Stripping operations were extended to an additional 20.5 acres during the year, making a total of 191.63 acres over which stripping operations have been carried on. The total area completely stripped at the end of the year was 76.33 acres. With an average thickness of 115 ft. there are 185,533 cu.yd. of stripping per acre; therefore the stripping to date is equivalent to completely stripping 150 acres. It is estimated that the area over which stripping has been completed, or partly completed, contains an average of about 1,558,000 tons of ore per acre and that the capping removed is equivalent to the complete stripping of 233,700,000 tons of ore. Of this quantity 35,190,400 tons, or about 15%, has been mined. The ratio of stripping to ore is about 1:4, or about 1 cu.yd. to 8 tons of ore. Of the ore produced 98.27% was mined by steam shovels. The average cost of steam-shovel mining was 30.96c. per ton, of which 8.34c. represented charges for stripping and development. The combined cost of surface and underground mining was 32.32c. per ton, of which 9.2c. was for prospecting with churn drills and for development, 7.5c. for stripping expense, and a working cost of 23.12c. per ton.

During the year the mills treated 6,470,166 tons of ore, of which 4,461,461 tons were treated at the Magna plant and 2,008,705 tons at the Arthur plant. The average grade of the ore milled was slightly under 1.425% copper. The average mill recovery at both plants was 66.04% as compared with 63.95% in 1913. The milling cost at the Magna plant was 34.35c. and at the Arthur plant 37.55c. per ton. The average cost at both plants was 35.36c. per ton. The average grade of concentrates was 18.19%. The average cost of copper as reported after deducting gold and silver credits, but not miscellaneous income, was 8.131c. per lb. The average total cost of mining and milling exclusive of transportation charges was 67.68c. per ton.

ANALYSIS OF RECEIPTS AND EXPENDITURES

Receipts from Operations and Investments		
From production of 115,690,445 lb. of copper @ 13.264c.		$15,345,269
From production of 34,729.363 oz. of gold @ $20		694,587
From production of 325,351.69 oz. of silver @ 55.545c.		180,717
From miscellaneous sources		1,883
Dividends from Nevada Consolidated, railroad, etc		2,631,063
Income from interest, rentals, etc		107,196
Total revenue from operations and investments		$18,960,715
Expenditures for Operations—Current and Deferred		
Current operations:		
Mining and milling	$3,836,141	
Treatment, refining and freights	5,701,846	
Selling commissions	150,056	
Stripping ore	485,262	
Mine development	56,978	
Total current operations reported		$10,230,293
Total income reported		8,730,422
Less interest paid		51,931
Net profit as shown in report for 1914		$8,678,491
Deferred expenditures to operations:		
Property account	$275,933	
Deferred stripping, etc	1,613,025	
Total charges to capital accounts		$1,888,958
Balance of operating and investment income over all current and deferred expenditures		6,789,532
Expenditures for Investments		
276 shares Garfield Water Co	$27,600	
52 shares Garfield Improvement Co	5,200	
35,000 shares Bingham & Garfield R R	3,500,000	
Increase in water rights Utah & Salt Lake Canal Co.	15,000	
	$3,547,800	
Less decrease in advances to Water Co. and $97,000 of railroad bonds sold	97,405	
Net increase in investments	$3,450,395	
Less capital stock receipts	2,040,500	
Balance, being amount in profits represented by investment securities, etc		$1,409,895
Amount actually available for dividends from 1914		$5,379,637

In 1914 there was 8920 ft. of drill holes completed, which makes the total amount of all drill holes to date 16,391 ft., or an average of 552 ft. per hole for 67 churn-drill holes and seven diamond-drill holes. Ore reserves are estimated to contain 342,500,000 tons of ore, averaging 1.45% copper. In determining the grade of the ore there were used 56,744 assays, representing 334,518 ft. of development work. The Bingham & Garfield R.R handled 5,902,196 tons of freight during the year, of which 4,829,877 tons was ore, 100,466 tons of which was shipped by other mining companies in Bingham and the remainder of the ore was shipped by the Utah Copper Co. The remaining tonnage handled by the road consisted of commercial freight. The road also carried 135,759 passengers, as compared with 134,151 in 1913.

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Seneca-Superior

The Seneca-Superior Silver Mines, Cobalt, Canada, for 1914 reports a production of 16,871 tons of ore, which yielded 1,430,673 gross ounces of silver. Of the ore produced 416 tons was high-grade ore, and the remainder was reduced to 40.96 tons of jig concentrates and 67.42 tons of table concentrates. The profit for the year was $321,742 from all sources. Dividends amounting to $335,218 were paid. It is estimated that the reserves now contain 2,035,000 oz. of silver. An average price of 53.02c. was received for silver, and the average profit per ounce was 22.49c., making total costs 30.53c. per oz. Details of costs per ounce were as follows: Exploration, 3.25c.; operating, 8.16c.; new plant, 1.59c.; administration, 1.35c.; marketing, 1.62c.; smelting loss, 1.06c.; royalty, 12.99c.; and depreciation, 0.51c. per oz. There was 3445 ft. of development work performed.

It is stated that the ore-dressing plant has developed into a small but complete mill. The single jig was replaced by a double jig, with trommel and weighing bins. A second Deister sand table and Deister slime table, together with a 4x8-in. Sturtevant crusher and a 4.5 ft. by 16-in. Hardinge ball mill, were installed. The mill tails assay about 5 oz. of silver per ton.

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Eagle & Blue Bell

The Eagle & Blue Bell Mining Co., Salt Lake City, Utah, reports a net operating gain of $121,536 for 1914. The mine produced $32,736 tons of ore having a gross value of $513,235, from which $226,750 was deducted for freights, smelting, and sampling and assaying, leaving a balance of $286,485 from ore shipments. The metal contents of the ore follow: 1444 oz. of gold, 555,411 oz. of silver, 8,588,565 oz. of lead and 31,443 lb. of copper. The report states that a great deal of interest is being shown in the perfecting of a scheme to treat the low-grade deposits of Tintic, but on account of the complexity of the ores and the refractory nature of certain minerals it is quite a problem to determine a method of treatment. The siliceous ores are amenable to the cyanide process, which makes a fair extraction, and a process which involves a chloridizing roast and subsequent leaching has made very good recoveries of the gold, silver and copper on experimental lots, but as a commercial success it is yet to be demonstrated. Dividends aggregating 15c. per share were paid during the year.

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Shattuck Arizona

The Shattuck Arizona Copper Co., Bisbee, Ariz., for 1914 reports a recovery of 10,846,918 lb. of copper, 198,119 oz. of silver, 2445 oz. of gold and 14,065 lb. of lead. The total receipts were $1,660,573, and disbursements were $1,073,076, leaving a net balance of $587,497, from which $30,632 was charged off as depreciation on permanent equipment. Dividend payments amounted to $525,000. The value of gold and silver per ton of ore smelted amounted to $1.91, or $29.80 per ton of refined copper. Lead-ore credits per ton of refined copper amounted to 46c. The net cost per pound of refined copper was 8.472c. The average price received for copper equal to New York delivery was 14.1293c. per lb. A total of 14,737 ft. of development work was added during the year, making a total to date of 75,262 ft. It is stated that developments on the 900-ft. level indicate that there is a good tonnage of commercial ore between the 900- and 800-ft. level ready for stoping. In the near future the shaft will be sunk 100 ft. deeper to prospect the primary sulphides exposed on the 900-ft. level about 150 ft. south of the shaft.

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Utah-Apex Mining Co., Bingham, Utah, for the quarter ended Dec. 31, 1914, reports a net income of $69,914. Work has been started on sinking the Parvenue shaft 150 ft. additional. Exploration work has been carried on in the upper workings and has exposed new reserves of mill ore.

The Arizona Commercial Mining Co. reports a balance of $225,624 in quick assets at the end of 1914. In order to handle the water a connection was made with the Grey shaft of the United Globe Mines and also with the 12th level of the Old Dominion. Development work amounted to 4176 ft. Some ore shipments have been made since Jan. 1, 1915.

The Davis-Daly Copper Co., Butte, Mont., for the last quarter of 1914 reports expenditures of $51,728. Mining is now being carried on at the 1750 level, where an orebody was recently found. It is thought that the vein cut on the 2500-ft. level is the downward extension of this orebody. Approximately $250,000 of assessments has recently been received.

The Contact Copper Co., Houghton, Mich., reports a balance of $4703 in cash and bills receivable at the end of 1914. In his report the superintendent advises further drilling; but unless the stockholders pay their assessments in sufficient amounts this cannot be done. An assesment of 50c. per share was called in April, 1914, of which only a modest amount has been paid.

The Adventure Consolidated Copper Co., Houghton, Mich., reports a balance of $2054 at the end of 1914. Receipts for the year totaled $6542 and expenditures $13,750, of which $7614 was for state taxes for 1913 and 1914. No mining work was done during the year, and the only current expenses are for the care of the property, taxes, insurance and maintaining an office in Boston.

The South Lake Mining Co., Houghton, Mich., reports for 1914 an income of $47,213 and expenses of $51,003. The company now has an excess of liabilities amounting to $3790, and will probably make a new offer of treasury stock in the near future. It is probable that arrangements will be made to stamp a stockpile that has accumulated from drifting on Nos. 1 and 3 north lodes.

The Victoria Copper Mining Co., Victoria, Mich., for 1914 reports a production of 1,486,242 lb. of copper. Receipts were $208,078 and expenses $238,466, making a loss of $30,388 on mining operations. The company now has a balance of $40,624, which consists principally of copper on hand. To-date the company has received $3,191,820 and spent $3,151,196. About one-half the receipts came from capital stock assessments.

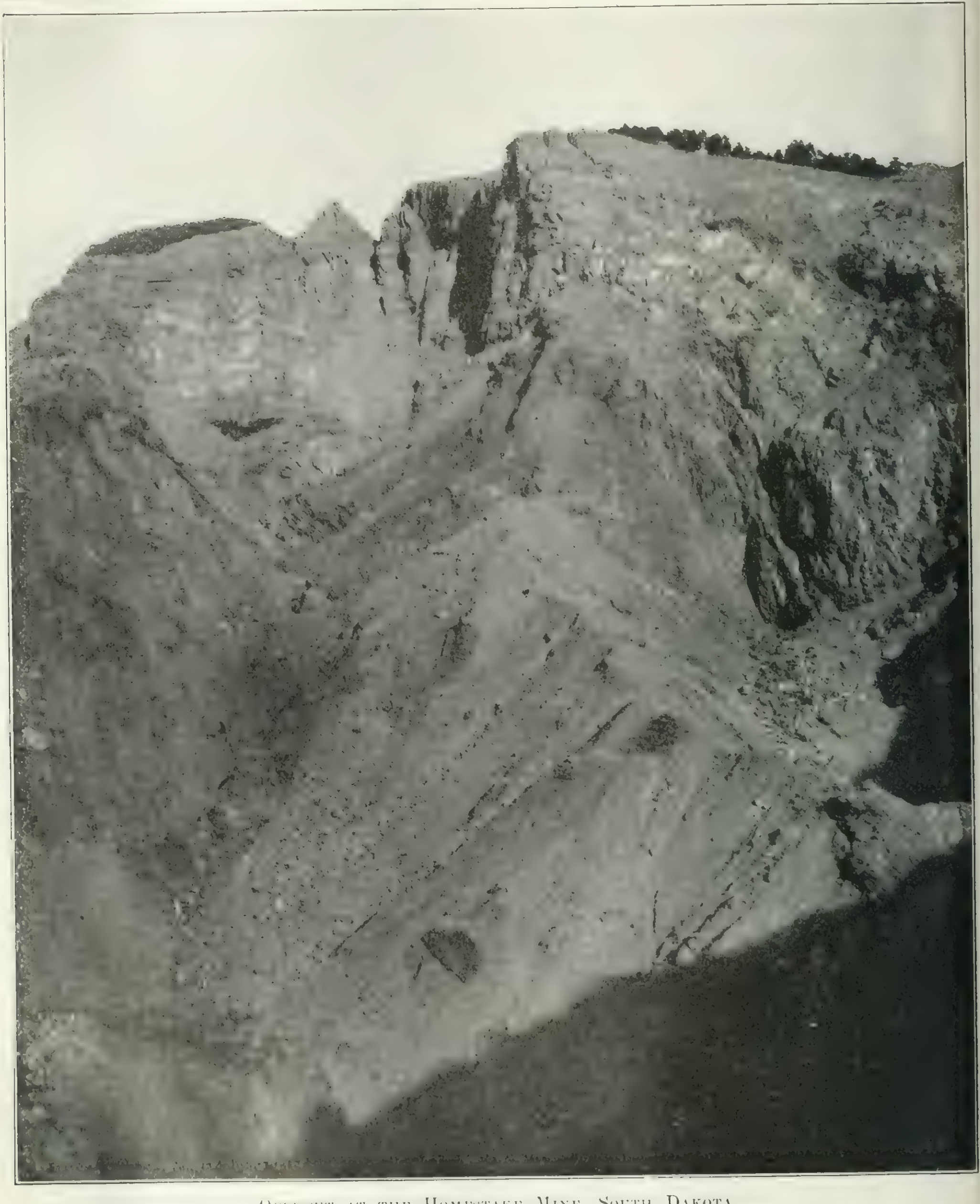
The Naumkeag Copper Co., Houghton, Mich., reports a balance in assets of $193,828.84 at the end of 1914. Expenditures since commencement of operations have amounted to $76,576, of which $57,905 was for development and $18,671 for general and administration expense. The report states that the lode developed is not one of commercial value, but the showing is sufficiently good to warrant the continuance of development work.

The Wettlaufer-Lorrain Silver Mines, Cobalt, Ont., reports that the property has not been operated since Oct. 31, 1913, and the only expense the company is under is for pumping and keeping a watchman. During 1914 some ore was sold from storage which netted $5163 after paying for all expenses. The directors have considered the acquisition of a new property, but so far have not found one sufficiently attractive to warrant an investment

The Old Colony Copper Co., Houghton, Mich., reports a cash balances of $56,971 on hand Oct. 1, 1914. Total receipts during the year were $80,724 of which $79,153 came from assessments. Expenditures aggregated $18,903. Eight diamond-drill holes, Nos. 26 to 33 inclusive, in all 12,774 ft. of holes, were drilled at an approximate cost of $2.74 per ft. not including overhead charges. It is stated that the results during the year are considered satisfactory both in increased footage drilled and the fact that every hole has shown presistent mineralization.

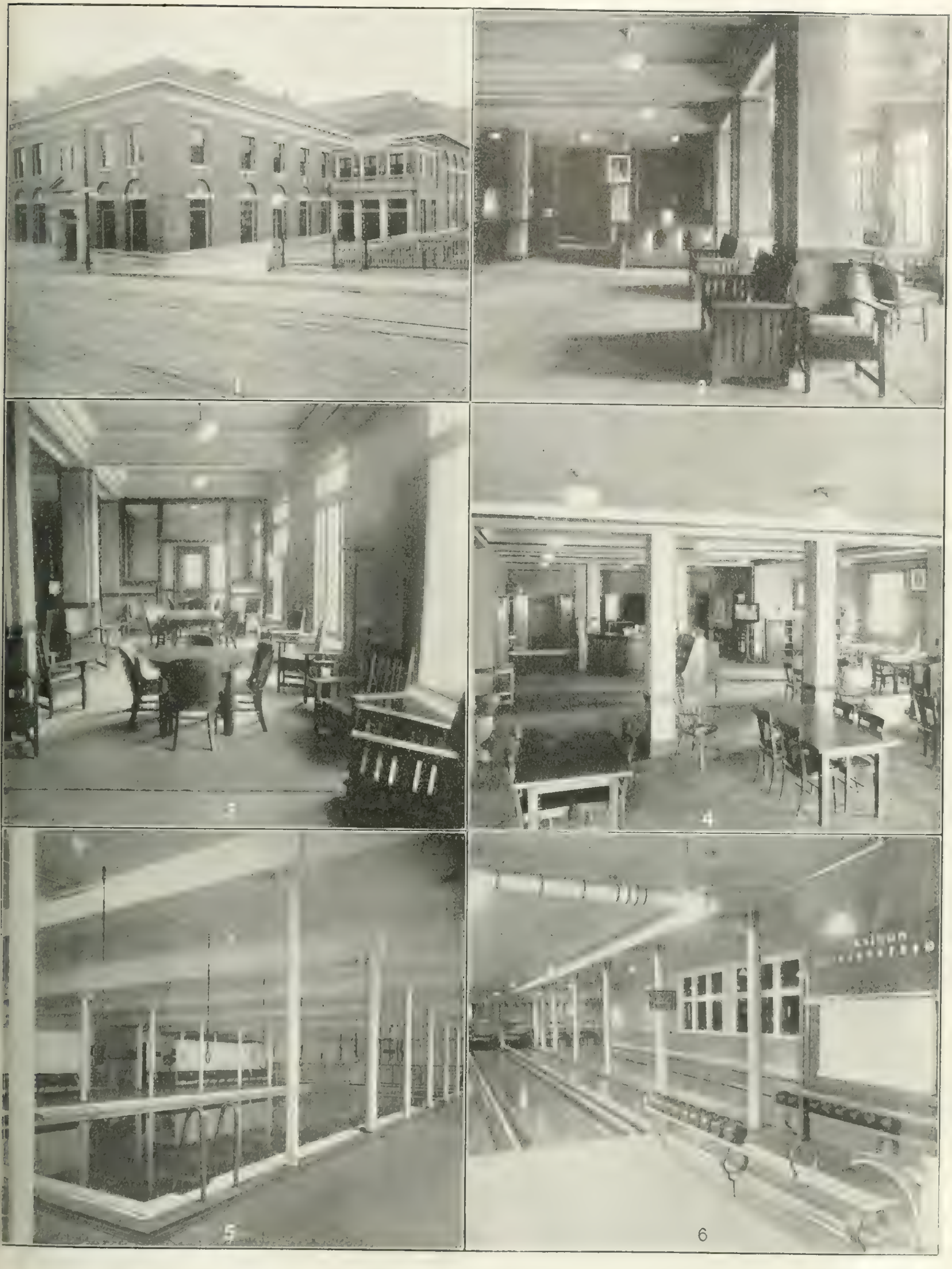
The Mass Consolidated Mining Co., Mass, Mich., [illegible] for 1914 receipts of $181,075 and expenditures of $[illegible] the receipts $100,000 came from assessments. Th[illegible] closed the year with a balance of $15,887. The [illegible] ft. of drifts, 210 ft. of crosscuts and 79 ft. of [illegible] during the period. It is estimated that the [illegible] tons of ore in reserve on the Butler lode. [illegible] produced amounted to 2,944,952 lb. from 209,354 tons of rock. The yield in copper was 14.07 lb. per ton and [illegible] per pound.

Photographs from the Field



OPENCUT AT THE HOMESTAKE MINE, SOUTH DAKOTA

Taking out great quantities of the characteristic Homestake low-grade ore is resulting in the gradual disappearance of the hill



THE NEW HOMESTAKE RECREATION BUILDING AT LEAD, S. D.

Erected at a cost of more than $235,000, for the free use of employees. The exterior, rest room, lobby and library are shown in the first four photographs. The last two views show the gymnasium and pool, and the bowling alleys.

Requirements for Prospecting Dredging Ground in the Yukon

By J. A. Macdonald*

The prospector of dredging ground in the Yukon is handicapped by regulations which require the payment of $100 per mile of river bed 60 days after application is filed. He is allowed to acquire 10 miles, but has to pay $1000 down, $10 per mile each subsequent year of the existence of his leasehold, and within three years of the issuance of his lease is required to place on the property a dredge approved by the Minister of the Interior.

One or more seasons will be required to prospect his ground thoroughly. If he begins prospecting before making application, he is at the mercy of anyone who may deem it good enough to acquire. The stipulated "60 days after application" will hardly enable him to get on the ground the necessary machinery and appliances for prospecting. The drilling equipment to make the necessary test will cost about $3000, laid down at White Horse, and take a month to get there. It will perhaps cost as much more in time and money to get the drilling equipment on the property.

After the ground is selected all that can be done in the 60 days between the date of application and the payment of the money is to make a superficial examination, which may be misleading in its results. The surface may prospect satisfactorily, but the results of later drilling may prove the deposit to be impracticable as a dredging operation.

The minimum width allowed for a dredging stream in the Yukon is 150 ft., all under that width being reserved for sluicing. Should a prospector have a leasehold 10 miles long, measuring from 200 to 300 ft. in width, such a stream ought to have at least a pair of drill holes at intervals of 500 ft., and this would not give too conclusive a test. Under favorable circumstances two holes per week might be drilled, taking into consideration all contingencies. Ten miles would require in such an examination 210 holes, which would take 100 weeks; and as a favorable season affords, say, 22 weeks, it is plain that it would require five seasons to complete the prospecting of this area.

The late Mr. Ogilvie, who spent many years in the Klondike in the capacity of chief Government surveyor, suggested that the applicant after 60 days be required to pay down 10% of the purchase money and to begin as soon as practicable comprehensive prospecting operations or work, not limiting the time to any specified number of days, for what would be possible in one place would be absolutely impossible in another. If the country is to be developed, possibilities must needs be taken into consideration, and, most important of all, impossibilities should be taken into account. The territorial mining engineer or some other competent authority in the territory should be able to decide easily what was and what was not possible in each case. As soon as a sufficient portion of the leasehold was prospected and results warranted it, the installation of a dredge should be required in a practicable time. Should all the ground not prove of a profitable grade, the privilege of abandoning the unprofitable portion should be permitted and the balance of the prospecting fee on this portion of the property should be refunded. This would not involve so much risk for the miner and would prevent dishonest speculation with poor or worthless ground.

The burdens imposed on the man developing dredging ground are much greater than those of the miner who is prospecting ground to be operated by sluicing. For the sluicing operation the claim is 500 ft. in length along a creek or gulch and 2000 ft. wide, thus containing 23 acres. The recording fee is $10 per annum, and the regulations require $200 worth of work on the claim every season. The methods by which this work may be done are described in the local regulations and are liberal in scope. Anyone who wishes can do the work with little trouble. It can be done in a month by one man.

A dredging leasehold 10 miles in length and having an average width of 300 ft. contains 363 acres; the recording fee for the first year is $1000, and $100 for each subsequent year. In the case of the sluicing claim the recording expense is at the rate of 44c. per acre, and for the first year in the case of the dredging lease $2.75 per acre, and one-tenth of that for all other years. The representation work on a sluicing claim—$200 per year—is equivalent to $8.70 per acre, while the representation work on a dredging lease, exclusive of prospecting which is absolutely necessary, is for the first three years the cost of a dredge, which would be at least $75,000 before a wheel turned, and perhaps several times that amount. This would be at the least estimate $25,000 per year for the first three years, or nearly $70 per acre.

Comparing the dredging claim with the lode claim shows a similar advantage for the lode miner. The lode claim, which is 1500 ft. square, or 51 acres, is acquired by planting and marking three stakes, paying a recorder's fee of $5, performing $100 worth of work per year for five years, when upon filing a plan and description by a Dominion land surveyor a patent deed may be obtained by paying $1 per acre, and the land is forever the property of the patentee, without power of interference from anyone. These conditions are decidedly easy.

If the dredger could be accorded some consideratio in the way of assurance that he would not lose hi ground and all the labor performed on it because he ha failed to live up to the regulations, he would not hav so much reason to complain. He is required to d certain work every year, and if he fails he is liable t lose all. This decision is in the hands of the Ministe of the Interior at Ottawa, and it may be assumed tha this gentleman will never impose any unreasonable o unnecessary hardship on anyone so long as he does th best he can under the circumstances—provided politica exigencies do not interfere. There is no positi assurance, however, that the minister will not exercis the right of cancellation permitted by the regulation and this thought breeds doubt in the mind of the investo

In the case of the quartz miner, absolute title can obtained. Why not provide something akin to that i the case of the dredger? It would ease his mind an assure him that if he failed in living up to the requir ments after spending a lot of money that an interest i the ground, proportionate to what he had expended, woul be given him. The future of dredging is the future of large area in the Yukon, which is too poor or too dif cult for the miner of small means to operate by sluicin Hence it is not unreasonable to ask consideration of t restrictions placed on the dredger. He should have more assurance against total loss and more freedom of action. He cannot assign or transfer his leasehold without the consent of the Minister of the Interior at Ottawa, whereas the lode-claim holder can acquire his claim absolutely and do with it as he pleases.

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*Box 83, Ottawa, Canada.

What Germany Is Doing in the Chemical and Metallurgical Industries

The following notes are taken from a friendly communication by the director of a great metallurgical company of Germany to a correspondent in New York. We are not permitted to disclose the name of the writer, but we may state that he is one who is in a position to know whereof he talks and his statements of fact may be accepted with confidence.

You will be interested to know that ways and means have been found to manufacture gun cartridges, rifle cartridges, and the fuse heads of grenades without copper or brass. Soft iron with a small copper content and zinc treated by a special process can replace, to a large extent, copper and brass. In this way copper consumption for military purposes will in future be reduced considerably.

England has also cut off our supply of gasoline and petroleum. As far as concerns the first, it can in most cases be satisfactorily replaced by benzol. For certain special purposes for which we still need gasoline two synthetic processes have been worked out which yield satisfactory gasoline; these will play a large part in the future. By the way, you will remember the process with which we made some experiments for you with the object of producing gasoline from mineral oils. This process has been simplified, and a large factory which will put it to use is to begin operation within the next few days. A second new gasoline manufacturing process has been invented by a professor of the Institute of Technology in ——. It is founded on the theory that ordinary bituminous coal can be regarded as unsaturated hydrocarbons; therefore, if hydrogen be added to the unsaturated hydrocarbons, gasoline will be formed, just as is the case in nature. The experiments are said to have given favorable results, and a large plant equipped on the basis of this process will begin work in the near future.

In shutting off saltpeter imports England thought that she was dealing us a particularly severe blow, which would prevent our manufacturing trinitrotoluol for our grenades, but here again the enemies of our commerce and of our industry have been disappointed. Within a short time enormous works will have been erected which will convert the nitrogen of the air into ammonia, and then by causing the combustion of the latter by the contact process will produce nitric acid. We ourselves have enlarged our plant at —— to turn out about 80,000 tons of nitric acid yearly; and we are convinced that we shall be able to manufacture the nitrogen for much less than it cost us in the form of Chile saltpeter even in normal times. After peace is concluded these factories will continue to work, and the imports of saltpeter will be permanently cut down to a small tonnage.

The place of petroleum, which is no longer being delivered by America, has been taken everywhere by acetylene, which can be burned in safety lamps of convenient size more cheaply than petroleum. After the war, gas-distributing plants throughout the German Empire will undergo an expansion such as has never been dreamed of, for we must insure ourselves against similar petroleum shortage in the future.

It will also interest you to hear that we have been using common cellulose instead of cotton for the manufacture of gun-cotton, and that the firing experiments have given entirely unobjectionable results.

It is noteworthy, furthermore, to observe how sulphuric acid, which has grown so expensive, has been replaced in the manufacture of ammonium sulphate for agricultural purposes. The —— Company, by the use of the Haber process, produces ammonia or ammonium carbonate. In order to extract ammonium sulphate it allows the carbonate to come into contact with gypsum, and thus obtain a complete reaction, giving ammonium sulphate and calcium carbonate. In like manner the enormous deposits of kieserite (magnesium sulphate) are being converted by ammonium carbonate. The bisulphate of the dynamite factories, by treatment with ammonia from the coke ovens, is converted into neutral sulphate and ammonium sulphate. The manufacture of sulphuric acid from magnesium and barium sulphates seems to be assuming large proportions. The barium sulphate is reduced with coal to barium sulphide. The latter is decomposed by carbonic acid into barium carbonate and hydrogen sulphide, which is then converted by various stages of combustion into either sulphurous acid or elementary sulphur. The resulting sulphuric acid is chemically almost pure, and since we have at our disposal unlimited quantities of barium sulphate, the cutting off of the Spanish Rio Tinto pyrites has failed to create a shortage of the necessary raw material. Entirely aside from this, Germany can attain a production of 40,000 tons of sulphuric acid per month from German blende alone.

As you know, the chief material necessary for the manufacture of aluminum, bauxite, has been mined in France. There were and still are in Germany tremendous stocks of this material, and considerable additional quantities were requisitioned in northern France and Belgium. Assuming, however, that the war will last for several years, we must figure on a possible shortage of raw material for the production of aluminum. Meanwhile the bauxite deposits in Carinthia, Dalmatia and Hungary are being mined, and although they may not yield quite as good a product as the French bauxite, they will, nevertheless, afford a welcome substitute. Still more important is the fact that a Heidelberg chemist has succeeded in discovering an apparently rational process for the recovery of aluminum oxide from ordinary clay containing about 30% Al_2O_3. This process also provides for the simultaneous extraction of alkalis which may be present, particularly potash. Two aluminum factories here will soon be completed and will make Germany in future independent of foreign countries for this metal.

It is interesting, besides, that serious attention has lately been given to the substitution of aluminum by metallic magnesium. It has been shown that metallic magnesium, and particularly a magnesium-aluminum alloy, possesses qualities which will enable it, if necessary, to replace copper as an electrical conductor. Another large magnesium factory is being built in order to put to use large quantities of magnesium chloride, which, as a byproduct of the potash industry, has hitherto been considered worthless.

United States Reduction & Refining

Upon application by a New York trust company, because of default in interest on $2,650,000 bonds, a receiver has been appointed by the United States Court for the United States Reduction & Refining Co. The *Boston News Bureau,* reporting the recent annual meeting, states that since 1911 the company has not operated any of its Colorado plants. Several of them were closed because of lack of ore; one plant was closed because the local railroad serving it was washed out by a cloudburst, and traffic did not justify the expenditure of rebuilding; one plant costing $600,000 was sold for junk, realizing thereby $18,248; another, costing $600,000, can be razed and sold for between $20,000 and $25,000; several of the plants have been burned.

The company's report as of Jan. 1, 1915, showed among assets the cost of property acquired amounting to $12,278,994. The vice-president, in answering the many questions that were put to him at the recent annual meeting, stated that all of the plants and equipment acquired, even though several of them had been burned, others dismantled and others sold, were represented in the above-mentioned statement of assets.

If all the affairs of the company have been conducted with the same business acumen which prompted continuing of these defunct plants in the asset column, the receiver has a mess in hand which gives him no occasion for jubilation over his new job and the stockholders may look forward to contenting themselves with the only part of the pig that does not become product, namely, the squeal.

April Mining Dividends

Dividends paid in April, 1915, by 27 United States mining companies making public returns amount to $4,248,185, as compared with $9,856,355 paid by 37 companies in April, 1914. Industrial and holding companies allied to mining paid $2,499,316, as compared with $3,372,071 in 1914. Canadian and Mexican mining companies paid $1,187,460 in April, 1915, and $1,732,215 in April, 1914.

The totals for the first four months are as follows: Mining companies, 1915, $13,846,244, as against $23,689,502 in 1914; metallurgical and holding companies, 1915, $18,395,765, as against $19,200,201 in 1914; Canadian and Mexican mines, 1915, $3,621,824, as against $7,097,372 in 1914.

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	3.00	150,000
Anaconda, c	Mont.	0.25	1,165,625
Argonaut, g	Calif	0.10	20,000
Bunker Hill & Sullivan, l.s	Idaho	0.25	81,750
Bunker Hill Con., g	Calif.	0.02½	5,000
Center Creek, z	Mo.	0.05	5,000
Champion, c	Mich.	4.00	400,000
Con. Interstate-Callahan, z	Idaho	0.25	115,000
Daly-Judge, s.l.	Utah	0.15	45,000
Golden Cycle, g	Colo.	0.02	30,000
Goldfield Con., g.s	Nev	0.10	355,915
Hecla, l.s	Idaho	0.02	20,000
Homestake, g	S. D.	0.65	163,254
Iron Blossom, s.l.g	Utah	0.10	100,000
Osceola, c	Mich.	2.00	192,300
Portland, g	Colo.	0.02	60,000
Silver King Cons., s	Utah	0.10	62,758
Silver King Coal., s	Utah	0.15	187,500
Stewart, c	Idaho	0.10	123,826
Tennessee, c	Tenn.	0.75	150,000
Tonopah Belmont, g.s	Nev.	0.12½	187,500
Tonopah Ext., g.s	Nev.	0.07½	70,757
Tonopah, g.s	Nev.	0.25	250,000
Vindicator, g	Colo.	0.03	45,000
Wolverine, c	Mich.	4.00	240,000
West Hill, z	Wis.	0.20	20,000
Yellow Aster, g	Calif.	0.02	2,000
Iron, Industrial and Holding Companies			
Am. Sm. Sec., pfd. A	U. S.	1.50	252,450
Am. Sm. Sec., pfd. B	Mex.	1.25	375,000
Bethlehem Steel, pfd	Penn.	1.75	239,625
Cambria Iron	Penn.	2.00	169,360
Guggenheim Expl	U. S., Mex.	0.87½	727,768
La Belle, pfd	U. S.	0.50	49,577
Pennsylvania Salt	Penn.	2.00	100,000
St. Mary's Min. Land	Mich.	1.00	160,000
U. S. Smelting, pfd	U. S., Mex.	0.87½	425,536
Canadian, Mexican and Central American Companies			
Aguacate, g.s.	C. A.	0.05	39,996
Butter's Salvador, g	C. A.	0.24	64,500
Beaver Con., s	Ont.	0.03	59,989
Con. Min. & Sm. Co. of Can	B. C.	2.00	116,098
Crown Reserve, s	Ont.	0.02	35,376
Caribou Cobalt, s	Ont.	0.02½	25,000
Hollinger, g	Ont.	0.04	120,000
La Rose, s	Ont.	0.25	187,329
Lucky Tiger, g.s	Mex.	0.10	71,534
New York & Honduras Rosario, g	C. A.	0.30	60,000
Nipissing, s	Ont.	0.25	300,000
Porcupine Crown, s	Ont.	0.03	60,000
Seneca Superior, s	Ont.	0.10	47,638

The Largest Iron-Ore Dock in the World

Special Correspondence

The new steel-concrete dock of the Duluth, Missabe & Northern Railway Company at Duluth was put into commission a few days ago. It is the largest structure of its kind in the world handling iron ore, and will greatly facilitate shipping at that port. It has 384 pockets for the storage of ore, each with a capacity of 350 tons, or seven carloads. The entire working capacity of the dock is 134,000 tons. Working at full capacity the company would find little difficulty in loading six freighters at one time. It is expected that a boat of 9500 tons capacity could be loaded in 30 minutes. Most of the machinery to dump the pockets, swing the conveyors and move practically everything else that has to be moved is operated by electricity. With this dock in use the Duluth, Missabe & Northern Railway Company can store over 300,000 tons of ore at Duluth. The four other docks have a capacity of about 200,000 tons. Construction work was started two years ago. The cost was $2,500,000.

Japanese Copper Production in 1914

The following figures of Japanese copper production were communicated to us by H. W. Paul, consulting engineer, of Yokohama:

PRODUCTION OF PRINCIPAL JAPANESE COPPER MINES

Mine	1913 Output, Tons	1914 Output, Tons	Mine	1913 Output, Tons	1914 Output, Tons
Ashio	9,935	10,631	Kunitomi	963	981
Hitachi	9,835	10,132	Makimine	799	992
Kosaka	6,660	7,520	Arakawa	1,056	919
Besshi	7,523	7,446	Yusenji	790	819
Osaruzawa	2,062	2,087	Hibiria	830	771
Ikuno	1,801	1,998	Yoshioka	710	742
Abeshiro	1,546	1,730	Okura	580	683
Okoya	1,441	1,482	Nagamatsu	593	630
Obiye	797	1,368	Hisaichi	833	598
Ani	1,137	1,373	Oarasawa	...	593
Kamaishi	1,152	1,167			
Yakuki	708	983	Totals	51,751	55,645

JAPANESE COPPER EXPORTS

Destination	1913, Tons	1914, Tons
Europe	19,843	19,642
America	5,543	5,207
China	13,320	13,577
India	3,574	3,274
Totals	42,280	41,700

The entire copper production of Japan, Formosa and Chosen for 1914 is estimated at from 70,000 to 75,000 tons. For the first three months of 1915 exports amount to 9,973,000 yen, as compared with 7,945,000 yen in 1914.

Oil Reserve for the Navy

In compliance with the request of the Secretary of the Navy that a petroleum reserve be created for the use of the United States Navy, Secretary Lane has recommended to the President that an area of 9481 acres in Natrona County, Wyoming, be set aside for this purpose. This area, which is already included in an outstanding oil withdrawal, covers the Teapot dome immediately southeast of the Salt Creek field. It is about 30 miles north of Casper, where there are a number of refineries, and is close to two pipe lines running to that town. The dome is untouched by the drill, and so far as is known to the Government no private interests whatever are interfered with by the creation of the reserve.

Embargo on Potash Exports

State Department officials see little encouragement in reports from Berlin that negotiations for raising the export embargo on potash indicate a favorable conclusion, according to press dispatches. The negotiations are predicated on an exchange of American cotton for potash and the British order in council excludes cotton, except some shipments made before it was promulgated.

Ambassador Gerard probably will try to arrange to exchange some American cotton shipments already made for detained potash shipments. That much, officials say may be accomplished.

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Metal Production of the United Kingdom for 1913 has been reported as follows by the Chief Inspector of Mines: Copper 421 long tons, gold (bar), 153 oz.; iron, 5,138,958 long tons lead, 18,130 long tons, silver, 138,046 oz.; tin, 5288 long tons zinc, 5823 long tons. In addition some aluminum and sodium were produced, but the quantity is unknown.

Correspondence and Discussion

Deficiency Engineering

Misther Editor—Well, now, Mr. T. Montmorency Dillon is beginnin' to get restless, an' he's thinkin' av quittin' the job av helpin' me build subways for polly-tishuns an' real-estate speckilaters.

At first I thought he had trout fishin' on his mind; but the other night, whin we was figurin' up our losses in the contractin' business, Tim sez all of a sudden, sez he to me, "Bill, I'm goin' into a new business. I'm goin' to take up defishinsy ingineerin'."

"Oh," sez I, sharpenin' me pencil an' savin' the shavin's for Kathleen to kindle the kitchen fire with, "ye mean ye're goin' to work for Effie Shinsy."

"No, Bill," sez Tim. "I may be more or less effishint, but I'll not be an effishinsy ingineer. There's plinty av thim these days, an' some av thim is pretty raw. Well, niver mind, 'tis a new fresh business intirely. I'll be merely a competent ingineer an' compete with some av thim fellies an' get the business. I'll call it defishinsy ingineerin' an' fill defishinsies instead av piddlin' with little trifles to cut ixpinses. Whin ye cut ixpinses ye put good min out av work; but whin ye fill difishinsies ye make plinty av new jobs an' the world wears a grin instead av an ugly frown. I think I'll quit contractin' an' do some expandin'."

Well, now, I'll be doggoned if I don't think Tim is right.

What do ye think about it, yersilf?

BILL MCGINTY.

Brooklyn, N. Y., Apr. 16, 1915.

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Science vs. Technical Gossip

In an earlier communication to the JOURNAL (Dec. 12, 1914, p. 1056) I advanced as a definition that "science is truth ascertained, classified and understood." No protest being of record, permit me to assume the definition as accepted and valid.

It is not ethical to assail any accepted authority, especially one whose position on the pedestal of fame is fairly secure. So I merely and meekly beg for information on a subject which has been of material interest to me.

Prof. J. A. Fleming, M. A., D. Sc., F. R. S., whose researches in conjunction with Professor Dewar have furnished many of the standard values for electric resistivity and other properties of metals and alloys, states in a paper on "Electric Resistivity of Electrolytic Nickel" (*Roy. Soc. Proc.*, 1899, Vol. 66, p. 57):

> Messrs. Matthiessen and Vogt therein state that samples of supposed chemically pure nickel and cobalt wires prepared by M. Deville were given to them by M. Wöhler.

Now, in the Matthiessen and Vogt paper referred to (*Phil. Trans. Roy. Soc.*, 1863, p. 384 according to Fleming, but actually pp. 369-383) it is stated on p. 381 that:

> Hearing, however, that Professor Wöhler possessed specimens of pure cobalt and nickel wire prepared by M. Deville, we wrote and asked him to lend them to us; this he immediately did. . . .

In the abstract (*Roy. Soc. Proc.*, 1863, Vol. 12, p. 455) it is stated:

> In conclusion, we give the values found for specimens of cobalt and nickel wire lent to us by Professor Wöhler.

In another publication (*Phil. Mag.*, 1863, Vol. 26, pp. 542-545) the identical abstract appears.

In the German version (*Ann. Pogg.*, 1863, Vol. 118, pp. 431-444) the text on pp. 441 and 442 is:

> . . . und wir hörten, dass Hr. Prof. Wöhler Proben reinen, von Deville dargestellten, Kobalt- und Nikkeldrahtes besässe, so wandten wir uns mit der Bitte an ihn, uns dieselben zu liehen. Für die grosse Bereitwilligkeit, womit derselbe unserm Wunsche entsprach, sprechen wir Hrn. Prof. Wöhler unsern aufrichtigsten Dank aus.

The data of Matthiessen and Vogt regarding nickel wire are, by their own statement, not conclusive as regards c.p. nickel. Had the nickel been actually *given* to them, as Fleming states, it is more than likely that they would have sought truth by chemical analysis. Being gentlemen of honor, they did not put the "pure" borrowed nickel to the final chemical test; but merely, though politely, expressed doubts as to its purity.

The point is: Did M. Wöhler finally get his nickel back again; or did Prof. Fleming have some inside information or technical gossip which justified garbling the original text? Technical gossip may be amusing, entertaining and often very effective in productive business; but it is not always science. I seek the truth, classified in such a way that I may understand it.

WILLIAM B. MCKINLAY.

New York, Apr. 21, 1915.

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Minerals of Santo Domingo

I desire to call attention to a misstatement in connection with my article on "The Minerals of Santo Domingo," published in the JOURNAL of Apr. 10, 1915.

On p. 642 the subhead "Copper Deposits Not of Commercial Grade" does not appear in my manuscript, and is an interpolation on the part of an editor, for which I am in no way responsible. Moreover, from a reading of my statements in the context it must be evident that no such conclusion is justified.

As a matter of fact, these copper ores are relatively rich, and could they be mined and concentrated would yield valuable commercial products. The property as a whole, however, has not been developed. Large sums of money have been ostensibly used for this purpose, but a mere modicum seems to have been actually expended in development work, and not intelligently used, at that. Consequently today this property, despite all the glowing prospectuses that have been issued regarding it, is not much more than a prospect, but nevertheless in my opinion is a good one. The unoxidized ores are chalcopyrite, bornite, and my assistant reports, since my return from there in December, some small quantities of chalcocite have been developed. It is unfortunate this property has never come into skillful hands, for it has po[illegible].

F. LYNWOOD GARRISON.

Philadelphia, Penn., Apr. 20, 1915.

Editorials

Lake Iron-Ore Railroad Rates

The rates charged on iron ore from the mines on the Mesabi range in Minnesota to the ports at the head of Lake Superior have always been high, or have been considered so by shippers. Up to two years ago the general rate was 80c. per ton; it was then reduced to 60c. by the action of the roads concerned. This was not sufficient, however, to meet the views of independent shippers and an application for still lower rates was made to the Interstate Commerce Commission. The shippers asked for a rate of 40c., probably not expecting to get all the reduction. The commission has now given its decision, granting the shippers only a quarter of what they asked, and fixing the rate at 55c. per ton.

The reduction affects three roads—the Duluth & Iron Range, the Duluth, Missabe & Northern and the Great Northern. The two former lines are owned by the United States Steel Corporation, and that ownership has been frequently criticized by independent shippers on the ground that the profits earned by the roads have reduced the cost of its ore to the corporation, giving it an advantage over its competitors at their expense. The Great Northern will be the chief loser this season, not only by the rate reduction, but also because its ore tonnage will be considerably reduced by the termination of the Hill leases.

The new rates appear to be reasonable, but not by any means low, considering the character of the traffic, which is a simple one and can be handled in heavy trains with small expense for collecting. Moreover, the grades from the mines to the Lake are all in favor of the traffic. On the other hand, it is to be remembered that much of the equipment is idle for five months of the year, that the ore cars must be returned empty and that a heavy investment has been required in ore docks and terminals. Doubtless all these points have been considered by the commission, and its decision may be accepted as a reasonably fair one.

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The Goldfield Apex Litigation

In the tentative compromise arrangement, subject to stockholders' ratification, between the Booth and Jumbo Ex, looking to the ending of their apex suit, there is ground for general congratulation. The geological talent employed by the Jumbo Ex comprised some of the best specialists on apex questions and the legal talent included some of the foremost apex attorneys in this country. With that array the Jumbo Ex could have put up a very stiff fight. Although the engineers advised the company that the geological contention of the plaintiff was well founded, and that in their opinion it would be better to effect the best settlement possible with the Booth, the attorneys saw ground for representations in a court of equity. With the ever-present chance of winning on a fluke and the aura of luscious fees, both legal and expert, to seduce judgment, the usual procedure would have been to advise their clients to proceed. The reverse was done.

This was a highly ethical thing to do, and if it were more common it would occasion less comment in this instance. That the suing company did not exact its pound of flesh secures for it a proper share of commendation in this broad-gage business adjustment of what promised to be a long-drawn-out, expensive and disagreeable suit.

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Blast Furnace vs. Reverberatory

Announcement has been made of the prospective abandonment of blast-furnace smelting at Anaconda. Garfield, however, has already placed the laurel on the brow—or shall we say the firing wall of the reverberatory? At least, its blast furnaces have been temporarily relegated to a seat in the rear. As the tonnage smelted is being increased, following the curtailment of a few months ago, all ore is being handled in reverberatories. Whether this will become permanent practice it is too early to decide, as the balance between the two types of furnaces is so delicate as to be readily changed by a slight alteration in the ore supply—especially in a custom-smelting works. Convenience in operation must also be considered.

Charging along the side walls of the reverberatories has not yet been adopted at Garfield; but even with the old method of charging, the pulverized coal has given the reverberatory the advantage, for the moment at least, of the blast furnace. Oil firing is not completely abandoned at Garfield, but pulverized coal has been shown in the preliminary installation to be more economical under present conditions, and it is understood that coal-dust firing will be adopted for all of the reverberatories as soon as the proper installation can be completed. It may be mentioned in passing that the El Paso Smelting Works is using its reverberatories, but not its copper blast furnaces.

It is not to be assumed, however, that the blast furnace is to be completely eliminated from the smelting field. There are many small plants where it will continue to be the best instrument for reducing the ores, and even in the larger works there will be occasions when the blast furnace will be utilized in preference to the unwieldy reverberatory. For example, a few weeks ago no reverberatory furnaces were being operated at Coppercliff, where coal-dust firing was developed to its present great efficiency; four blast furnaces were being run on the regular roasted charge, and two were smelting a charge consisting of green-ore fines and converter slag, each of these furnaces handling about 150 tons of fines and 125 tons of converter slag. Thus while the plant was approaching full capacity, blast furnaces were exclusively used at this works.

To reach its extreme economy the reverberatory must be operated at full capacity, and this is awkward when there is not enough suitable material to satisfy its great appetite. One reverberatory is now in operation at Coppercliff; but up to a few weeks ago green-ore fines were not being produced in sufficient quantity to warrant starting a reverberatory, and the accommodating blast furnace was called into requisition. The reverberatory at Coppercliff requires about 500 tons of charge per day, and consequently was not so convenient a unit as the blast furnace. This is one of the reasons for the continued use of the blast furnace at moderate-sized properties. The Detroit Copper Co.'s plant in the Southwest is a case in point. Here the blast furnace is used despite the fact that the material smelted (concentrate) is exactly what is regarded as ideal feed for a reverberatory. There will continue to be properties that will perpetuate the blast furnace, although its place may be taken by the reverberatory in works where conditions are regular, tonnages large and the charges prepared in just the right way. While the blast furnace may be vanquished under these conditions, it will still find friends who will appreciate its accommodating maw and its flexibility in operation.

The Iron Industry in Europe

The position of the iron and steel industries in Europe is not an easy one under present conditions. On the one hand is a great demand for certain classes of materials and on the other are the drawbacks of a short labor supply, interference with transportation of raw material and fuel and to some extent the total stoppage of works by war operations. In England, of course, the last condition does not exist, but the trade is embarrassed by the labor situation and by the suspension of an important part of its export business. We have no statistics for the current year, but there will probably be some decrease in production. In Germany the current statistics are published as usual, and it appears that production is going on at the rate of about 60% of a normal year. The export trade is almost entirely cut off, but domestic business is large, the demand for war munitions more than making up for any loss in ordinary trade. The supply of iron ore has presented some difficulties, but these seem by all accounts to have been overcome. The supply of ferromanganese is said to be very short. Usually most of the manganese ore used comes from Russia, and that supply has been cut off entirely.

In Russia the coal and iron industries in Poland are practically suspended, but the important districts of South Russia and the Urals are entirely untouched and are active. In Austria the industry is understood to be in a bad state, as much from financial conditions as from war troubles.

French iron makers have suffered severely, as the zone of active war operations covers the most important producing sections of the country, as well as those supplying ore and fuel. There are, however, many important steel works which are untouched and in active operation. The full extent of the damage done will not be apparent until the war is over. France has never been a heavy exporter of iron and steel, and has suffered little on that side of her trade.

Belgium, of course, has been the greatest sufferer, her iron trade being prostrate for the time, and its future servival is entirely uncertain. So far, however, it seems to be the fact that comparatively few of the important works in that country have been destroyed or badly damaged. It has been the policy of the German invaders to preserve industrial establishments which they might be able to use for their own benefit, so that it is not impossible that buildings and machinery will be found largely intact; while coal and iron mines have suffered only such damage as is inevitable from the stoppage of work.

Undoubtedly the iron and steel industries of Europe will suffer severely while the war lasts; but we must not expect to have things our own way when peace comes and with it the expected demand for new material. Our competitors abroad will probably be as alert and almost as active as ever, and it will not take them long to repair the damage done.

Trouble at Guanajuato

Reports from Mexico indicate that conditions are becoming worse instead of better. That part of the country south of Aguas Calientes, which, up to a few months ago, has been comparatively free from disturbances, is now in a particularly turbulent state. At Guanajuato the government retires with the sun and a new one may come up resplendent in the morning. The state government has removed its seat from Guanajuato, the ancient capital, to Leon. The change is decidedly disadvantageous for the mining companies, since shipments of ore and bullion must be accompanied by certain official documents, the securing of which now necessitates the sending of special messengers from Guanajuato. The shipments may not move without these documents. The mining business at Leon is insignificant, but being on the plains instead of in the mountains, there are probably certain military advantages which are not to be despised, such as facilities for prompt evacuation.

Higher Furnaces in Pyrite Smelting

Shipment to the Granby company's Anyox plant of a fourth furnace 5 ft. higher than the original furnaces at this works again calls attention to the increased height of furnaces now used in pyrite smelting. When pyrite smelting was first undertaken the early experimenters concluded that a low column, hot blast and numerous other factors were essential to success in utilizing the heat possibilities of the ore. Many of the rules laid down in the early days of this industry, we have since discovered, were largely the expression of operating difficulties of the experimental period and of handicaps imposed by the equipment of the day or by the ore deposits on which the process was tried.

It was not considered safe to make a first matte higher in copper than 20 to 25%; double smelting was looked upon as imposed by practical considerations; low blast pressure and hot blast were regarded as essential; the merits of column and layer charging were discussed, and it was thought that the ore column should come within the limits of 4 to 7 ft. in height. It was, and still is, exceedingly difficult to find ore conditions to suit this process, but approximations of these conditions have been found at several properties, and many of the conclusions reached by the early experimenters have been diametrically changed by later practice. Perhaps the greatest blow to the creed of the pyrite smelter was when Robert Sticht announced the abandonment of hot blast at Mt. Lyell, where the first great commercial development of pyrite smelting took place.

With the use of cold blast came a greater volume of air and an increase in the blast pressure. Turbo-blowers began to find favor to give these higher pressures. At Mt. Lyell the 54x210-in. furnaces receive about 20,000 cu.ft. of air per minute at 64-oz. pressure, and at times the pressure is even higher. New multistage turbo-blowers now being installed will permit air to be supplied at 8 lb., if desired. The height of the ore column at Mt. Lyell gradually increased, until it is now nearly 18 ft. above the tuyeres. While in New York last winter Mr. Sticht stated that it would probably be still higher were it not for limitations of the furnace building. The new blast furnaces at Mt. Morgan in Queensland have been erected so that a 25-ft. column may be maintained, if found desirable. Conditions at different deposits, and even at the same mine, vary so that finality is never reached in such matters; but it is evident that the former limitations in regard to low ore column and low blast pressures passed with the abandonment of the heated blast.

BY THE WAY

The Thomas Iron Co. at Easton and Hokendauqua, Penn., is the oldest company making pig iron in the United States and still working under its original name. The company was organized Apr. 4, 1854. In the 61 years since then the company has made 6,245,312 tons of pig iron and has paid out dividends amounting to $9,386,112, an average of $1.50 per ton of iron made.

⁂

Contractors frequently devise unique methods of thawing dynamite in places where regulation conveniences are not available. The *Du Pont Magazine* states that one ingenious contractor placed "the dynamite to be thawed on shelves around the sides of a small building about 10 ft. square with double walls, in the middle of which was an oil stove. A thermometer was placed at a convenient point in the room and a man was instructed to stay in the thaw-house continually while the oil stove was burning to watch the thermometer and turn down the wick when the temperature rose above 80° F. To insure the faithful performances of his duties he was *locked in the room* by the foreman of the blasting gang, and had, therefore, every incentive to keep the temperature at a safe point, as he had no opportunity to evade his responsibility." Every incentive is right!

⁂

The Proper Slogan*

This business of diggin' the copper
  Is risky, at best, an' that's straight,
Which makes it exceedin' improper
  To take extra chances with fate.
The man who with danger is flirtin'
  Is lightin' a mighty short fuse.
Don't gamble with death, for it's certain
  That sooner or later you'll lose!

Up at the collar or down in the stope,
"Safety First" is the wisest dope!

If timbers seem doubtful an' quaky
  Don't "guess they will do for the day,"
If ground up above you is shaky
  Don't reckon at "maybe will stay."
You want to watch out what you're doin'
  In manway or crosscut or drift,
Or else you may totally ruin
  Yourself—or the feller next shift.

Out at the station or in at the stope,
"Safety First" is the wisest dope!

There's many a widow in mournin',
  There's many a sweetheart who cries,
Because of a man who was scornin'
  The rules an' precautions that's wise.
So listen, you boys, to my carol,
  So I won't be wastin' my breath,
Don't monkey with danger an' peril,
  Don't gamble so reckless with Death!

For up in the smelter or down in the stope
"Safety First" is the proper dope!

⁂

Alaska Surveys and Investigations for 1915

The U. S. Geological Survey is dispatching 12 parties to Alaska to continue the systematic surveys and investigations that have been in progress for the last 18 years. Of these parties three will be sent to southeastern Alaska, one into upper Chitina region, one to Port Valdez; two will work in the Turnagain Arm-Knik region; one will make investigations in the Yukon-Tanana region and two in the Ruby-Kuskokwim region, and another will traverse the little-known area lying between the Ruby district and the Tanana River. One party will be engaged in general investigations in different parts of the Territory. These parties will sail from Seattle during May, so as to take full advantage of the field season. All the men needed for the work have been engaged, and the purchase of horses, supplies and equipment is well under way.

The detailed topographic mapping adjacent to Juneau, in southeastern Alaska, begun last year, will be continued by D. C. Witherspoon. The base map of this important gold-lode district is essential to an exhaustive study of the district which will be undertaken next year.

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Copper Imports and Exports

The Department of Commerce reports the exports of copper in March as given below, in pounds; the figures for January and February being added:

	March	Three Mos.
Pigs, ingots and bars	59,677,711	155,031,609
Plates and sheets	1,995,350	11,901,804
Rods and wire	4,646,867	12,886,530
All other forms	263,422	643,241
Total	66,583,350	180,463,184
Total, 1914	96,519,947	266,040,461

There were in March, 1914, in addition 344 tons of ore and matte, valued at $6050. The copper contents are not stated.

The imports of copper in March are reported by the Department of Commerce, in pounds, as follows:

	Tons	Copper Contents
Ore	21,733	5,585,602
Matte and regulus	5,831	5,456,899
Old metal for remanufacture		252,423
Pigs, ingots, bars, etc.		11,156,871
Composition metal, chief value copper		8,298
Total copper		22,460,093
January and February		34,230,127
Total for three months		56,690,220

The net exports for the three months were therefore 123,772,961 lb. Like the exports, the imports show a considerable decrease this year.

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*Written by Berton Braley for "The Anode."

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALKALI-METAL SILICATES, Process of Decomposing, Samuel Peacock, Philadelphia, Penn., assignor, by mesne assignments, to Agricultural Research Corporation, New York, N. Y (U. S. No. 1,134,413; Apr. 6, 1915.)

ALLOYS—Process of Making Alloys (Copper and Boron). Edward D. Gleason, New York, N. Y., assignor, by mesne assignments, to Neu-Metals & Process Co., Long Island City, N. Y. (U. S. No. 1,136,909, Apr. 20, 1915.)

ALUMINA—Method of Making Alkali-Soluble Alumina. Paul R. Hershman, Chicago, Ill., assignor to The Mineral Products Co., New York, N. Y. (U. S. No. 1,137,619; Apr. 27, 1915.)

ALUNITE—Treatment of Alunite and the Like. Charles H. MacDowell, Chicago, Ill., assignor to the Mineral Products Co., New York, N. Y. (U. S. No. 1,136,549; Apr. 20, 1915.)

BARIUM OXIDE—Process of Producing Barium Oxide. Spencer B. Newberry and Harvey N. Barrett, Baybridge, Ohio. (U. S No. 1,133,392; Mar. 30, 1915.)

BLAST-FURNACE CONSTRUCTION. Thomas E. Thomas, Niles, Ohio. (U. S. No. 1,137,244; Apr. 27, 1915.)

BLAST FURNACES—Apparatus for Feeding Lime to Blast Furnaces. James G. Morgan, Jackson, Ohio. (U. S. No. 1,137,415; Apr. 27, 1915.)

BLOWING ENGINES—Safety Device for Blowing Engines. Henry G. O'Reilly, Joliet, Ill. (U. S. No. 1,137,164; Apr. 27, 1915.)

BORON NITRIDE—Process of Making Boron Nitride. George Weintraub, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,135,232; Apr. 13, 1915.)

CABLEWAY. William James Alexander Rankin. New York, N. Y., assignor to Lidgerwood Manufacturing Co., New York, N. Y. (U. S. No. 1,133,818; Mar. 30, 1915).

CINNABAR—Manufacture of Cinnabar Alexander Eibner, Munich, Germany. (U. S. No. 1,137,199; Apr. 27, 1915.)

CLASSIFYING—Process of and Apparatus for Classifying Comminuted Material. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,136,293; Apr. 20, 1915.)

CLAY CLEANER. Bernard Jacquart, South River, N. J., and John V. V. Booraem, New York, N. Y. (U. S. Nos. 1,136,676 and 1,136,677; Apr. 20, 1915.

CONCENTRATING TABLES—Rocking Support for Concentrating Tables. Emil Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. (U. S. No. 1, 135,965; Apr. 13, 1915.)

CONCENTRATOR—Ore Concentrator. Fraser D. Reid, Cobalt, Ont. (U. S. 1,134,649; Apr 6, 1915.)

CONVERTERS—Means for Increasing the Air-Blast of Converters and Furnaces. Ralph Baggaley, Pittsburgh, Penn. (U. S. No. 1,135,489; Apr. 13, 1915.)

COPPER—Electrolytic Process for the Extraction of Copper. Noak Victor Hybinette, Christiania, Norway. (U. S. No. 1,136,424; Apr. 20, 1915.)

COPPER—Metallurgy of Copper. Elias A C. Smith, New York, N. Y. (U. S. No 1,134,767; Apr. 6, 1915.)

COPPER-SMELTING FURNACE. Walter George Perkins, London, England. (U. S. No. 1,136,834; Apr. 20, 1915.)

CRUSHER. Edward P. Le Compte and Rubin Colvin, Park City, Utah. (U. S No 1,135,824, Apr. 13, 1915.)

CRUSHER—Rotary Crusher. Joseph L. Hiller, Mattapoisett, Mass. (U. S. No. 1,135,017; Apr. 13, 1915.)

CUPOLA FURNACE—Metallurgical Apparatus. Charles J. Rice, Ashland, Ky., assignor to the Pneumatic Cupola Co., Ironton, Ohio. (U. S. No. 1,133,317; Mar. 30, 1915.)

CYANIDING—Apparatus for the Separation of Finely Divided Solids from Liquids. John V. N. Dorr, Denver, Colo. (U. S No. 1,135,997; Apr. 20, 1915.)

CYANIDING—Process of Treating Ores. Edward M Hamilton, Bristol, England, assignor to Charles Butters, Oakland, Calif. (U. S. No. 1,136,872; Apr. 20, 1915.)

DRILL—Coal and Rock Drill Pearson Jopling, Rock Island, Ill., assignor of one-half to Marguerite Hoffman, Rock Island, Ill. (U. S. No. 1,135,530; Apr 13, 1915.)

DRILL—Fluid-Operated Tool Louis W. Greve, Cleveland, Ohio, assignor, by mesne assignments, to the Cleveland Rock Drill Co, Cleveland, Ohio (U. S 1,135,178, Apr. 13, 1915.)

DRILL—Percussive Tool with Detachable Cutter Frank Ondra, Johannesburg, Transvaal, South Africa, assignor of one-half to Max Pollak, Johannesburg. (U. S. No. 1,135,546; Apr 13, 1915.)

DRILL EXTRACTOR. Michael Conley, Denver, Colo. (U. S. No. 1,133,709, Mar. 30, 1915.)

EXCAVATOR—Drag-Line Excavator. Lawrence Roys, South Milwaukee, Wis., assignor to Bucyrus Co., South Milwaukee, Wis (U. S. No 1,135,928; Apr. 13, 1915.)

EXCAVATOR BUCKET William N Springer, Peoria, Ill., assignor to Avery Co (U. S No 1,136,844, Apr 20, 1915.)

FERROCHROMIUM Process of Producing Carbon-Free Ferrochromium. Hans Goldschmidt and Otto Weil, Essen-on-the-Ruhr, Germany, assignors to Goldschmidt Thermit Co., New York, N Y. (U. S. No 1,136,669; Apr 20, 1915.)

FERROSILICON PRODUCT and Method of Continuously Producing the Same. Herbert Champion Harrison, Lockport, N. Y., assignor, by mesne assignments, to Electro Metallurgical Co (U. S. No. 1,134,128; Apr. 6, 1915.)

FILTER. Charles Butters, Oakland, Calif. (U. S. No. 1,136,863, Apr. 20, 1915.)

FLOTATION MACHINE. Charles E. Rork, Douglas, Ariz. (U. S No. 1,136,485, Apr 20, 1915.)

FOUNDRY CUPOLA. George M. Klug, Ionia, Mich. (U. S No. 1,135,025; Apr. 13, 1915.)

GASES—Method of Neutralizing Corrosive [illegible] in Gases Thomas E Murray and Edwin B. Ricketts, New York, N. Y (U. S No 1,132,679; Mar 23, 1915.)

GRIZZLY—Revolving Grizzly. Ray C. Newhouse, Milwaukee, Wis. assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,135,606; Apr. 13, 1915.)

HYDROXIDES OF METALS—Process and Apparatus for Producing Hydroxides of Metals by Means of Ammonia. Hans A. Frasch, New York, N. Y. (U. S. No. 1,135,785; Apr. 13, 1915.)

INGOT MOLD—Top for Ingot Molds. Edward F. Kenney, Westmont Borough, Penn (U. S. No 1,135,381, Apr. 13, 1915.)

KELP—Process for the Extraction of Mineral Salts and Organic Constitutents of Kelp. Adolphe G. Artz, San Francisco, Calif., assignor, by direct and mesne assignments, to Kelp Products Co., San Francisco, Calif. (U. S. No. 1,136,390; Apr. 20, 1915.)

MAGNETIC SEPARATOR. Myron Dings and Robert A. Manegold, Milwaukee, Wis., assignors to Dings Electro-Magnetic Separator Co., Milwaukee, Wis. (U. S. No. 1,136,215; Apr. 20, 1915.)

METAL COATING—Apparatus for Spraying Molten Metal and Other Fusible Substances. Max Ulrich Schoop, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S. No. 1,133,507; Mar. 30, 1915.)

METAL COATING—Method of Spraying Fusible Substances. Max Ulrich Schoop, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S. No. 1,133,508; Mar. 30, 1915.)

MINER'S LAMP. Stanly J. Yellen, Great Neck, N. Y. (U. S. No. 1,136,303; Apr. 20, 1915.)

ORE CAR. Argyle Campbell, Chicago, Ill., assignor to Enterprise Railway Equipment Co., Chicago, Ill. (U. S. No. 1,133,614, Mar. 30, 1915.)

ORE CAR—Gondola Car. Charles H. Clark, Crafton, Penn., assignor to Clark Car Co., Pittsburgh, Penn. (U. S. No. 1,136,318; Apr. 20, 1915.)

ORE CARS—Dump-Car Doors. Charles H. Clark, Crafton, Penn., assignor to Clark Car Co., Pittsburgh, Penn. (U. S. No. 1,136,317; Apr. 20, 1915.)

ORE DUMP CAR. Allison R. Chambers, New Glasgow, Nova Scotia. (U. S. No. 1,135,993; Apr. 20, 1915.)

ORE DUMP CAR. Charles H. Clark, Crafton, Penn., assignor to Clark Car Co., Pittsburgh, Penn. U. S. Nos. 1,136,315 and 1,136,316; Apr. 20, 1915.

ORE TREATMENT—Process and Apparatus for Treating Ores. Lewis E. Porter, Los Angeles, Calif., assignor of one-half to Hugh E. Stock, Casper, Wyo. (U. S. No. 1,136,483; Apr. 20, 1915.)

PERCUSSIVE TOOL. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,134,718; Apr. 6, 1915.)

PULVERIZER. Joseph L. Hiller, Mattapoisett, Mass. (U. S. No. 1,135,795; Apr. 13, 1915.)

SCREEN for Separating Sand from Slime. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,133,461; Mar. 30, 1915.)

SCREEN OR SEPARATOR. Thomas Leggett Sturtevant, Quincy, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,134,166; Apr. 6, 1915.)

SCREENING CONVEYOR. Arthur Richard Houston, Ensley, Ala. (U. S. No. 1,136,674; Apr. 20, 1915.)

SEPARATOR—Fine-Ore Separator. Charlie Wilbur Bell, Rickey, Ala. (U. S No 1,135,754; Apr. 13, 1915.)

SEPARATOR (Magnetic). Joseph L. Hiller, Mattapoisett, Mass. (U. S. No. 1,135,016; Apr. 13, 1915.)

SEPARATOR. William K. Liggett and Walter J. Armstrong, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. Nos. 1,135,304 and 1,135,594; Apr. 13, 1915.)

SIZING—Apparatus for Sizing or Volumetric Grading of Materials Charles L. McKesson, Colorado Springs, and Benjamin F. Rice, Denver, Colo. (U. S. No. 1,135,123; Apr. 13, 1915.)

SLAG—Slag-Removing and Indicating Mechanism for Openhearth Furnaces. Walter A. Kosinski, Chicago, Ill. (U. S No 1,133,975, Mar 30, 1915.)

SLAG STEAM GENERATOR Leonce L. Battu, New York, N. Y., assignor to Slag Steam Generator Co., New York, N. Y (U. S. No. 1,135,984; Apr 20, 1915.)

SMELTER GASES—Process of Preventing the Escape of Sulphur Dioxide in Smelting Sulphide Ores. William A. Hall, New York, N. Y (U. S No 1,134,846; Apr. 6, 1915.)

SULPHIDE ORES Apparatus for the Wet Dressing of Sulphide Ores. Benjamin Sedgely Smith, Sydney, N. S. W (U. S No. 1,136,622, Apr 20, 1915.)

SULPHIDE ORES Method of Treating Ores. Ralph Baggaley, Pittsburgh, Penn (U. S. No 1,135,488; Apr. 13, 1915.)

TITANIUM ALLOYS and Method of Producing the Same Hans Goldschmidt and Otto Weil, Essen-on-the-Ruhr, Germany, assignors to Goldschmidt Thermit Co., New York, N Y (U. S. No 1,136,670; Apr 20, 1915.)

ZINC Muffle for the Distillation of Zinc. Max Engels, Westend, near Berlin, Germany. (U. S. No. 1,136,519; Apr 20, 1915.)

ZINC OXIDE Process of Making Pure Zinc Oxide and Recovering Substances from Waste and Like Liquors. Waldemar Asef, Philadelphia, Penn. (U. S No. 1,135,9[illegible]; Apr 20, 1915.)

ZINC-PRODUCING FURNACE. Albert Zavelberg, Hohenlohehutte, Germany (U. S No. 1,136,304; Apr. 20, 1915.)

PERSONALS

G. C. Bateman was in New York last week.

F. R. Short has returned from Peru, and after a short visit to his home in San Francisco will go to Alaska.

Eli Larson, a well-known prospector of Edmonton, Alberta, has returned to that city from a trip to the North.

H. L. Mead, who has been engaged in examination work in southern Utah for several months, has returned to New York.

H. A. Morrison, formerly of Dedrick, Calif., has accepted a position in the mill of the Aurora Consolidated Mining Co., Aurora, Nev.

Lawrence Addicks, who has been in the East attending the annual meeting of the American Electrochemical Society, left New York on May 1 for Arizona.

Thomas Cantley, vice-president and general manager of the Nova Scotia Steel & Coal Co., is on his way to Petrograd, Russia, in connection with extensive contracts for war munitions.

H. J. Rahilly, formerly superintendent for the Minneapolis Copper Co. at Cumpas, Sonora, Mexico, has accepted a position in the United States Government service and is located in Alaska.

Louis Shaffer, of Silverton, Colo., was married Apr. 21 to Miss Erma Chill. He is superintending developments under way by the American Oil Flotation Co. in several Silverton properties.

Charles P. C. Beresford, manager of the Prestea Block A Co., at Prestea Gold Coast Colony, Africa, is at Cobalt, Ont., for the purpose of engaging about 30 miners to replace men who have gone to the war.

Professor Henry S. Munroe, it is announced, will retire from his professorship of mining in the Columbia University School of Mines on June 30, after 38 years of service there. His retirement will be universally regretted.

At a meeting of the directors of the Woodward Iron Co. in New York, Apr. 22, J. H. Woodward was reëlected president; A. H. Woodward was chosen chairman of the board; R. S. Banister, vice-president; D. E. Wilson, treasurer; H. E. Smith, assistant secretary.

Charles Butters has moved his New York offices to the Equitable Building, 120 Broadway. Mr. Butters' Oakland address has been changed to 6272 Chabot Road, Oakland, Calif., owing to a change of street name, the situation of the plant remaining the same.

Alvin R. Kenner has been in New York attending the annual meeting of the Rio Plata Mining Co. He will proceed to Mexico City to close negotiations for the acquisition by his company of mines on the Becerra estate near the company's present property in Chihuahua.

Russell T. Cornell has removed his office to 80 Maiden Lane, New York, immediately adjoining those of Ricketts & Co., Inc., by whom he has been retained as associate mining and consulting engineer. His new association will not in any way affect his present status as an independent engineer.

Durward Copeland, professor of metallurgy and ore dressing at the Missouri School of Mines and Metallurgy, is in New York, preparing for a trip to England, the Straits and other tin-producing countries. He will spend the coming year in the study of the tin conditions of the world for South American interests

S. C. Thomson, late consulting mining engineer to S. Neumann & Co., and J. N. Bulkley, late consulting mechanical and electrical engineer to the General Mining & Finance Corporation, Ltd., London and Johannesburg, have opened joint offices in the Equitable Building, 120 Broadway, New York, as consulting engineers.

Thomas G. Thompson, a teacher-student in the chemistry department of the University of Washington, Seattle, has been honored with a Carnegie research fellowship of the Iron & Steel Institute. It is the first honor of this kind to be awarded in the United States for two years. The work to be prosecuted is on the protection of iron and steel from corrosion.

Selwyn C. Edgar, Jr., has been made president of the Edgar Zinc Co., St. Louis, most of the capital stock of which is controlled by the United States Steel Corporation, succeeding his father, Selwyn C. Edgar, who has retired. The new president has been connected with the Edgar Zinc Co. for the past 17 years and has occupied various positions of responsibility.

OBITUARY

John L. Roberts, a well-known prospector in the Alma district, Colorado, died of cardiac dropsy, Apr. 7, in the Red Cross Hospital, Victor.

Jacob Kleinhans died at Anaconda, Mont., Apr. 19, aged 34 years. He was born in Michigan, but had worked at the Anaconda reduction works for a number of years. He was a prominent member of the local union.

Morton Lindley died at his home in Oakland, Calif., Apr. 15, age 53 years. He was born at Sacramento and graduated from the University of California. He had practiced as a mining engineer for many years, and had developed the Mammoth copper mine in Shasta County, with other properties in California and Mexico. He leaves a widow, son and daughter.

Edward B. Bovion, the first man to explore the James Bay slope in northern Ontario for the provincial government, died in Toronto, Ont., Apr. 23 in his 95th year. He was born in England and came to Canada in 1850. He acted for several years as a mining inspector and in 1874 was returned as a member of Parliament for Algoma District. He was subsequently appointed as stipendiary magistrate, and took an active part in the development of the north country. In 1882 and following years he made several important exploration trips between Lake Superior and James Bay, and his reports on the mineral and other natural resources of the region contained much valuable information. In 1891 he wrote a report on the lakes, rivers and water powers of Ontario. Mr. Bovion leaves a widow and four daughters.

Nathan A. Taylor, known in iron and steel circles as the pioneer in American tinplate manufacture and senior member of the N. & G. Taylor Co., died at his home in Philadelphia, Apr. 25. He was born in Philadelphia, 69 years ago. In 1868 he became a partner in the Taylor firm of the tin importers founded by his grandfather, William Taylor, in 1810. The present business, of which he was the head, is one of the largest in the tinplate industry in the country, having factories at Cumberland, Md., and central offices in Philadelphia. In 1891 he launched his firm into the manufacture of tinplate, taking the lead in this industry. He was a member of the Union League, Philadelphia Country Club, Cricket Club and numerous other organizations. He was identified prominently with the Fairmount Park Association. Mr. Taylor is survived by a widow and four daughters.

SOCIETIES

Utah Society of Engineers held the annual meeting and dinner at the Newhouse Hotel, Salt Lake City, on Apr. 16. C. P. Overfield was toastmaster, and toasts were responded to by S. C. Park, the mayor of Salt Lake City, the Rev. P. A. Simpkins, Dr. W. C. Ebaugh. Silvester Q. Canon, the retiring president of the society, gave the annual address. The new officers elected were: S. S. Arentz, president; R. S. Lewis, first vice-president; W. A. Wilson, second vice-president; C. J Ullrichs, secretary; L. H. Krebs, treasurer. During the yea the society held 10 regular and three special meetings. Ther are 152 members in good standing, this being an increase o 11 for the year.

American Iron & Steel Institute—On Apr. 29 the offices o the Institute will be removed from the Hudson Termina Building, 30 Church St., where they have been for the las five years, to the 29th floor of the new Adams Express Co Building, 61 Broadway, New York. Among the papers thu far selected for the eighth general meeting at the Waldorf Astoria, New York, on May 28, are the following: "Blas Furnace Advancement," by Andrew E. Maccoun; "Moder Merchant Steel Mills," by Jerome R. George; "Corrosion o Steel," by Daniel M. Buck. Addresses describing the welfar work of the Tennessee Coal, Iron & R.R. Co. will also b made by Dr. Lloyd Noland and others.

Oregon Bureau of Mines—The Governor has appointed commission consisting of H. N. Lawrie, chairman, Portlan W. C. Fellows, R. M. Betts, Baker County; W. J. Woo Albany; J. F. Reddy, Medford. H. M. Parks of Oregon Agr cultural College, Corvallis, was reëlected director of the burea and plans were laid for the expenditure of the $25,00 appropriated for the work of the next two years by the la legislature. Chairman Lawrie said that during the last tw years the bureau published eight volumes on the miner resources of Oregon. For this biennium the work will concentrated into one volume, and will be known as the souvenir edition of the Panama-Pacific Exposition and will be distributed free to visitors to the Oregon Building. Oregon will spend $10,000 on a mineral exhibit at the Panama-Pacific Exposition and the same will be in charge of Fred R. Mellis who had charge of the mineral exhibit at the Lewis & Clark fair in Portland, 1905. The exhibit will be placed in the Mines & Metallurgy Building and will be ready May 1.

University of Washington—In connection with the "open house" of the various engineering departments of the University on Apr. 15 the laboratories of the College of Mines were in full operation. Seniors and juniors ran the various divisions of work while freshmen and sophomores acted as guides. Among the special features of the performance were the operation of the stamp battery, crushing and concentrating machinery of the mill; rock drilling; mine timbering; first-aid and mine-rescue work; mineral and rock exhibits; fire and wet assay methods; cyanide and flotation processes; and metallurgical demonstration.

Each year the College of Engineering and the College of Mines make a combined engineering trip to some point of interest to all the students. This year the trip was taken to the White River hydro-electric plant of the Puget Sound Traction, Light & Power Co. at Dieringer, Wash., with a rated capacity of 20,000 kw. and to the Stuck River project near Auburn, Wash. The latter project involves the creation of a new drainage channel for the White River, which overflows its banks and floods an adjacent rich agricultural district The work is being done by two counties at a cost of $1,500,000. Between 250 and 300 students made this trip.

Colorado School of Mines—The annual inspection trip of the Senior Class began Apr. 26. The party includes 35 students and seven members of the faculty. After visiting the important metallurgical plants near Colorado Springs, inspecting hydro-electric-power plants near Manitou and studying geological phenomena in the neighborhood, the party will go to the Cripple Creek District where visits will be made to several of the most important mines and mills. The party will proceed thence to Concrete to study cement manufacture and then visit zinc plants near Cañon City. Three days will be spent in studying lead and zinc mining in the Leadville District and two days will be consumed in investigating the hydraulic placer mining and dredging operations at Breckenridge. The class will visit the power development of the Central Colorado Power Co. on the Grand River at Shoshone, inspect the marble quarries at Marble, and study the manufacture of coke at Carbondale. The party proceeds thence to Castle Gate, Utah, to study the coal-mining operations of the Utah Fuel Co. From Salt Lake City the party will make extensive side trips to various important mines and metallurgical plants, including the copper mines of Bingham Cañon, the mills and smelters at Midvale, Magna, Garfield and International, and the mines at Park City. A visit will be made to the outdoor terminal station of the Utah Power & Light Co. and to several power plants. The party will return to Denver May 24. The annual commencement will be held May 28, at Golden.

Montana Society of Engineers—The annual convention was held at Butte according to program previously announced. Members from all parts of the state began arriving in Butte, Apr. 8, where they were cordially received by the local members. Friday forenoon, Apr. 9, the engineers visited the new electric hoist at the North Butte mine, the mill of the Butte & Superior and the concentrator of the Timber Butte. The afternoon was spent in a visit to the Washoe smelter at Anaconda where Manager Mathewson and members of the staff conducted the visitors through the various departments of the works, pointing out and describing the features of the extensive additions being made, including the sulphuric acid plant. In the evening the Montana Power Co. entertained the engineers with a display of moving pictures, illustrating a number of its hydro-electric plants. The display included a series of Butte underground scenes, executed by the Anaconda Safety First department and showing in a striking manner bad practice which usually leads to more or less serious accidents. April 10 was devoted to the transaction of business, election of officers and the address of the retiring president, Reno H. Sales. The officers for the ensuing year are: M. H. Gerry, Jr., president, A. W. Richter, first vice-president and J. H. Kyd, second vice-president. Papers were read by F. R. Ingalsbee of the U. S. Forest Service and by Mr. Lamont of the Westinghouse company who presented G. B. Rosenblatt's report on the new electric hoist of the North Butte mine. Mr. Gardner read an interesting paper on the cost of mining excavations in prospect work. A banquet at the Silver Bow Club, attended by 60 members, concluded the convention which was one of the most successful ever held by the society.

INDUSTRIAL NEWS

The Vulcanite Portland Cement Co. will move its New York office about May 1 to 8 West 40th St.

The Door Cyanide Machinery Co. announces that after May 1, 1915, its New York office will be at 17 Battery Place.

Brandis & Sons Mfg. Co., makers of engineering instruments, has removed to its new buildings, 754-758 Lexington Ave., Brooklyn, N. Y.

The recent change in name of the Witte Iron Works Co. of Kansas City, Mo., to Witte Engine Works is one of name only. The management of the factory is unchanged.

Clarence Boyle, Jr., formerly district sales manager of Taylor-Wharton Iron & Steel Co., Connell Building, Scranton, Penn., has become associated with Clarence Boyle, Inc., of Chicago.

M. N. MacLaren, New York manager for the Nordberg Mfg. Co., of Milwaukee, Wis., announces the removal of the New York office from 42 Broadway to the new Equitable Building, 120 Broadway, on Apr. 26, '15.

Edwin S. Jarrett, formerly vice-president, and Ralph H. Chambers, formerly chief engineer and general manager of the Foundation Co., have organized the Jarrett-Chambers Co., Inc., contractors, with offices at 30 East 42nd St., New York.

The sale of Nuttall gears, pinions and trolleys, manufactured by the R. D. Nuttall Co., Pittsburgh, for the mining and industrial fields in the Chicago territory, has been transferred to the Westinghouse Electric & Mfg. Co., 39 So. La Salle St., Chicago, Ill.

Robert J. Raley, for a number of years past representative of the Sullivan Machinery Co. in the iron and copper country of northern Michigan and Minnesota, has now established his office permanently in Duluth at Room 910, Alworth Building, and may be reached there by mail or personal call.

The Thomas Furnace Co., Milwaukee, Wis., plans to blow in its blast furnace early in May, for a run on low-phosphorus iron. Orders for such iron aggregating a round tonnage have been accumulated. This will be the only furnace in the West making standard low-phosphorus iron for the merchant trade. The ore for this product is taken from the old Indiana mine west of Iron Mountain, Mich., on the Menominee range.

O. L. Remington, general manager of William McLean & Co., Melbourne, Australia, is in the United States investigating new types of machinery for mining and metallurgical work. He will be at 3219 North Capitol Ave., Indianapolis, Ind., until about May 12, and after that for a few days at the Hotel La Salle, Chicago, where H. P. McColl, engineer for the same firm, is already stopping. They will be pleased to look over catalogs, models, etc.

The Mine & Smelter Supply Co., a Colorado corporation that originally maintained a single establishment in Denver and afterward moved its main office to New York to cover also branches in Salt Lake City and Mexico City, has moved the headquarters back to Denver. W. L. Loveland, general manager of the company, succeeds T. Evans as local manager, while W. B. Kinkead continues as general purchasing agent. No other changes will be made in the local staff.

The Richardson-Phenix Co., Milwaukee, Wis., announces that it has purchased the patents, good-will and manufacturing rights of the Osborne "NoKut" valve and that it is now carrying a complete line of the various size valves in stock. The Richardson-Phenix Co. decided to manufacture the "NoKut" valve because it feels that the feature of using a protector to prevent wire-drawing and cutting of the valve disk and seat place this valve in a class by itself. Literature describing the "NoKut" valve may be had by addressing the company as above.

TRADE CATALOGS

Vulcan Iron Works, Wilkes Barre, Penn. Catalog. Electric hoists. 64 pp., illus., 6x9 inches.

Witte Engine Works, Kansas City, Mo. Catalog No. 46. Witte internal combustion engines. 36 pp., illus., [illegible]

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3015. Portable air compressors. 32 pp., illus., [illegible] Form No. 4032. Jackhamer mounting, type JM-6. [illegible], 6x9 inches.

Editorial Correspondence

SAN FRANCISCO—Apr. 28

Good Road Construction has come to be a California habit. Inyo County furnishes the latest, if not the finest, demonstration of the spirit of individual effort for economic road building. The road between Bishop and Long Valley is in much need of repair. Mono County, in which most of the road lies, is short of funds. So Inyo County people have proposed an automobile excursion over the road carrying volunteer road workers. They are going to combine a Mayday picnic with a pick-and-shovel performance that will put the road in passable shape and give the workers an opportunity for Sunday trout fishing in Mono County. The fact that the interest in Inyo County in good road building is due in a large degree to the constant effort in the past three years of a mining engineer is good proof that the mining industry will be given the fairest kind of a show in the making of roads. W. G. Scott, who for 20 years has been known as a practical mining engineer, is the acknowledged leader in the good roads movement in Inyo County and throughout California. Mr. Scott is executive secretary of the Inyo Good Road Club, chairman of division of National Parks and member of the council of national advisors in the National Highways Association. He is largely responsible for the interest taken by Secretary Lane in the proposed opening of the Tioga road and author of Assembly Bill No. 1022 providing an appropriation of $50,000 for the improvement of the road from Bridgeport south in Mono County. There is no better proof to California miners that the mining districts will be adequately provided for in national and state road building than Mr. Scott's interest in both undertakings.

DENVER—Apr. 29

Extensive Carnotite Properties are owned by the Standard Chemical Co. of Pittsburgh in the southwestern portion of the state tributary to Placerville, a station on the narrow-gage division of the Denver & Rio Grande Ry. Joseph M. Flannery, president, has been inspecting the properties, including the new $125,000 mill erected at Naturita on the San Miguel River in Montrose County. He states that this mill treats 60 tons crude ore per day and that his company will erect three more but smaller mills during this season.

Wireless Telegraphy is a function in the operation of at least one Colorado mine for communication is thus held daily between the office of the Ajax Gold Mining Co., in Denver, and the mine at Victor. President E. A. Colburn and his son, H. C. Colburn, who is superintendent of the company, are sufficiently interested in this modern invention to have installed a complete station at the mine whereby messages are received from and dispatched to a station in Denver belonging to a friend of these men. The smokestack at the Ajax power-plant serves as a tower. Using usual code, messages are sent every night covering details of the day's doings at the mine and mill while instructions are received for the next day's work. The mill is temporarily closed down for purpose of increasing its capacity to 300 tons per day by the addition of slimers. This will permit the company to treat custom ores in addition to its own. If a present effort to secure more favorable switching and local freight rates prevails, it is probable that the district will immediately begin the shipment of ore of lower grades than has heretofore been possible.

BUTTE—Apr. 29

A Big Influx of Labor has been caused by the news that the mines of Butte were nearly all resuming work and that the mining companies were also increasing their forces. An unusual percentage of these men are utterly unfitted for the work here. Prosperous as Butte is at present, it cannot hope to take care of the army of unemployed men moving upon it from every direction. "Already there are more men of this class in Butte than can be employed" said Vice-President C. F. Kelley of the Anaconda company. "While the companies have been putting on skilled miners, they have no employment for men who are without experience in work underground. If the influx of unemployed keeps up, the situation will be serious, for the city will be packed with men out of money and without any possibility of getting employment. The warning should go out from here through the unions and other agencies that Butte cannot give employment to any more unskilled laborers."

President Thayer Comments as follows on the activities in the various locations where the company is engaged in business: "At our lumber camps at Bonner and other points, there is some increase in business but not on the same scale as in other industries. We keep a large force of men at work in these camps to take care of the lumber requirements for mining purposes. The hard times in the commercial lumber business are due not so much to the war in Europe but to the constantly increasing use of reinforced concrete in the building trades. Great Falls will witness a busy summer, getting the new electrolytic refining plant into shape as rapidly as possible and also completing some improvements at the smelter. The coal mines of the company at Bear Creek and at Sand Coulee are running full blast. With the present demand for copper and the high price, the company will, without question, lose no time in putting all its Butte mines in operation at capacity just as quickly as it can be done. The high price of copper is also having the effect that the amount of commercial ore coming to the smelters from independent operators, is constantly increasing."

SALT LAKE CITY—Apr. 30

The New 35-Ton Holt-Dern Roaster of the Park City Mills Co. is to be fired early in the coming week for a trial run of 30 days on American Flag ore, which it was especially made to treat. There is a considerable tonnage of low-grade ore at this mine, and tests made during the past three months by Mr. Dern and Mr. Holt promise an extraction of more than 85% and at a daily rate of 50 tons treated, it is thought the extraction can be made to exceed 90%. Mr. Holt will oversee the work, and G. A. Keep will have charge of the mill.

The Output of the Carbon County Coal mines, which has been increasing with improving conditions in the mining industry, will be further enlarged to meet the demands of the smelteries returning to their former production, and of the railroads hauling ore, etc. At the Sunnyside mines, a five-day week is in force and with the present methods employed, the output is as large as that produced in the past in six days, and it is expected that the working week will be lengthened before long. Out of the 700 coke ovens, 600 are fired, supplying coke to the smelteries in Salt Lake Valley, Anaconda, and Butte. This number will probably be added to. Coal from these mines is furnished the Denver & Rio Grande for use on the east end of the road; and gas and coke plants in this city use about 12 cars a day for their product. The camp of Sunnyside has 1500 to 2000 dwellings, most of which ar occupied. The Winterquarters, Clear Creek, and Castlegat mines are each producing about 1500 tons daily, working thre days a week. At Mohrland and Hiawatha the men are work ing two or three days a week. It is expected that opera tions will soon be resumed at the Panther Cañon mines. A Black Hawk experimental ovens have been put up for produc ing coke by a new process. The steel tipple, the finest in th West, is in commission. The output of this camp is sent t market over the recently completed branch railroad fro Price. The fire which occurred in some of the mine working not long ago has been completely subdued. At Kenilwort the mines are working three days a week, and at Storrs an Standardville the same working week is in force. About 40 tons daily are being produced in a five-day week by the Cam eron Coal Co. from Price Cañon, just above Castlegate. Lab conditions are good throughout the region.

SEATTLE—Apr. 26

In the McQueston District, Stewart River, pay has be discovered by O. P. Johnson on Johnson Creek. The depth bedrock is 18 ft. and 80 ft. of driving in pay has been don Johnson Creek heads in the same hills as Highet Creek, whe mining by hydraulic methods and otherwise has been carri on for years.

Cleary Creek and adjacent Chatanika flats will produ more gold this year than last is predicted. On Wolf Cree the largest tributary of Cleary, good pay has been found several places and many operators are working. There w be several outfits hoisting pay this summer on upper Clea and Al Hilty will continue his large-scale opencut work ne the town of Cleary. Plants will be scattered from Discove claim down to 14 below, and on the Chatanika flats the us number of drift mines will be working.

Chicagof Island a Larger Producer of gold this year on account of the recent discovery of several new veins is the report just brought down from the north. The northern island which for the past eight or 10 years has produced much of the plaster of paris used in the United States and has added considerable to the gold production of the north will probably increase its gold production a third as several of the companies now on the ground of the recent discoveries have started development and will put in larger outfits. The first discovery of payable gold ore was made in 1904.

A New Strike of Pay has been made in the Andreafski gold fields, the first important find since the establishment of the district by the discovery of gold on Wilson Creek last spring. The new strike is located five miles across the divide from the head of Wilson Creek which is about 15 miles from the town of Marshall. The pay has been located on three claims owned by W. C. Blander, Plunket & Patton and Albert E. Edwards. The entire district, of which little is known, is the tundra section between the Bering Sea and the Yukon and the good dirt found on Wilson Creek last year has stimulated the opening up of a considerable district for prospecting.

The Susitna District according to many northerners who have made a canvass of the county has wonderful possibilities. Its development with the coming of the government railroad will be rapid. The district is about 100 miles wide by 250 miles long and contains not only gold, but silver, copper, lead, antimony and iron, and presumably other minerals. This belt is situated near the head of the Susitna River and trends across the country from Mt. McKinley toward Knik. The outer edge of the region has been opened by William Martin who last year after paying $1 per lb. for the delivery of freight to his ground cleared up $100,000 with a small Lane mill. His output was about $380,000, but a large portion of the profits was expended in freighting. Prospectors in the district have discovered some antimonial ores, some high-grade quartz veins, some big lenses of high-grade copper and some silver-lead ore. Because of the extraordinary difficulties of getting freight into the territory the discoveries have been abandoned until such time as transportation would be available. At the time of the building of the Alaska Northern Ry. to the Matanuska coal field several people took in outfits with the expectation that the road would eventually tap the district. The coal lands were withdrawn however, work on the road suspended and the operators were forced to give up their ground. The low-grade gold ore occurs in big dikes which are split by seams of high-grade free-milling material. Some of those who are enthusiastic over the district maintain that the deposits are as large as those of the Treadwell mine which has produced over $50,000,000 on $2 ore. The ore taken from many different sections of he district averages $5 or $6 to the ton. There has always been considerabe speculation about the district but it was known that nothing could ever be done with it until transportation was available. Now that the government road will ap the district this interest has revived to such an extent that next to the discussion of the construction of the road itself, he coming opening of the Susitna is the most discussed quesion in the north.

FAIRBANKS, ALASKA—Apr. 9

Fairbanks Creek has shown great activity in quartz minng this winter. At least 25 men are taking out ore. The ustom mill of C. E. Heilig is temporarily closed for repairs. This mill is a Huntington with a daily capacity of 25 tons. rites & Feldman are running their five-stamp mill on one hift. E. L. Scrafford has a small crew on Chatham Creek and nother on Treasure Creek taking out antimony ore. He is aid to have a contract to supply 4000 tons to a San Franisco firm. On Happy Creek John Fahy has a dump out epresenting 5000 to 6000 sq.ft. of bedrock which he expects to verage $2 per ft. Letender & Co. have a dump of 14,000 ft. his is practically a new creek, having been added to the st of producers last year. On Ester Creek there are 17 diferent outfits at work. Sluicing is expected to start Apr. 20. his is unusually early.

The Tolovana District it is now definitely known will be producer this season. On Olive Creek there are at least n holes to bedrock averaging 30 ft. in depth. Pay runing as high at $5 per sq.ft. of bedrock has been traced for vo miles and crosscut for 210 ft. It will be hard to get uicing water on this creek which is a tributary of the east rk or main Tolovana. On Livengood Creek (which is really e middle fork of the Tolovana) 12 holes have proven 2½ les of pay running from $1 to $1.50 per sq.ft. This creek also about 30 ft. deep and has been crosscut for 80 ft. he gold from both Olive and Livengood creeks is fine and gged in texture. A hole 90 ft. deep on the right limit bench the latter creek, 2000 ft. from the creek bed, has shown good prospects in coarse gold. The prospects in this region have all been found within a circle 10 miles in diameter, about 50 miles northwest of Fairbanks. About 150 men are actively prospecting in the district.

DULUTH—Apr. 30

The Lake Ore Rate from Duluth for 1915 has been fixed at 40c. per ton, the same as last year, which includes loading into vessel. From Marquette to Lake Erie ports the rate is 35c. and from Escanaba 25c.

Eight State Owned Iron Mines will make their initial shipments in 1915, viz., Wanless, Shiras, Prindle, Duncan, Deacon, Philbin, Smith and Hill Annex. Thus far the State of Minnesota has received over $4,000,000 advance royalties on its properties, which money goes into the school funds.

The 60c. Ore Rate to Duluth, Two Harbors and Allouez Bay from the Mesabi range has been pronounced unreasonable by the Interstate Commerce Commission and the railroads have been ordered to charge not more than 55c. The roads affected are the Duluth, Missabe & Northern, the Duluth & Iron Range, and the Great Northern. The case was started three years ago by some of the independent shippers who tried to prove that the existing rate of 60c. was unreasonable. The shippers showed that the roads made good profits at 60c., which fact probably won them a lower rate. The case was hard-fought as the three roads carry a good many million tons of ore each year from the range to the docks. It is believed that the new rate will be controlling on the Vermilion and Cuyuna range, although no findings were made regarding those hauls by the commission.

DOUGLAS, ARIZ.—Apr. 28

The Mining Companies in Northern Sonora have been operating under adverse conditions since December 1st last year. At Nacozari the Moctezuma Copper Co. is operating its mill on ore from the mines at Pilares, five miles east of Nacozari. On Nov. 28 there were several bridges burned on the Nacozari R.R. by Maytorena forces to interrupt communication between Agua Prieta and Nacozari; the road was repaired and traffic resumed for a few days and some more bridges were burned and for about two months bridges were burned as fast as they were repaired. Villa and Maytorena forces in great numbers came over from Cananea about the middle of February and captured all the towns on the Nacozari R.R. except Agua Prieta, which was not attacked because of the agreement between Generals Scott and Villa. Until the first of April there were no trains in or out of Nacozari with either food supplies or ore. Since then the Maytorena forces have all withdrawn to Cananea and trains have been running regularly and there are plenty of supplies in the country and all of the ore mined has been hauled out. South of Nacozari no properties were able to work during the time that the railroad was not running, for there was no food to sell the miners and there were so many bands of armed men running through the country, away from the railroad, that if a mine was started one of the bands would come in and either take all of the few provisions there were or force all the men to join them. This meant that the mines had to be abandoned until conditions settled and when they were once abandoned the "gambocinos" or highgraders went into the mine and worked it for their own benefit. In Nacozari the conditions were a little different for the company had large supplies on hand when the railroad stopped but these ran out soon and it was nearly impossible to get supplies there and about all to be had was a little corn and flour. The money question was another factor which was hard on the people. There are several classes of money used the best of which is bank money or old Federal money which is worth about 13c. on the dollar now and the other classes are worth about 7c. Wages have remained about the same in Mexico and all of the supplies have gone up so that the poor people could hardly make a living with wages at $4 per day. There were also many counterfeits in the country and they can hardly be told from the official issues. The people were compelled to take this money and so were the stores but it was not good to pay duties with either on ore or supplies, so when the stores once received the money it was hard for them to dispose of it. The Tigre Mining Co. has had a similar experience with money and provisions, but added to this they have been raided several times, first by one side and then by the other. Last month all of the mules used to haul the ore from the mine to the railroad were confiscated and none has yet been returned. What ore has been taken out [illegible] has had to pay double duties, one to each faction, [illegible] duties to the Carranza faction are much higher [illegible] were previously. During all this trouble Am[illegible] foreigners have been well treated by both part[illegible] two Americans who were killed near Nacozari [illegible] miners have been avenged by the authorities who [illegible] the two men and had them shot the next day.

The Mining News

ALASKA

ALASKA JUNEAU (Juneau)—Estimated 100,000,000 tons ore above tunnel level suitable for milling. Equal amount estimated as probable below tunnel level. New mill 6000 tons daily capacity expected to be ready to operate in 18 months.

ALASKA GOLD (Juneau)—First shipment of concentrates has been made from new Gastineau mill. This was brought to Seattle on steamer "Evans" and comprised 2821 sacks valued at $55,600 and eight boxes of gold bullion valued at $6000. Shipment is being sent to Selby.

RAMSAY-RUTHERFORD (Valdez)—Has broken into vein on 340 level and has drifted about 25 ft. on ore from 12 to 18 in. carrying high values in free-milling gold. Five-stamp mill now on ground is expected to be busy all summer. Finding ore on 340 level has resulted in renewed prospecting on many other claims in district, which have splendid surface prospects.

CAMERON-JOHNSON (Valdez)—Is making arrangements with Paddy O'Neil, who drove Alaska Gastineau tunnel, to have tunnel cut through mountain which separates it from beach. About $50,000 worth of machinery was recently purchased for further development work. Mine adjoins the Cliff which produced $900,000 in four years. Fourteen-ton test on Cameron showed average of $35 per ton and picked cargo of ore treated at Tacoma smeltery gave an average return of $143 per ton.

ARIZONA

Greenlee County

DETROIT COPPER (Morenci)—Concentrator will be overhauled during summer, consummating plans contemplated for some time. Flow sheet will be simplified. Some new equipment will be installed. Experiments with flotation will also be more definitely carried out by installation of several units. Mill is over 10 years old.

Yavapai County

BIG PINE CONS. (Prescott)—Plans have been completed and grading will be started within week or 10 days for cyanide plant. Will have crushers, chilean mill, tube mill, Dorr agitators and thickeners, Oliver filter and Merrill press. Will treat about 80 tons per day. Company has about 50,000 tons of $10 ore developed.

CALIFORNIA

Amador County

FIVE-TON LEWIS AUTO TRUCK is employed hauling sulphurets from mines on Mother Lode in Amador City district to Jackson chlorination works. Additional trucks will be put in commission for hauling timbers from higher mountain districts.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary report for March shows 11,000 tons crushed, valued at $56,814; total working expense, $23,764; total development expense, $9231; surplus, $23,819. This breaks record of plant since treatment began.

HARDENBERG (Jackson)—Litigation expected to follow temporary closing down of the mine, as Hardenberg proper was operated under purchase bond and operating company holds possessory right to adjoining ground on which working shaft was sunk. H. Malloch, San Francisco, is manager.

MOUNTAIN KING (Pine Grove)—Option of purchase has been amended so as to escape restrictions of blue-sky law. The amendment permits extraction and treatment of pay ore wherever disclosed and does not impose development provided in original agreement. Percentage of proceeds is to be applied to purchase price. W. B. Pitts is owner.

Butte County

LITTLE JOE (Enterprise)—Frank Egan of Oroville is preparing to reopen this mine.

EL ORO DREDGING (Oroville)—Redredging is contemplated. The boats have for some time been working on tailings and Charles Helman, manager, states tests made justify redredging gravel and placing ground in condition for agricultural purposes.

Calaveras County

STAMP-MILL installation contemplated by Perry Condit of Murphys at his mine near Collierville.

FELLOWCRAFT (San Andreas)—Mine has been reopened by John C. Benson of San Francisco.

FORD (San Andreas)—Hoist and other machinery being made ready for reopening mine by San Andreas people.

ARRASTRE installation contemplated by E. J. Bumsted of Angels Camp at his mine on San Domingo Creek.

CALAVERAS COPPER (Copperopolis)—Oil-flotation process installed and reported to be in operation. Coffer and Trask, lessees.

ROYAL CONSOLIDATED (Hodson)—Ore extraction is in progress and 20 stamps of the 100-stamp mill have been put in commission. Forty men are operating. F. W. Page, manager.

PIONEER CHIEF (San Andreas)—J. E. King and others will reopen mine and install steam-power hoist and other machinery, with view of substituting electricity as soon as development warrants. Mine so far developed by 300-ft. shaft. Ore $8 per ton. Shaft will be deepened to 600 ft. before drifting.

Colusa County

MANZANITA (Williams)—This quicksilver mine in Sulphur Springs district, owned by J. W. Cuthbert, has been leased to San Jose men who are preparing to reopen and operate. This is first quicksilver mine in California to have profitably concentrated cinnabar ores. George V. Northey is manager.

Kern County

PHOENIX (Randsburg)—Five stamps are being added, to five now in operation, also a 25-ton Trent universal agitator.

COLORADO

Boulder County

BOULDER COUNTY METAL MINERS ASSOCIATION (Boulder)—J. G. Clark, manager of tungsten mining properties, has been selected to succeed M. B. Tomblin as secretary of the association. He will be assisted by Colonel Irvine, another experienced mine operator. Mr. Tomblin is now secretary of Colorado Metal Miners' Association with headquarters in the Bureau of Mines, Capitol, Denver.

Ouray County

TWO KIDS (Ouray)—Gold Crown Mining Co. has 12-ft. vein in which 3 ft. runs about $17 gold. Will install mill which will also treat custom ores.

San Miguel County

TOMBOY (Telluride)—During March mill treated nearly 12,000 tons. Concentrate worth $44,000 was sold to smelters while U. S. mint in Denver purchased $43,500 bullion. Dividend of $29,535 was declared. Upon capitalization of 300,000 shares, $5 par, this mine has distributed profits amounting to $3,475,320.

Summit County

DREDGING is responsible for regular consignments of gold bullion from Breckenridge to the mint in Denver. Local gold usually sells for about $16 per oz. Last week, bricks aggregating 93 lb. avoirdupois were shipped. Four dredges are working in this district, three by Tonopah Placers Co. This company's No. 1 boat is digging along the Blue River below town; No. 2 is well up Swan River above the pioneer camp of Swan City; while No. 3 is in lower French Gulch. French Gulch Dredging Co.'s boat is further up this same gulch.

WELLINGTON (Breckenridge)—Two mills are producing about 225 tons zinc concentrate and 60 tons lead concentrat per week, working three shifts. Mine is in excellent shape

Teller County

WILD HORSE (Cripple Creek)—Mill being overhauled b new leasers who are also blocking out ore reserves.

COMMONWEALTH (Cripple Creek)—McIntyre and Lewis lessees, are screening this Beacon Hill dump and shippin fines averaging 1 oz. gold per ton.

ELKTON (Elkton)—Roosevelt tunnel is lowering water these workings at rate of 6 in. per day. New level will soo be started at 1600-ft. point in shaft.

ORPHA MAY (Altman)—Mine dump being screened Norman Garstin, leaser. Ships dirt averaging 1 oz. per to Intends to install simple washer in order to raise grade product before shipment.

CRESSON (Cripple Creek)—The "vug" still produces go tonnage of rich ore that goes to Golden Cycle mill, Colora City. Two carloads of first grade, sacked, and 2 carloads second grade, loose, were shipped last week.

QUEEN GOLD (Cripple Creek)—Will undertake extensi development operations in its property on Battle Mountai Power plant has been overhauled and is in working orde Sinking of El Oro shaft will be resumed in few days; w be sunk 250 ft.

JERRY JOHNSON (Cripple Creek)—Cripple Creek De Leasing Co. has been incorporated by H. A. Riedel and A. Mackey of Denver to sink and develop ground below prese bottom of shaft, 850 ft. Upper workings are under lease Frank Caley who is erecting a 100-ton cyanide mill that expected to be ready for operation June 1.

GOLDEN CYCLE MINE (Victor)—This mine, now own by Vindicator Consolidated Gold Mining Co., is fast wip out the indebtedness incurred by its purchase. Already fi of the notes given to finance this purchase have been deemed, according to official notices sent to Vindicator sto holders. These notes called for monthly payments of $35, each so that they are now cancelled up to September. coming from 1775 level is of better grade than any fr upper workings. Extensive development being done on 1 level in fine orebodies.

IDAHO

Shoshone County

STEWART VS. ONTARIO—Decision by U. S. Supre Court rendered in favor of Ontario, principal owner Senator Jonathan Bourne, sued on account extraction of 40, tons rich silver-lead ores.

ANTIMONY SILVER (Wallace)—New company organized in Wallace to work recently acquired antimony deposits on Pine Creek. Property was partially developed years ago. Have 12 in. of shipping grade antimony ore in 15-ft. shaft.

INTERSTATE-CALLAHAN (Wallace)—Construction of aërial tramway connecting mill with railway at Sunset station, began last week. Between 70 and 80 men are employed and it is anticipated that carrier, about 10,500 ft. long, will be completed and ready to operate not later than end of May.

FLORIDA

Marion County

FLORIDA SOFT PHOSPHATE & LIME CO. (Ocala, and 30 Church St., New York)—Contracts being let for 200-ton grinding plant at Citra where company has bed of soft phosphate rock 12 to 39 ft. thick, underlain by limestone. Lehigh-Fuller mill will be used for grinding phosphate and Gardner mill for crushing limerock. Both products being used for fertilizing. The phosphate will not be acid treated, tests having indicated about 27% phosphoric acid with over 6% immediately available.

MICHIGAN

Iron

OLIVER IRON MINING (Escanaba)—Crushing plant started operations on May 1. About 300,000 tons from Dober mine at Iron River will be treated.

McGILLIS (Iron River)—This mine being reopened by Oliver Iron company. Machinery from old Mansfield being installed there. New headframe will be erected. Property adjoins the Berkshire.

QUEEN (Negaunee)—This Oliver property of Regent Group will put on night shift May 10. This will give employment to about 150 men. Blue mine of same group was closed May 1. A shovel is at work loading ore from stock.

PORTLAND (Michigamme)—Regular shipments now being made by Hoose & Person Cons. Co., who have contract to mine ore for Oglebay Norton Co. Is only shovel property on Marquette range. Ore is going to Escanaba.

OLIVER IRON MINING—(Ishpeming)—Lake Superior Hematite property was closed down May 1. Pumps will be pulled and mine abandoned. Miners were transferred to Section 16 mine, which is now working full time with double shifts About 75 new hands were hired.

LAKE ANGELINE (Ishpeming)—Is again working small force. Cars that stood at mine all winter with ore have been moved to docks and unloaded. Three lake shipments have already been made. It is believed that exploration work will be started by company before long. All ore now mined comes from side hill through tunnel and is loaded direct into cars.

MINNESOTA

Mesabi Range

SCRANTON (Hibbing)—It is stated, although not officially, that this one of most valuable state owned properties will be stripped this season.

IRONDALE LAND CO. (Biwabik)—Will shortly begin drilling its holdings adjoining in part Wiggins Estate lands now eing drilled by Oliver company.

HAWKINS (Nashwauk)—A 60x60-ft. addition to washing lant is being erected. Operations at mine have not yet tarted but repairs are being made in preparation.

BIWABIK—Drills are at work on the Judd property, west f here, and on bluffs north of Merritt hill Many other drills re at work in this vicinity and it is believed several new nines will be developed.

CROSBY (Nashwauk) —Allis-Chalmers Co. has been awarded contract for all machinery to be installed in new washing lant to be erected. Building operations will be started hortly, plans having been approved

QUINN-HARRISON (Nashwauk)—Construction of washing lant progressing rapidly Will be ready by June 15. Subontractors have steam shovel grading four-track yard, and nining company has one shovel stripping Overburden being ised to make dam for tailings from washer.

BUFFALO-SUSQUEHANNA (Hibbing) Because of objecions from local residents Winston-Dear Contracting Co. will ot operate its shovels at night in stripping. Mine is close o town Most of the overburden has been removed and comany or operators will not be greatly inconvenienced

MONTANA

Lewis and Clark County

BARNES KING DEVELOPMENT (Kendall) Efforts of is company directed towards early commencement of active perations at its newly acquired Piegan-Gloster mines near larysville. Work is going steadily forward on power line etween Great Falls and Deer Lodge which is expected to ach Marysville first part of May Mill and power plant at ines ready for operation.

EAST HELENA SMELTERY—Increased shipments of ore ve made it necessary to increase capacity of East Helena neltery by enlarging two of four blast furnaces. Manager rank M. Smith says that within next 30 days force of men nployed will be increased from 350 to 450 Great activity reported from Coeur d'Alene lead mines which furnish the ulk of the ore for this plant.

Madison County

MONTANA ILLINOIS MINING (Jefferson Island)—Has ecuted 3-year lease on Bismark group of mines to Iowaontana Development Co. New company is to put in flotation lant capable of handling 100 tons per day and an electric ower plant not less than 200 hp Fields flotation process s been selected to be used. Work to install these plants to be started at once.

Silver Bow County

BUTTE DULUTH (Butte) —Captain Wolvin, who is in New ork to arrange for necessary financial assistance to place mpany in position to resume operations, says he has no doubt aid required will be forthcoming if matters can be cleared at Butte end. This refers to bankruptcy proceedings now pending which must be cleared up before financial aid can be secured

NORTH BUTTE (Butte)—Edith May vein has been cut on new 3000 level driven from Granite Mountain shaft; same vein which has produced large tonnage of ore on [illegible] level. New electric hoist at Granite Mountain shaft being tested and within a week or two will be put into active service. Company now producing 900 tons of ore per day; will probably be increased to normal of 1200 tons when new hoist is ready for operation.

RAINBOW LODE DEVELOPMENT (Butte)—Proposition to issue $400,000 of 6% convertible bonds to raise money to complete payment for property, complete Butte & London contract and develop Rainbow shaft, has been adopted by directors of company and placed before stockholders. There is still due a total of $120,000 on property. Estimated amount required to complete Butte & London contract is $97,000 If done, the company will have acquired 51% interest in Greendale Exploration Co. at total cost of $170,000, less value of equipment purchased, which remains the property of the Rainbow company. There is also required $186,000 for development at Rainbow shaft. With issue of bonds, it means that the work of completing development of properties will begin again and that by July 1 work will be resumed at Butte & London property.

NEVADA

Clark County

MOBILE (Goodsprings)—Property now shipping about 300 tons of zinc carbonate per month; ore being transferred to road by aërial tram and thence to Jean by motor truck.

MILFORD (Goodsprings)—Property bonded to Los Angeles syndicate, which has force of 20 men at work. Reported that milling will soon be resumed, and shipments of zinc carbonate ore will be commenced.

Churchill County

NEVADA WONDER (Wonder)—New oreshoot discovered on 1300 level. Recent development work on 1000 level opened two oreshoots for total length of 500 ft.; average value of ore milled, $15.

Elko County

NEW POWER PLANT FOR BULLION will be built on South Fork of Humboldt River, it is stated. Water power available sufficient to generate 4000 hp.; plant to generate 1500 hp. planned. Permission to take water from South Fork for power purposes granted with provision that it be returned to river above farm lands.

LONG HIKE (Jarbridge)—Rich strike made in this property recently. At present Jarbridge only accessible by foot or horseback on account of deep snow.

NEVADA COPPER M. M. & POWER (Contact)—Arrangements completed for power from Idaho Power & Light line to Contact. With satisfactory power supply it is probable that a flotation plant will be built.

Esmeralda County

SIMMERONE (Goldfield)—Simmerone vein recovered in development work on opposite side of fault. This vein produced $60,000 from within 30 ft. of surface in early days of Goldfield.

Humboldt County

THE NEVADA SHORT LINE RY. will complete building of balance of its line to Rochester. There will be some high bridges and heavy grades. Sufficient tonnage of ore has been developed to keep the railroad busy for several years.

CHARLESTON NATIONAL (National)—Work will be resumed at once.

BUSY BEE (Willard)—Oreshoot showing free gold struck at depth of 15 feet.

NEW TOWNSITE OF WILLARD filed articles of incorporation at Winnemucca; capitalization 5000 shares of $5 par value. Stated 3000 shares already subscribed for.

HONEY BEE (Willard)—Articles of incorporation filed; capitalization, 1,000,000 shares, par value, $1. Principal place of business Lovelock. This is first mining company of Willard to incorporate and is property upon which first strike of Willard was made

ROYLANCE REDUCTION (Kennedy)—Construction of 100-ton reduction plant to begin at once Plant especially designed to treat low-grade refractory ores of district; process electrochemical. Estimated cost of plant $50,000. Expected to be in operation in August Ores from Ida, Hazel Bell and Virginia claims, recently purchased, to be treated If plant is success, it will be enlarged to treat custom ores. Kennedy 60 miles south of Winnemucca.

Lincoln County

YUBA LEASING (Pioche) —Tests being made in San Francisco to determine suitable milling process. If ores amenable to economic treatment, plant will be built

Lyon County

NEVADA-DOUGLAS (Ludwig)—Delay in shipment of machinery has retarded progress on new leaching plant Force of men being increased, gypsum pit being put in shape for operation, and 25 men doing development work on Western Nevada mine

Mineral County

NEW CAMP OF TINTIC, four miles north of Rawhide, established recently Oreshoots opened for length of [illegible] along contact; additional discoveries being made by prospectors. Considerable rush to district and much ground located.

Nye County

TONOPAH ORE PRODUCTION for week ended Apr. [illegible] 10,109 tons, compared with 10,760 tons week previous. Shippers were Tonopah Belmont, 3391; Tonopah Mining, [illegible]; Tonopah Extension, 1568; West End, 800; Jim Butler, [illegible]; Tonopah Merger, 200; North Star, 50; and Halifax, [illegible] tons.

NEW MEXICO

Grant County

EL CENTRO (Lordsburg)—Company has absorbed Sutton Consolidated Co. and Last Chance mine in Pyramid district. Faris V. Bush appointed fiscal agent.

EMPIRE ZINC (Pinos Altos)—Dam being built near Cleveland mine. Dimensions, 175 ft wide and 40 ft. high. Will impound 3,000,000 gal. water. Machine shop and auxiliary buildings being erected at mill site.

HARDSCRABBLE (Pinos Altos)—Part interest purchased by Bisbeee, Ariz., men, and together with J. T. Janes, owner, operations will be resumed. Ore now blocked out and shipping will begin soon. Mine has good surface equipment.

TWIN PEAKS (Twin Peaks) via York, Ariz.—Property bought by E. A. Wayne, former manager of Ernestine Mining & Milling Co., Mogollon, and David Gough, of El Paso, Tex. Reports from district to effect operations will be resumed on large scale. Property well equipped with mining and milling facilities. Fraser Bros. former owners and operators.

Lincoln County

AMERICAN (Nogal)—Stamp mill being repaired and put into condition for immediate operation.

WATER-POWER RIGHTS granted A. H. H. Palmer, of Mogollon, for milling purposes. Allows 10 sec.-ft. water.

GOLDEN EAGLE (Mogollon)—Company has filed incorporation papers. Capitalization $600,000. Denver people organizers.

YELLOW JACKET (White Oaks)—Shipments to Pueblo smeltery have been resumed after short period of inactivity. New tunnel being driven.

NEW YORK

Orange County

GUYMARD LEAD & ZINC (Guymard)—Given decision in New Jersey against Erie railroad for $13,000 account damage alleged from building spur. Chauncey Gumaer, manager, testified had been unable to work shaft since building spur. Erie contended used only land deeded by mine and mine never had been paying venture.

PENNSYLVANIA

Fayette County

AMERICAN MANGANESE MFG. CO. (Dunbar)—Has been making 40 to 50% ferromanganese from Cuyuna Range ores and is now arranging to make 80% ferromanganese from mixture of Cuyuna and Brazilian ores as soon as supply of latter can be secured, probably in May or June.

UTAH

Juab County

TINTIC ORE SHIPMENTS for week ended April 23 totaled 116 cars of 50 tons each compared with 123 cars week previous.

YANKEE CONSOLIDATED (Tintic)—Last shipment by leasers which are averaging two to three cars per month assayed 40 to 41% zinc and brought $42 per ton.

CHIEF CONSOLIDATED (Tintic)—Has several hundred tons shipping ore on dump at old Scotia mine West Tintic ready for shipment when condition of roads will permit.

BULLION BECK (Tintic)—Four jigs are operating on old dumps yielding $30 product from low-grade material. Estimated several hundred thousand tons of similar dumps in camp which can be similarly treated profitably.

Salt Lake County

OHIO COPPER (Bingham)—Leasing of the mine and mill to outside parties contemplated.

A. S. & R. CO. (Murray)—Owns old Sioux dump at Tintic containing 30,000 tons averaging about $7.50 per ton which it is shipping for siliceous flux.

COLUMBUS EXTENSION (Alta)—Plans being considered for installation of battery of jigs near portal of tunnel for treatment of large tonnage of low-grade ore blocked out.

BIG COTTONWOOD COALITION (Alta)—Filed papers of incorporation 1,000,000 shares, par 25c. each. Will drive tunnel 1500 ft. to cut veins and drain workings. Tunnel site 500 ft. lower than any other tunnel in district.

MICHIGAN-UTAH (Alta)—Property sold at foreclosure sale for $75,000. Was bid in by agents of bondholders who represent $575,000 of bonds turned in under new plan for reorganization. New name will be Michigan-Utah Consolidated Mines Co. Incorporated under laws of Utah with 1,500,000 shares of 25c. par value. Each shareholder will receive one new for two old, and one new share will go to very holder of $1 in bonds. New stock will be assessable, and it is expected that small levy will be made to raise funds for starting work. An immense footage of work has been done in the Alta property. It is generally supposed that but nominal expenditure will be necessary to place property in shape for immediate production in ground other than that from which Clift Leasing Co. shipped 5000 tons of $10 ore last year.

Summit County

PARK CITY SHIPMENTS for week ended Apr. 24 were 1960 tons compared to 1300 tons week previous.

SILVER KING COALITION (Park City)—Has put on night shift in mill.

Tooele County

INTERNATIONAL SMELTERY (Tooele)—Is receiving 400 to 500 tons of low-grade iron fluxing ore per day from Prince Consolidated at Pioche.

VIRGINIA

Augusta County

CRIMORA MANGANESE CORPORATION (Crimora, and 15 Broad St., New York)—Preparations being made to operate old Crimora manganese mine on more elaborate scale. Surveys being made for increased water supply and new mill site. About 8¼ acres of the 90-acre basin, containing manganese ore in clay, was formerly worked. Is intention to put old mill in shape to operate until new 50-ton unit can be erected. Clay estimated to contain about 5% manganese ore. At present 30 men are working with pick and shovel. Later, it is planned to mine either by steam shovel or dragline excavator. A. A. Hassan, consulting engineer, will be in charge at property until new plans are consummated.

Louisa County

BOYD-SMITH (Mineral)—This company, which has pyrite mine near here, is also developing lead-zinc vein at Ella Cooper, about three miles from Mineral. Small mill is now being erected.

WASHINGTON

Stevens County

DOMINION SILVER LEAD (Colville)—Organized by W. H. Leimey, Spokane, with capital stock $100,000 to take over Old Dominion properties near Colville. Concentrators, air compressors, hoist, pumps, etc., will be installed; $25,000 to be spent in development.

Spokane County

CRYSTAL (Spokane)—Plans for erection of oil burning smelting plant near Crystal mine at old Fort Spokane.

WISCONSIN

Grant County

EAST END EXTENSION (Platteville)—New shaft, penetrated vein of zinc ore 18 ft. in thickness.

Lafayette County

LAWRENCE (Cuba City)—Utt & Thorne have taken over and unwatered this mine.

SALLY WATERS (New Diggings)—R. Sheffer and others have made valuable discovery of heavy sheet zinc in new shaft.

FRONTIER (Benton)—Company contemplates erection of one or two additional mills on properties recently developed at Benton.

PLATTEVILLE DEVELOPMENT CO. (Platteville)—This new company of local people has commenced prospecting on John Temple land near village of Benton.

CANADA

British Columbia

ROCHER DE BOULE COPPER (Hazleton)—Regular shipments of 100 to 120 tons ore per day to Granby smeltery have been begun.

GENERAL MINING & MILLING LEASING CO. (Nelson)—Organized by R. A. Hutchinson and associates of Spokane, has taken three-year lease on Kootenai Gold Mines, six miles southeast of Nelson. Remodeling of old 20-stamp mill, installation of pump and driving of tunnel 400 ft. below present level of lower workings to be started immediately. Mine has been in operation about 20 years and said to have produced approximately $1,000,000. At present 23 different leasers are working on property. Company also announces plans for construction of mill this season on Flying Dutchman property, 15 miles north of Nelson.

Ontario

TROUT MILLS SMELTERS (North Bay)—New York people have taken over property and have gang of men at work repairing and fitting up works.

COBALT LAKE—Work of pumping out Cobalt Lake was commenced Apr. 22. Two big pumps with combined capacity of 7000 gal. per minute are in operation.

SCHUMACHER (Porcupine)—Breaking ground for erection of new mill following plan of Vipond, using rolls and ball mills. Capacity 150 tons daily.

DOME (South Porcupine)—Large crushing plant to be installed at 425 level of No. 2 shaft, ore for which will be collected from stopes by electric storage-battery locomotives, hauling trains of cars carrying five tons.

Yukon

CANADIAN KLONDYKE (Dawson)—No. 1 dredge began operating on Apr. 17; No. 3 and 4 were to have started the following week. Working of righting No. 2 capsized dredge is progressing.

AFRICA

Rhodesia

GOLD PRODUCTION IN MARCH was 71,733 oz.; for the three months ended Mar. 31 it was 210,484 oz. Other metal and mineral production for the three months was 40,606 oz. silver, 5 tons lead, 747 tons copper, 26 tons asbestos, 16,134 tons chrome ore and 95,089 tons coal.

CENTRAL AMERICA

Nicaragua

TUNKY MINING CO. (San Pedro and 835 Real Estate Trust Bldg., Philadelphia)—Is doing development work on the Nueva America group in Bana Cruz district, and in Pis Pis district on Atlas group which lies between Tonopah Mining Co.'s Panama mine and the Bonanza mine. Tunky company also controls Potosi group about 40 mi. distant, near La Luz Los Angeles company's property. Potosi, together with dredging rights on Siuna and Oconguas Rivers, has just been optioned to Tonopah-Belmont Development Co. which is sending three engineers to Nicaragua to examine these properties.

Salvador

BUTTERS DIVISADERO CO., LTD., (Divisadero)—This company, which installed pipe line, storage tanks, and oil burners about a year ago, has decided to install interna combustion engines. Originally contemplated a single unit but has since been decided to install two 360-b.hp., two-cycl Bolinder engines, direct connected to two G. E. 250-kv.-a 2300 volt, a.c. generators. Engines are to be shipped from Stockholm in August. Company has just ordered from Amer ican Steel & Wire Co. an 11,800-ft. Bleichert aerial tramway to transport ore which company has purchased from an old mine near Divisadero.

The Market Report

METAL MARKETS

NEW YORK—May 5

The furious advance in both copper and spelter appears to have been halted, and during the last week the markets for these metals have been irregular. Tin has been quiet and a little lower. Lead has been strong and a little higher.

The American Metal Co., Ltd., of New York, announces the removal of its St. Louis offices to Suite 1625, Boatmen's Bank Building, St. Louis.

Copper, Tin, Lead and Zinc

Copper—During the last two days of April the market attained a level of 18⅞@19c., regular terms, and some round lots were sold at those prices, although business on the whole was of less value than it had been. The sharp decline in Standard copper at London had a sentimental effect, however, which resulted in scaring off buyers, bringing out cheap sellers of electrolytic, and producing irregularity generally. The large producers maintained their prices of 19c., regular terms, and certain of them found customers willing to pay that price, a sale of a round lot at that price being reported May 5; but other producers who were holding to that price reported no sales of consequence during the week. On the other hand, beginning with May 1 there were sellers at as lo was 18½c., regular terms. The copper market of last week is to be characterized as quiet and irregular.

Visible stocks of copper in Europe on Apr. 30 are reported as follows: Great Britain, 16,376; France, 2263; afloat from Chile, 2325; afloat from Australia, 5400; total, 26,364 long tons, an increase of 2116 tons over the Apr. 15 report.

Exports of copper from the United States for the week ended Apr. 24 are reported by the Bureau of Commerce at 11,585,358 lb. The larger items were 5,328,249 lb. to Great Britain, 4,543,639 lb. to France and 3,893,930 lb. to Italy. Imports were 4,094,746 lb. metal and 2,913,339 lb. in ore and matte; 9,008,085 lb. in all, chiefly from Canada, Cuba and Peru.

Copper Sheets base price was advanced 1c. per lb. Apr. 28, and is now 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 19½@20c. per lb. carload lots at mill.

Tin—This market was quiet but there was a fair turnover at prices a little lower than those that prevailed at the close of the previous week. The importation of tin under British consular supervision has been put upon a workable and apparently satisfactory basis.

Visible stocks of tin on Apr. 1 are reported as follows, including tin afloat: London, 8359; Holland, 55; United States excluding Pacific ports, 7371; total, 15,785 long tons, an increase of 318 tons during March.

Imports of tin ore and concentrates into Great Britain in March were 3279 tons; of which 2376 tons were from Bolivia.

Lead—While the A. S. & R. Co. maintains its price at 4.20c., New York, independent producers have been realizing a materially higher price on considerable tonnages for early shipment to domestic consumers. The St. Louis market has also been a little stronger.

Spelter The heavy business recorded in our last report continued into Apr. 29, when a large tonnage was again sold. On the following day higher prices were asked, but the climax appeared to have been reached. Since Apr. 29 only a relatively small tonnage was reported sold, and there was a good deal of irregularity in prices. A round lot of May spelter was sold at 12½c., on May 4, but at the same time there were sellers for that delivery at 13c. On May 5, May spelter was freely offered at 13c., and May-June was to be had at 12c. The spelter market at the close of the week is distinctly softer in tone, and there appears to be more prompt and near-by spelter available than was thought, this indicating among other things the manifestation of the new production. On the other hand, the present level of spelter prices is simply paralyzing consumption for ordinary purposes. The largest galvanizing interest of the United States is reported to be frankly advising its customers to use painted sheets instead of galvanized. A cable dispatch from a well informed quarter in London on May 5 said, "No buyers here. The high level of prices is killing business. The Government is taking wire bridght instead of galvanized."

Zinc Sheets have again advanced sharply 1½c. during the week and are now $17.50 per 100 lb., f.o.b. La Salle, Ill., less 8% discount. Usual extras charged.

Other Metals

NEW YORK—May 5

Aluminum is more active and sales seem to be increasing. Prices are firmer, and 19@19¼c. per lb. is quoted for No. 1 ingots, New York.—**Antimony** is very scarce and the market is excited and rather nominal. What metal is offered is entirely from second hands, and future supplies are uncertain. Ordinary brands are quoted at 35@37c. per lb.; while 40c. is offered for Cookson's. No bids for futures are accepted.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is rather nervous

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc	
Apr. May	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb	St. Louis, Cts. per Lb	New York, Cts. per Lb	St. Louis, Cts. per Lb
29	4.7913	50⅜	18.55 @18.80	40	4.20 @4.25	4.10 @4.15	11.42½ @13.67½	11.25 @13.50
30	4.7925	50½	18.70 @18.80	40	4.20 @4.25	4.10 @4.15	11.67½ @14.17½	11.50 @14.00
1	4.7925	50½	18.50 @18.80	39	4.20 @4.25	4.10 @4.15	11.67½ @13.17½	11.50 @13.00
3	4.7913	50¼	18.30 @18.80	40	4.20 @4.30	4.12½ @4.17½	11.67½ @13.67½	11.50 @13.00
4	4.7919	50⅜	18.30 @18.80	39	4.20 @4.30	4.12½ @4.17½	11.67½ @13.67½	11.50 @13.50
5	4.7925	50	18.30 @18.80	39	4.20 @4.30	4.12½ @4.17½	11.17½ @13.17½	11.00 @13.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The difference between the price delivered and the New York cash equivalent is at present 0.15 to 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
Apr.-May	Silver	£ per Ton	Cts per Lb	3 Mos	Best Sel'td	Spot	3 Mo	£ per Ton	Cts per Lb.	£ per Ton	Cts per Lb
29	23⅞	79¼	17.25	80¾		160½	162¼	21¼	4.62	64	13.90
30	23$\frac{11}{16}$	77	16.89	78½		159½	161½	20⅞ @21¼	4.54 @4.62	64	13.90
1	23$\frac{11}{16}$										
3	23$\frac{11}{16}$	76½	16.62	78		162½	164¼	21⅛	4.59	66	14.34
4	23⅝	76	16.51	77¼		160½	162	20⅞	4.43	66	14.34
5	23$\frac{9}{16}$	78¼	17.00	79¼		161½	162½	20¼ @20¾	4.37 @4.50	65	14.12

The above table gives the closing quotations on London Metal [illegible]. All prices are in pounds sterling per ton of 2240 lb., except silver w[illegible] per troy ounce of sterling silver, 0.925 fine. Copper quotation[illegible] copper, spot and three months, and for best selected, price [illegible] subject to 3 per cent. discount. For convenience in comparison [illegible] in pounds sterling per 2240 lb., with American prices in cent[illegible] ing approximate ratios are given, reckoning exchange at $4.8[illegible]; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.8[illegible] £1 = 0.21¾c.

and excited. The price for large lots in New York is $65 per flask of 75 lb.; but no large sales are reported. For small orders the quotation was down to $70 per flask early in the work, but is up again to $75@80. San Francisco by telegraph $62.50@65, large lots, with few or no sales. London £12 per flask, with £11 7s. 6d. named from second hands

Gold, Silver and Platinum

Gold sales at the U. S. Assay Office in New York in April were $2,604,217. For the four months ended Apr. 30 the total sales were $27,712,308 in 1914, and $10,609,328 in 1915; a decrease of $17,102,980 this year.

Gold receipts at the Australian mints two months ended Feb. 28 were: Sydney, 71,314 oz.; Melbourne, 75,149 oz.; Perth, 248,224 oz.; total, 394,687 oz., or $8,158,180 in value.

Silver—The market has weakened under lapse of orders from the East. The up-country offtake in India has been rather moderate of late.

Platinum—The market continues quiet, with sales small and little business doing. Prices are unchanged at $38@40 per oz. for refined platinum. Hard metal brings $43@47 per oz., according to iridium content.

Our Russian correspondent reports that offerings of platinum at Ekaterinburg have decreased. Speculators are buying up small quantities at the current low prices. Only the large companies are making preparations to work this season. The companies dealing abroad report that there is little or no demand for the metal. Quotations at Ekaterinburg are 9 rubles per zolotnik for crude metal, 83% platinum; at Petrograd 31,000 rubles per pood, nominal, for the same grade. These prices are equal to $30.08 and $30.38 per oz., respectively.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 1

The base price this week for 60% zinc ore was $60 per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS WEEK ENDED MAY 1

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,125,950	391,770	252,300
Year	65,295,100	2,120,960	7,376,830

Shipped during week to separating plants, 4,768,190 lb. zinc ore.

JOPLIN, MO.—May 1

Blende, high price $78; assay base 60% zinc, premium ore $75; medium grades $73@70, down to $68 for the lowest grade marketed. Calamine, base 40% zinc, $47.50@42 per ton; average, all grades of zinc, $58.92 per ton. Lead, high price, $54.50; base $51@52 per ton of 80% grades; average, all grades of lead, $49.22 per ton.

SHIPMENTS WEEK ENDED MAY 2

	Blende	Calamine	Lead	Values
Totals this week..	13,484,930	919,590	2,424,790	$486,100
Totals this year...	185,595,240	16,380,390	28,001,470	6,557,650

Blende value, the week, $406,740; 18 weeks, $5,568,840.

Calamine value, the week, $19,770; 18 weeks, $299,750.

Lead value, the week, $59,590; 18 weeks, $669,060.

Iron Trade Review

NEW YORK—May 5

Little change is to be reported this week in the iron and steel trades. New business seems to be on the increase, not in any sensational way, but with a quiet and steady growth.

Structural business is increasing slowly and many new contracts are under negotiation. There is talk of new railroad orders but they do not develop very fast

The pig-iron market has been much more active. A number of large contracts for basic pig are reported and foundry buyers are taking hold. Southern iron has been in demand, with some speculative buying apparent.

Pig Iron Production in Great Britain in 1914 is reported by the British Iron Trade Association as follows: Forge and foundry, 3,430,448; hematite and bessemer, 3,235,403; basic, 2,003,693; Spiegel, ferro, etc., 336,354, total, 9,005,898 long tons This is a decrease of 1,476,019 tons, or 14.1% from 1913. The production for 1914 was 4,507,984 tons in first half and 4,497,914 in the second half, showing very little change.

PITTSBURGH—May 4

Steel mill operations are still estimated at about 70% of capacity, but there has certainly been no increase in the rate in the past week or two, on the whole, and in the wire trade there has been a slight seasonable decrease in production and shipments. The total bookings in all branches of the steel trade are running slightly lighter than the average of March and unless activity increases shortly a decrease in production and shipment of steel is inevitable. The preponderating opinion in the trade seems to be that there will be an increase, and in some quarters the view is expressed that there may easily be an actual boom in the trade within a very few months.

The Pennsylvania R.R. yesterday issued its formal inquiry for 138,000 tons of rails, to make 150,000 tons for the season counting the six 2000 ton lots of experimental rails ordered earlier in the year. It is reported that the experimental rails, rolled by allowing the blooms to cool before further rolling, have shokn no superiority to justify paying an extra, and that rails now to be bought will be made on the specifications used last year. The Pennsylvania is about to close for about 22,000 tons of steel for cars to be built at the Altoona shops, and has asked bids from outside car builders, to be in hand May 10, for 14,000 cars. If these cars are bought it is thought other roads would buy more freely and it is said that if the railroads as a whole should purchase one-half their actual requirements the steel trade would be given such an impetus that the market would take care of itself.

Pig Iron—There is slightly more activity in foundry grades, but the expected activity in basic has not appeared locally, although several steel interests to the West have bought rather freely of southern Ohio and Alabama basic. The market continues quotable as follows: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report the average prices in April, based on an average of actual sales, at $13.60 for bessemer and $12.50 for basic, at Valley furnaces, the same as for several months past.

Ferromanganese—The English producers have named a new price of $88, Baltimore. Prompt lots are bringing $90@95, without much demand.

IRON ORE

The Interstate Commerce Commission has ordered a reduction of 5c. per ton made in the railroad rates on iron ore from mines on the Mesabi range to the ports at the head of Lake Superior. This brings the rate from 60c. down to 55c. per ton. The new rates will take effect June 15. There is some discussion as to whether the prices of ore will be reduced by that amount.

COKE

Connellsville—Nothing has come of recent inquiries for furnace coke for second half shipment, and the market is not overly firm, prompt furnace indeed being a shade easier. Foundry coke for spot shipment is in slightly better demand. We quote: Prompt furnace, $1.50@1.60; contract furnace to July 1, $1.60@1.65; contract furnace to Jan. 1, $1.75; prompt foundry, $2@2.35; contract foundry, $2.20@2.30, per net ton at ovens.

Chemicals

NEW YORK—May 5

The general market has been quiet and without any special fluctuations to be noted.

Arsenic—Business has been fair only, with no special demand. Prices are unchanged at about $4 per 100 lb. for both spot and futures

Copper Sulphate—Business is about as usual, with fair sales Current quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is a little irregular, but prices are generally firm. Quotations are 2.30c. per lb. for all positions this year.

Potash Salts—The Department of Commerce reports the imports of potash salts, not including fertilizer salts, into the United States in March at 3,404,575 lb. in 1914, and 1,921,637 lb. in 1915; a decrease of 1,482,938 lb Imports of kainit, manure salts and other fertilizer salts were 92,917 long tons in 1914 and 13,638 tons in 1915 a decrease of 79,279 tons this year

PETROLEUM

Exports of mineral oils from the United States in March were 167,152,694 gal., being 5,367,488 gal. less than in March, 1914. For the three months ended Mar. 31 the exports were 486,356,390 gal. in 1914, and 465,665,337 gal. in 1915; a decrease of 20,691,053 gal., or 4.2%, this year.

The monthly statement of the "Oil City Derrick" reports new oil wells completed in April as follows: Pennsylvania grade, 314; Lima-Indiana, 38, Central Ohio, 70, Kentucky, 5; Illinois, 54, Kansas-Oklahoma, 357, Texas-Louisiana, 140. In the month 978 wells were completed, an increase over March of 109. New production amounted to 186,260 bbl. The greater gain in wells completed and new production came from Cushing and the Gulf Coast fields The end of April showed 447 rigs and 1423 wells drilling.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Acacia, g	Colo	1,454,304	$ 1	$ 122,004	Jan	'11	$0 01
Adams, s l c..	Colo	1,438,989	10	778,000	Dec	'09	0.04
Ahmeek, c	Mich	80,000	25	2,550,000	Apr	'15	3 00
Alaska Mexican, g.	Alas	50,000	5	3,453,381	Feb	'15	0.20
Alaska Treadwell, g.	Alas	180,000	25	15,085,000	Feb	'15	1 00
Alaska United, g	Alas.	200,000	5	1,792,990	Feb.	'15	0 30
Am Zinc, Lead & Sm	U S	180,200	25	983,320	Jan.	'14	0.50
Anaconda, c	Mont	168,640	25	95,410,625	Apr	'15	0.25
Argonaut, g	Calif	1,992,500	5	1,640,000	Mar.	'15	0.10
Arizona Copper, pf	Ariz	200,000	1 20	2,009,744	Nov.	'14	
Arizona Copper, com..	Ariz	1,426,120	1 20	17,092,498	Feb.	'15	0.18
Bagdad-Chase, g., pf	Calif	1,519,896	5	202,394	Jan.	'09	0.10
Baltic, c	Mich.	84,819	25	7,950,000	Dec.	'13	2 00
Bingham N H, c	Utah	100,000	5	408,564	Mar.	'15	0.10
Bonanza Dev, g	Colo	228,690	1	1,425,000	Oct.	'11	0 20
Brunswick, g	Calif	395,287	1	155,880	Mar.	'15	0.06
Bunker Hill Con., g	Calif	300,000	1	830,000	Apr.	'15	0 02½
Bunker Hill & Sul., l.s.	Ida	200,000	10	16,037,250	Apr.	'15	0 25
Butte-Alex Scott, c.	Mont	327,000	10	148,000	Oct.	'13	0 50
Butte & Ballaklava, c	Mont	71,000	10	125,000	Aug.	'10	0 50
Caledonia, l s c	Ida	250,000	1	442,800	May	'15	0.02
Calumet & Arizona, c	Ariz	617,385	10	21,250,750	Mar.	'15	0.50
Calumet & Hecla, c	Mich.	616,758	25	124,750,000	Mar.	'15	5.00
Camp Bird, g s	Colo.	100,000	5	10,318,109	Jan.	'15	0 08½
Centen'l-Eur., l.s.g.c.	Utah	1,100,051	5	4,050,000	Apr.	'14	1.50
Center Creek, l z.	Mo	100,000	10	526,000	Apr.	'15	0.05
Champion, c	Mich.	100,000	25	9,100,000	Apr.	'15	1.00
Chief Consolidated, s g l	Utah	871,384	1	262,983	Aug.	'14	0.05
Chino, c	New Mex	777,458	5	4,513,530	Mar.	'15	0.50
Cliff, g	Utah	864,820	1	90,000	Jan.	'13	0.10
Cliff, g	Alas	300,000	1	210,000	Oct.	'13	0.01
Colo. Gold Dredging	Colo	100,000	10	650,000	Sept.	'14	1 00
Colorado, l s g	Utah	100,000	0 20	2,570,000	Dec	'12	0 03
Columbus Con., g.s.	Utah	1,000,000	5	226,832	Oct.	'07	0.20
Commercial Gold	Ore	285,540	1	43,750	Dec.	'10	0 00½
Con. Mercur, g	Utah	1,000,000	1	3,445,313	July	'13	0.03
Continental, z l	Mo	22,000	25	330,000	Jan.	'15	0.50
Copper Range Con., c..	Mich	393,692	100	13,986,746	Oct.	'13	0.75
Daly Judge, s l.	Utah	300,000	1	945,000	Apr.	'15	0.15
Daly West, s.l.	Utah	180,000	20	6,606,000	Jan.	'13	0.15
Doctor Jackpot, g	Colo	3,000,000	0 10	45,000	Mar.	'11	0 00½
Doe Run, l	Mo	65,783	100	3,550,969	Dec	'13	0.76
Eagle & Blue Bell, g s l	Utah	893,146	1	304,601	Oct	'14	0 05
Elkton Con., g	Colo	2,500,000	1	3,479,460	Nov	'14	0 02
El Paso, g	Colo	490,000	5	1,707,545	Feb.	'14	0.10
Ernestine, g s..	N M	300,000	5	120,000	Dec.	'12	0.05
Fed. M. & S., com	Idaho	60,000	100	2,708,750	Jan.	'09	1.50
Fed. M. & S., pf	Idaho	120,000	100	9,106,707	Mar	'15	1.00
Florence, g	Nev	1,050,000	1	840,000	Apr	'11	0 10
Frances-Mohawk, g	Nev	912,000	1	546,000	Jan.	'08	0.05
Free Coinage, g	Colo	10,000	100	180,000	Dec.	'09	1.00
Fremont Con., g	Calif	200,000	2 50	258,000	Oct	'14	0.02
Frontier, z	Wis	1,250	100	146,202	Nov.	'13	2.00
Gemini-Key'ne, l g s	Utah	5,000	100	2,305,000	Dec.	'14	10.00
Gold Chain, g	Utah	1,000,000	1	130,000	May	'13	0 03
Gold Coin of Victor	Colo	1,000,000	1	1,350,000	Feb.	'09	0.02
Gold Dollar Con	Colo	2,500,000	0 10	100,000	Dec.	'12	0.00½
Gold King Con, g	Colo	5,750,370	1	1,407,319	Dec	'11	0.03
Golden Cycle, g	Colo	1,500,000	5	3,930,000	Apr	'15	0.02
Golden Star, g	Ariz	400,000	5	140,000	Mar	'10	0.05
Goldfield Con, g	Nev..	3,558,367	10	27,932,086	Feb	'15	0.10
Grand Central, g	Utah	500,000	1	1,620,750	Sept	'14	0 05
Granite, g	Colo	1,650,000	1	270,000	Nov.	'12	0 01
Hazel, g	Cal	900,000	1	971,000	Dec.	'13	0 01
Hecla, l.s.	Idaho	1,000,000	0 25	3,240,000	Apr.	'15	0.02
Hercules, l s	Idaho	1,000,000	1	5,550,000	Dec.	'13	..
Homestake, g	S D	218,400	100	37,334,716	Apr.	'15	0 65
Horn Silver, l.s z	Utah	400,000	25	5,642,000	Sept.	'07	0 05
Iowa, g s l	Colo	1,666,667	1	233,499	Aug.	'14	0 00½
Iowa-Tiger Leasing g.s.	Colo	12,655	1	9,250	Dec.	'14	1.00
Iron Blossom, s l g	Utah	1,000,000	0 10	2,370,000	Apr.	'15	0.10
Iron Silver, s l g	Colo	500,000	20	4,950,000	Dec.	'14	0.10
Jamison, g	Cal	390,000	10	378,300	Jan.	'11	0 02
Jerry Johnson, g	Colo	2,500,000	0 10	187,500	Nov.	'14	0.01
Kendall, g..	Mont	500,000	5	1,505,000	July	'14	0 06
Kennedy, g	Cal	100,000	100	1,831,001	Apr.	'10	0.03
King of Arizona, g	Ariz	200,000	1	396,000	Aug	'09	0.12
Klar Piquette, z l	Wis	20,000	1	259,000	Apr	'13	0 50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct.	'13	0 00½
Liberty Bell, g	Colo	133,552	5	1,559,179	Sept.	'13	
Little Bell, l s	Utah	300,000	1	75,000	Mar.	'11	0 05
Little Florence, g..	Nev	1,000,000	1	430,000	Jan.	'08	0 03
Mammoth, g s c	Utah	400,000	25	2,300,000	July	'13	0 05
Mary McKinney, g	Colo	1,309,252	1	1,169,308	July	'14	0 02
May Day, g.s l	Utah	800,000	0 25	172,000	Feb	'15	0 02
Mexican, g.s.	Nev	201,600	2 50	161,910	June	'14	0.75
Miami, c	Ariz	746,759	5	3,712,249	Aug	'14	0 50
Modoc, g.s..	Colo	500,000	1	275,000	Dec	'11	0 01
Mohawk, c	Mich	100,000	25	3,375,000	Feb.	'15	1 00
Monarch-Mad'a, g s l	Colo	1,000,000	1	40,000	May	'11	0 01
Montana-Tonop., s g	Nev	921,865	1	488,588	Dec.	'12	0 10
Mountain, c..	Cal	250,000	25	4,216,250	May	'08	0 14
National, g	Nev	750,000	1	570,000	May	'11	0 10
Nevada Con, c	Nev	1,999,524	5	17,476,572	Mar	'15	0 25
New Century, z.l..	Mo	330,000	1	237,600	Oct.	'09	0 01
New Idria, q..	Cal	100,000	5	1,680,000	Apr.	'14	0 10
North Butte, c	Mont	410,000	15	11,890,000	July	'14	0 50
North Star, g.	Cal	250,000	10	4,537,040	Mar	'15	0 20
Old Domin'n, M. & Sm.	Ariz	162,000	25	3,888,000	Mar	'15	0 50
Ophir, s g..	Nev	201,600	3	2,068,360	Jan.	'12	0 10
Opohongo, g.s.l.	Utah	898,978	0 25	80,907	Jan.	'13	0.02
Oroville Dredging	Cal	700,000	5	1,614,298	Mar	'15	0 12
Osceola, c	Mich.	96,150	25	12,371,998	Apr	'15	2 00
Parrot, c	Mont	229,850	10	7,462,712	Feb	'15	0 15
Pearl Con., g.	Wash.	1,909,711	0 05	181,422	Dec.	'10	0 02
Pharmacist, g.	Colo	1,500,000	1	7,500	Feb.	'10	0 00½
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct	'11	0 03
Pittsburgh-Idaho, l.	Idaho	803,000	1	216,810	Oct	'12	0 04
Pittsburgh Silver Peak, g	Nev	2,790,000	1	771,200	July	'14	0 02
Portland, g	Colo	3,000,000	1	9,903,080	Apr	'15	0 02
Quilp	Wash	1,500,000	1	67,500	Feb	'12	0 01
Quincy, c	Mich.	110,000	25	21,007,500	Mar	'15	1 25

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Ray, c	Ariz	1,482,436	$ 10	[illegible]	[illegible]	'14	$0 37½
Republic, g	Wash	1,000,000	1	170,000	[illegible]	'12	0 01½
Rochester, l z	Mo	4,900	100	[illegible]	[illegible]	'12	0 50
Round Mountain, g	Nev	866,426	1	[illegible]	[illegible]	[illegible]	0 04
Seven Troughs Coal., g	Nev	1,500,000	1	75,000	[illegible]	[illegible]	[illegible]
St. Joseph, l	Mo	1,472,252	10	9,492,710	[illegible]	[illegible]	[illegible]
Shannon, c	Ariz	300,000	10	[illegible]	Jan.	[illegible]	[illegible]
Shattuck-Arizona, c	Ariz	350,000	10	2,275,000	Feb.	[illegible]	0 50
Silver King Coal., l	Utah	1,250,000	5	2,722,385	Apr.	[illegible]	0 15
Sioux Con., s l g	Utah	745,389	1	872,097	July	'11	0 04
Skidoo, g	Cal	1,000,000	5	365,000	Oct.	'14	0 01
Snowstorm, c s	Ida	1,500,000	1	1,192,103	Oct	'13	0 02
South Eureka, g	Cal	299,981	1	391,880	Feb.	'15	0 05
Standard Con., g s	Cal	178,394	10	5,274,407	Nov	'13	0.25
Stratton's Ind., g	Colo	1,000,000	0 60	456,625	Dec	'14	0 03
Success, z	Ida	1,500,000	1	930,000	June	'13	0 02
Superior & Pitts., c	Ariz	1,499,792	10	8,878,778	Mar	'15	0 20
Tamarack, c	Mich	60,000	25	9,420,000	July	'07	4.00
Tennessee, c	Tenn	200,000	25	4,606,250	Apr	'15	0.75
Tomboy, g s	Colo	310,000	4 85	3,634,065	Dec	'14	0 48
Tom Reed, g.	Ariz	909,555	1	2,443,757	Apr.	'15	0 06
Tonopah Belm't, s g	Nev	1,500,000	1	7,178,006	Apr	'15	0.12½
Tonopah Ext., g	Nev	943,433	1	778,331	Apr.	'15	0 07½
Tonopah of Nev., s g	Nev	1,000,000	1	12,600,000	Apr.	'15	0.25
Tri-Mountain, c..	Mich	100,000	25	1,450,000	Dec.	'13	2.00
Tuolumne, c	Mont	800,000	1	520,000	May	'13	0.10
Uncle Sam, g s l	Utah	500,000	1	495,000	Sept	'11	0 05
United Cop. Min., c	Wash	1,000,000	1	40,000	Nov.	'12	0 01
United (Crip. Ck.) g.	Colo	4,000,100	1	440,435	Jan.	'10	0 04
United Globe, c	Ariz	23,000	10	2,127,500	Dec.	'14	7.00
United Verde, c	Ariz	300,000	10	34,822,000	Feb.	'15	0.75
Utah, s.l.	Utah	100,000	10	281,860	Dec	'10	0 02
Utah, c	Utah	1,624,290	10	27,016,180	Mar	'15	0.75
Utah Con., c	Utah	300,000	5	8,700,000	Mar	'15	0 50
Valley View, g	Colo	1,000,000	1	240,000	Dec	'10	0 04
Victoria, g s l	Utah	250,000	1	207,500	Mar.	'10	0 04
Vindicator Con., g	Colo	1,500,000	1	3,172,000	Apr.	'15	0.03
Wasp No. 2, g..	S D	500,000	1	466,966	Dec	'14	0 01
Wellington Mines, g	Colo	10,000,000	1	350,000	July	'13	0 00½
Wolverine, c	Mich	60,000	25	8,220,000	Apr.	'14	2 00
Yak, s.l.	Colo	1,000,000	1	1,847,685	Dec.	'14	0 02
Yankee Con., g.s.	Utah	1,000,000	1	167,500	Jan.	'13	0 01
Yellow Aster, g	Cal	100,000	10	1,163,789	Apr.	'15	0.02
Yellow Pine, l z s	Nev	1,000,000	1	481,008	Mar	'15	0.01
Yukon Gold, g	Alas	3,500,000	5	6,884,500	Mar.	'15	0.07½

Iron, Industrial and Holding Companies

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Amalgamated, c..	Mont	1,538,879	100	$91,280,147	Feb.	'15	$0 50
Am. Sm. & Ref., com	U. S.	500,000	100	27,833,333	Mar	'15	1.00
Am. Sm. & Ref., pf	U. S	500,000	100	51,333,333	Mar	'15	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	10,022,350	Apr.	'15	1.50
Am. Smelters, pf. B.	U. S	300,000	100	14,750,000	Apr.	'15	1.25
Greene Cananea	U S	450,642	100	4,371,646	June	'14	1 00
Guggenheim Expl.	U S	380,315	25	21,655,763	Jan.	'15	0 87½
Inter'l Nickel, com	U. S	115,826	100	15,794,571	Mar.	'15	2 50
Inter'l Nickel, pfd	U. S	89,126	100	8,358,491	Feb.	'15	1.50
National Lead, com	N Y	206,554	100	8,570,801	Mar.	'15	0.75
National Lead, pf	N. Y.	243,676	100	29,693,093	Mar.	'15	1.75
Old Dominion, c	Ariz	293,245	25	6,000,390	Mar.	'15	0.50
Phelps, Dodge & Co..	U S	450,000	100	38,234,304	Mar.	'15	3.50
U. S. Steel Corp., com	U. S.	5,083,025	100	222,360,438	Dec.	'14	0 50
U. S. Steel Corp., pf.	U S	3,602,811	100	376,598,255	Feb.	'15	1.75
U. S. S., R. & M., com	U.S.-Mex	486,348	50	6,362,181	July	'14	0.75
U. S. S., R. & M., pf.	U S-Mex	351,114	50	15,518,465	Apr.	'15	0 87½

Canadian, Mexican and Central American Companies

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest		Amt.
Ajuchitlan, g s	Mex	50,000	$ 5	$ 212,500	Oct	'12	$0.25
Amparo, g.s..	Mex	2,000,000	1	1,580,884	Feb	'15	0 03
B C Copper	B C.	591,709	5	615,198	Jan.	'13	0 15
Beaver Con., s	Ont	1,996,490	1	529,857	Apr	'15	0 03
Buffalo, s	Ont	1,000,000	1	2,757,000	July	'14	0 03
Canadian Goldfields, g	B. C	600,000	0 10	290,000	July	'14	0 001½
Chontalpan, g s l z	Mex	7,000	25	59,500	May	'14	0 75
Cobalt Townsite, s	Ont	45,000	1	1,042,259	May	'14	0 10
Coniagas, s	Ont	800,000	5	7,240,000	Feb	'15	0 30
Con. M & S Co. of Can	B C	58,052	100	1,942,809	Apr	'15	2 00
Crown Reserve, s	Ont	1,768,814	1	6,031,654	Apr.	'15	0 02
Crow's Nest Pass C. Co	B C	248,506	25	2,182,864	Mar	'11	0 25
Dos Estrellas, g s	Mex	300,000	0 50	10,335,000	Dec	'13	1 50
El Oro, g s	Mex	1,147,500	4 85	8,668,418	July	'13	0 24
Esperanza, s g	Mex	455,000	4 85	13,162,151	Mar.	'15	0 24
Granby, s.l.c..	B C	148,496	100	5,533,457	June	'14	1 50
Greene Con., c	Mex	1,000,000	10	9,544,400	May	'14	0 50
Guanajuato D., pf	Mex	10,000	1000	274,356	Jan	'11	3 00
Hedley Gold..	B C	120,000	10	1,584,000	Mar	'15	0 50
Hollinger, g	Ont	600,000	5	3,090,000	Apr.	'15	0 20
Kerr Lake s..	Ont	600,000	5	5,670,000	Mar	'15	0 25
La Rose Con., s	Ont	1,498,627	5	5,349,656	Apr	'15	0 25
Le Roi No. 2, g	B. C	120,000	24 30	1,472,580	Jan	'13	0 36
Lucky Tiger Con., g	Mex	715,337	10	2,984,410	Apr	'15	0 10
McK.-Dar. Sav., s	Ont	2,247,692	1	4,405,471	Feb	'15	0 03
Mines Co. of Am. (new)	Mex	1,700,000	10	*1,215,000	July	'13	0 12½
N. Y. & Hond. Ros., g	C. A	150,000	10	3,640,000	Apr	'15	0 30
Nipissing, s	Ont	1,200,000	5	12,990,000	Apr	'15	0 25
Peñoles, s l g	Mex	80,000	25	6,361,688	June	'13	1 25
Peregrina M. & M., pf	Mex	10,000	100	328,656	Sept	'10	3 [illegible]
Pinguico, pf	Mex.	20,000	100	840,000	Oct	'13	[illegible]
Right of Way Mines	Ont	1,685,500	1	219,115	Nov.	'14	[illegible]
Rio Plata, s	Mex	374,518	5	345,745	Feb	[illegible]	[illegible]
San Rafael, g	Mex	2,400	25	1,442,380	[illegible]	[illegible]	[illegible]
San Toy, g s	Mex	5,750,000	1	530,000	July	[illegible]	[illegible]
Sorpresa, g s	Mex	19,200	20	3,979,2[illegible]	[illegible]	[illegible]	[illegible]
Stand'd Silver Lead	B C	2,000,000	1	1,5[illegible]	[illegible]	[illegible]	[illegible]
Temiskaming, s	Ont	2,500,000	1	1,384,1[illegible]	[illegible]	[illegible]	[illegible]
Tem. & Hud. Bay, s	Ont	7,761	1	1,940[illegible]	[illegible]	[illegible]	[illegible]
Tretheway, s	Ont	1,000,000	1	1,06[illegible]	[illegible]	[illegible]	[illegible]
Wettlaufer-Lorrain, s	Ont	1,416,590	1	637,4[illegible]	[illegible]	[illegible]	0 05

*Previous to reorganization, $5,258,881.

†Previous to January, 1910, $324,644.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	May 1	June 1	$0.005
Andes Silver, Nev.	May 4	May 25	0.03
Argenta, Ida.	May 10	June 10	0.001
Belcher, Nev.	May 15	June 8	0.15
Best & Belcher, Nev	May 12	June 1	0.05
Big Elk, Ida	Apr 17	May 15	0.001
Caledonia, Nev	May 11	June 1	0.05
Cedar Creek, Ida	May 5	June 5	0.005
Consolidated Imperial, Nev.	Apr. 27	May 18	0.01
Con Virginia, Nev	May 4	May 25	0.10
Contact Copper, Mich	May 15		0.50
Crown Point, Nev	May 17	June 8	0.15
Diam'field Black Butte, Nev.	Apr. 30	June 3	0.01
East Hercules, Ida., (post.)		May 15	0.001
Emerald, Utah (three ts.)		June 9	0.01
Enterprise, Ida (post.)		May 20	0.002
Exchequer, Nev	May 11	June 1	0.03
Giant, Ida	Apr. 9	May 14	0.002
Houghton, Mich	May 25		1.00
Idaho-Los Angeles, Ida	Apr. 24	May 15	0.005
Idaho-Nevada, Ida	May 10	June 5	0.002
Ivanhoe, Ida	Apr. 10	May 10	0.002
Knight Christensen, Utah			0.13
Laclede, Ida	May 24	June 14	0.003
Majestic-Idol, Nev	Dec. 15	Jul. 20	0.005
Mullan, Ida.	Apr. 24	May 24	0.002
Mountain Rose, Ida	Apr. 19	May 19	0.001
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Hope, Ida	May 5	June 2	0.002
Oreano, Ida (post.)		May 10	0.0015
Overman, Nev.	May 19	June 8	0.05
Raven, Ida	May 15	June 14	0.0006
Samson, Ida (post.)		June 3	0.002
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Cliff, Ida (post.)		May 29	0.0025
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida	May 15	June 15	0.002
Smuggler	Apr. 17	May 17	0.0025
Tarbox, Ida	Apr. 26	May 28	0.0025
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Virginia, Ida	May 10	May 29	0.02
Wisconsin, Ida	May 15	June 15	0.003
Yellow Jacket, Nev	May 14	June 8	0.15

Stock Quotations

Among sales at auction we note: 300 shares Gold Hill Copper Co., $57 lot; 300 shares Furnace Creek Copper Co., $5 lot; 2000 shares Nevada Superior Con. Copper Co., $2 lot.

COLO. SPRINGS May 4		SALT LAKE May 4	
Name of Comp.	Bid	Name of Comp.	Bid
Acacia	04½	Beck Tunnel	05½
Banner	01¾	Black Jack	10¼
Cripple Cr'k Con	01⅝	Colorado Mining	10½
C. K. & N.	05	Crown Point	01¾
Doctor Jack Pot	09	Daly-Judge	5.25
Elkton Con	43	Gold Chain	11
El Paso	1.19	Grand Central	57
Findlay	04	Iron Blossom	64
Gold Dollar	‡02⅜	Little Bell	14
Gold Sovereign	04½	Lower Mammoth	03½
Isabella	17¾	Mason Valley	3.00
Jack Pot	06½	May Day	14
Jennie Sample	02	Opohongo	01¼
Jerry Johnson	04	Prince Con	45½
Lexington	‡008	Seven Troughs	02
Mary McKinney	32	Silver King Coal'n	3.20
Pharmacist	01⅜	Silver King Con	1.85
Portland	1.17	Sioux Con	02¾
Raven B. H.	.03½	Uncle Sam	04
Vindicator	1.63	Yankee	01

TORONTO		May 4	
Bailey	02	Dome Exten	10
Coniagas	4.75	Foley O'Brien	23
Peterson Lake	23	Hollinger	24.25
Right of Way	03	Imperial	07
Seneca Superior	1.25	Jupiter	11
Silver Queen	01½	McIntyre	53
T. & Hudson Bay	19.00	Pearl Lake	01½
Timiskaming	38	Porcu. Gold	‡25
Wettlaufer-Lor	04	Preston E. D.	02½
Big Dome	13.00	Rea	12

SAN FRANCISCO		May 4	
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡04	Belmont	4.25
Andes	02	Jim Butler	83
Belcher	14	Lone Star	.07
Best & Belcher	.01	MacNamara	04
Caledonia	.11	Midway	18
Challenge Con	‡06	Mont.-Tonopah	39
Confidence	09	North Star	21
Con. Virginia	.12	Rescue Eula	13
Gould & Curry	02	West End Con	76
Hale & Norcross	03	Atlanta	37
Julia	‡01	Booth	16
Mexican	28	C. O. D. Con	05
Occidental	79	Comb. Frac.	.12
Ophir	05	Jumbo Extension	1.27½
Overman	02	Pitts.-Silver Peak	12
Potosi	‡01	Round Mountain	42
Savage	01	Sandstorm Kendall	10
Sierra Nevada	05	Silver Pick	08
Union Con	.17	Central Eureka	17
Yellow Jacket	.18	So. Eureka	‡2.25

N. Y. EXCH. May 4	
Name of Comp.	Clg.
Amalgamated	73¼
Am Sm & Ref, com	72
Am Sm & Ref, pf	108
Am Sm Sec, pf B	83½
Anaconda	35¾
Batopilas Min	1
Bethlehem Steel	135
Bethlehem Steel, pf.	111½
Chino	46
Colo. Fuel & Iron.	31¼
Federal M. & S., pf	30
Great Nor., ore., ctf.	36⅝
Guggen. Exp	60
Homestake	117½
Inspiration Con	31¾
Mex. Petroleum	81
Miami Copper	26
Nat'l Lead, com.	66½
National Lead, pf.	109
Nev. Consol	15
Ontario Min	3
Quicksilver, pf.	1¼
Ray Con.	23⅜
Republic I&S, com.	30
Republic I&S, pf.	87
SlossShell'd, com	37¼
Tennessee Copper.	33½
Utah Copper	66½
U. S. Steel, com.	58⅛
U. S. Steel, pf.	108½

N. Y. CURB May 4	
Name of Comp.	Clg.
Alaska Juneau, w. i.	15⅛
Alta Con	83
Beaver Con	39
Big Four.	07
Blue Bell	03
Braden Copper.	8¼
Buffalo Mines	⅝
Can. Cop. Corpn	1⅛
Can. G. & S.	04
Caribou	.50
Cashboy	.06½
Chambers Ferland	20
Con. Ariz. Sm	.75
Con. Coppermines.	2
Davis-Daly	1
Diam'field-Daisy	06
Dia. Black B.	03
Florence	52
Goldfield Con.	1⅜
Goldfield Merger.	27½
Greene Cananea.	30½
Kerr Lake.	4$\frac{15}{16}$
La Rose	50
McKinley-Dar-Sa	31
Mines of Am.	2⅛
Nevada Hills.	23
New Utah Bingham	1$\frac{7}{16}$
Nipissing Mines	6⅛
Ohio Copper.	25
Oro.	10
Pacific Smelt.	‡.09⅛
South Utah	‡⅛
Stand'd Oil of N.J.	410
Standard S. L.	1$\frac{9}{16}$
Stewart	1¾
Tonopah	7⅜
Tonopah Ex	3$\frac{9}{16}$
Tonopah Merger.	38
Tularosa	$\frac{3}{16}$
West End Ex	05
Yukon Gold.	2¾

LONDON Apr 23	
Alaska Tre'dwell	£7 6s 3d
Cam & Motor.	0 15 0
Camp Bird	0 9 6
El Oro.	0 7 10
Esperanza.	0 8 6
Mexico Mines.	3 16 3
Oroville.	0 12 3
Santa Gert'dis.	0 7 6
Tomboy.	1 4 3
Tough Oakes.	0 14 3

BOSTON EXCH. May 4	
Name of Comp.	Clg.
Adventure	2⅛
Ahmeek	380
Alaska Gold M.	37
Algomah	3¼
Allouez	53½
Am. Zinc	13
Ariz. Com., ctfs	7¼
Bonanza	15
Butte-Ballaklava	3
Butte & Superior	68
Calumet & Ariz.	70
Calumet & Hecla.	570
Centennial	21½
Cliff	1
Copper Range.	56½
Daly West	3
East Butte	13
Franklin	11⅜
Granby	85
Hancock	21
Hedley	26⅜
Helvetia	80
Indiana	8½
Island Cr'k, com.	46½
Island Cr'k, pfd.	89⅛
Isle Royale	28
Keweenaw	3¼
Lake.	14
La Salle.	7
Mass	12¼
Mayflower	5⅛
Michigan	1⅛
Mohawk	73
New Arcadian.	10½
North Butte	34¼
North Lake.	3
Ojibway	3
Old Colony	5⅛
Old Dominion.	53½
Osceola	84
Quincy	84
Santa Fe	2¼
Shannon.	9
Shattuck-Ariz	28½
Superior	33¾
Superior & Bost.	3⅛
Tamarack.	38½
Trinity.	6
Tuolumne.	.40
U. S. Smelting.	38½
U. S. Smelt'g, pf.	46½
Utah Apex.	3⅛
Utah Con.	12¾
Victoria.	3
Winona.	4½
Wolverine.	62½
Wyandot.	1½

BOSTON CURB May 4	
Name of Comp.	Bid
Alvarado	.50
Bingham Mines.	6⅛
Boston Ely	32
Butte & Lon'n Dev	24
Calaveras	2
Calumet-Corbin.	12
Chief Con.	.90
Corbin	.90
Cortez.	30
Crown Reserve.	.85
Eagle & Blue Bell	1¼
First Nat. Cop	2¾
Houghton Copper.	3½
Iron Cap Cop., pf.	5¼
Majestic	45
Mexican Metals.	18
Nevada-Douglas.	80
New Baltic.	3½
Oneco	2
Raven Copper	07
Smokey Dev.	35
So. Lake	6½
Tonopah Victor.	‡17
Trethewey	12
United Verde Ext	3$\frac{11}{16}$

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.49	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99		63.182		67.786	
June	13.603		61.336		66.274	
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360		150.702	
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900		3.808		18.503	
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074		4.924		21.393	
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90		13.90		14.27	
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

The Engineering and Mining Journal

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Gold and Silver in Chile

By Mark R. Lamb*

SYNOPSIS—A short description of the various operating gold and silver mines of Chile. The field for American engineers never was great and Chilean engineers are beginning to fill even what field there was.

We have frequent inquiries from the States regarding the opportunities on the West Coast for skilled gold and silver miners and metallurgists, but the openings are so scarce that it is no pleasure to reply. Perhaps a few lines of description of each of the operating properties will be of service to enough people to warrant their publication.

The most important property is the Compañía de Minas y Beneficiadora de Taltal, with a mine and cyanide mill at Cachinal. The company is owned by Chilean capital and is under the direction of G. P. Ives, of Houghton, who designed and built the plant to replace an amalgamation plant. The cyanide plant is able to treat low-grade silver ore, and for that reason has been successful, as ores which cannot be amalgamated, and even waste dumps, are turned into ore by his success with the cyanide plant.

The capacity of the mill is 30 tons daily. The cyanide loss is 2 lb. per ton of ore, or 1½ lb. per lb. of silver produced. The ore is crushed in two ball mills, milling to 14 mesh. Extraction is between 80 and 85%.

Profit is made on ore containing 9 oz. per ton at the present price of 22d. (47.5c.) per oz. Treatment costs are $2.30 per long ton, including a stiff cost of fuel oil and water.

Mr. Ives has lately introduced air drills (at 10,000-ft. elevation), and is cutting even his present low mining costs.

The mine has been worked for ores rich enough to stand the cost of amalgamation, and on that basis was worked out. The success of Mr. Ives' cyanide plant means a greatly prolonged life, and there is no reason why the plant cannot be considerably increased in capacity, with corresponding increase in profits, except the present price of silver. Undoubtedly as soon as the war is over this increase will be considered.

The most important gold mine, from the present profit point of view, is the Mina Miles, belonging to Don Felipe Herrera and operated by Felipe Herrera, Jr. The mine has been an intermittent producer for years, but until the last 18 months has been shut down and full of water. About a year ago Señor Herrera bought a boiler, sinking pump and Tremain steam stamp, and got going with a small amount of money. At present he is taking out of the Tremain an average of $100 per day and is preparing to ship high-grade pyritic ore which cannot be amalgamated. This shipping ore will average about 3 oz. and will be sent to England. The cost, including the commission of the shipping house, which advances against the value of the ore, is around 10% on this grade. The ore cannot be shipped to the States under similar conditions, and this is curious. Perhaps details will be interesting.

Las Vacas Stamp Mill

Mina Miles, at Talca

The miner samples his ore, assays it and ships it to the London address of the buyer or intermediary. H[illegible] the shipping papers, together with his own ass[illegible] Valparaiso office of the consignee, who advances 90% of the value of the shipment.

The ore, concentrate or precipitate, or a [illegible]illation of these, reaches London, is sampled by an umpire and assayed, and is either offered for sale or a bargain may have been made upon a fixed tariff, after which regular shipments are made. In due course the returns come in, and the balance either way is adjusted. I have made numerous shipments from Condoriaco of precipitate, concentrates and ores of gold and silver, and invariably under the above-cited arrangement, though we have tried to make similar arrangements to ship to the States unsuccessfully.

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*Mining engineer, Huerfanos 1157, Santiago, Chile.

The gold mine with the most complete equipment is Las Vacas. The mine is near the port of Los Vilos and has had its ups and downs during a hundred years, old iron tools of the early Spaniards being found occasionally. The old records of the mine production are quaint and interesting and make an attractive basis for reorganization proceedings and propaganda when the mine falls into bad ways. At present it is being operated on a systematic and intelligent basis, an addition having been made recently to the plant and considerable development being done in the mine.

The manager is Don Juan E. Garnham, who, while not professing technical knowledge, is a business man of long experience. He has had the good fortune to get around him three skilled men. H. C. Marret of Australia is mine captain and has done much needed development and preparatory work in the mine, has increased the drilling equipment and is putting the mine on a basis to produce regularly. This work has required a heavy expenditure for timbering, as many fills needed supporting before they could be drawn. These fills, of what was formerly considered waste, will be treated by the modern and complete cyanide plant which is now in running order. The ore is a hard quartz, with a percentage of pyrite, which is concentrated out. The plant is equipped to cyanide the concentrate; but the cost of shipping is so low that unless a high extraction on the concentrate can be made, the concentrate will no doubt be shipped to England.

James S. Anderson, an experienced cyanider, formerly with John Taylor, is in charge of the plant. The plant, while it has a capacity for only 40 tons per day of 24 hours, is the most complete and efficient in South America. Briefly, it consists of stamps, Dorr classifier, tube mill, Isbell vanners, Dorr thickener for slime, air agitation for slime and concentrate and vacuum filter. The stamps mill in water and amalgamation is effected in the mortar, on the battery plates and on tube-mill plates.

The battery is composed of five 900-lb. stamps purchased years ago and five 1250-lb. stamps which have just been erected. With the tube mill doing its fair share of the grinding and using coarse screens on the battery Mr. Anderson will have no difficulty in getting 4 tons per stamp, and may exceed that figure.

The consulting engineer of the company is E. David Pope, an Australian mining engineer of experience and ability. He has been in charge of the remodeling and addition of machinery, including the stamps, compressor and power equipment, and together with Mr. Marret has radically changed the system of mine development, and has found ore, the existence of which was not known.

Taken altogether, the company has every facility upon which to base a hope of immediate and long-continued success.

The Loma Blanca mines near San Felipe, south of here, is also a mine with a long and at one time excellent record. A few years ago a 20-stamp mill was erected to amalgamate the ores, but was run for a short time only. An accident to the mill engine stopped work, and for some reason the plant was never started again. Recently another company has taken a long lease on the mine and mill, has repaired the plant and is now milling ½-oz. ore, amalgamating only.

There are two factors which have lately become of importance to gold and silver miners in Chile, and which must be taken into account, though it seems a cold-blooded thing to do.

The first is that, due to the stoppage of the nitrate plants, there is an enormous excess of labor. This labor must exist and is willing to work for anything offered. While few companies are taking any unfair advantage of the situation, new enterprises are starting on a much lower wage basis than was paid formerly.

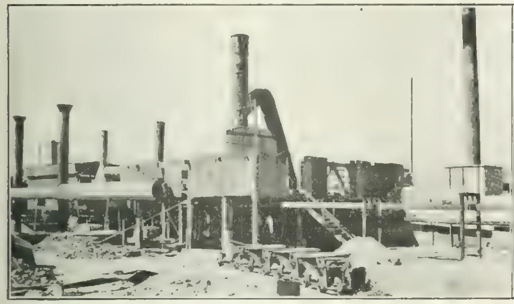
The second point is a corollary of the nitrate disaster, since on account of the lessened shipment of nitrate (which pays export duty) the government income is low, and consequently the value of the paper money has dropped. This means that at the same time that less wages are paid the gold and silver produced buys more paper money than formerly. This may or may not be a permanent condition. The exchange of the country has been dropping steadily for years, and as the general public fears for the credit of the country if the war is long, the value of the paper money will certainly not increase. The country is in able and honest hands, so far as the government is concerned; and as many of its public men have held office—more, in proportion, perhaps, than in other countries—it is certain that the ultimate result will be for the good of the government finances.

A STREET CORNER IN SANTIAGO

In any case, conditions could be a great deal worse, if comparisons are made with other countries; and as the agriculturist has a bumper crop under harvest it is almost safe to say that this is the most favored of all American countries. If only there were more mines operating or developing it would be possible to advise an immigration of miners and metallurgists. As it is, the only man who has an opportunity here is the one with capital, even if it is not very large, and he has an excellent opportunity. There are many small prospects that I know of personally (and quite likely others that I have not seen) that will warrant a speculation. This is not a general invitation to all American capital out of a job, as the country would be crowded with one steamer load.

The import duty on mining machinery is only 5%, and is kept low as a special inducement to the mineral industry. There are a few small machine shops in the country, but none of them would attempt to build a cyanide plant, a concentrator or a smeltery. The freight from New York to the Coast is much less than that from Chicago to Goldfield, for example, and with few exceptions the mining districts are less than 100 miles from the port. All of the foregoing facts mean that with cheap and excellent labor, cheap living expenses, low freights and duties and short hauls, the conditions are ideal for mining investments. It should perhaps be recalled to the reader that Chile is long and narrow. The Longitudinal Ry. has lately been completed, and this runs north and south practically through the length of the country. Compared to railway rates elsewhere, its rates both for ore and for machinery are moderate.

Throughout the mining districts of Chile the climate is excellent the year round. If you will think of Los Angeles' climate, with the hottest days left out in summer and with a more reasonable amount of rain in the winter, it will give an exact impression of the climate where the mines are in Chile. As soon as generalizations are made it is necessary to indicate the exceptions. The climate at Braden is cold in winter, and at Chuquicamata and on the nitrate fields the summers are very hot.



Copper Smeltery at Calama

Mill and Cyanide Plant at Condoriaco

Until very recently the foreign technical man could see no competitors ahead of him among the Chilean University men. The rooted prejudice against "doing things" made it always necessary to call for outside help when serious work was projected. This condition is changing, and now there are Chileans in charge of important mining and nitrate plants who not only know the theory of their jobs, but are able intelligently to supervise the details. I could make this paragraph very interesting if it were permissible to indulge in personalities. It is interesting to record that we have lately had numerous applications from university students for positions where they can begin at the bottom and work up. To one who has lived in Mexico or Central America this will be noteworthy, as it certainly requires a strong determination on the part of the young man to force him to work as a peon at the beginning, against the wishes, usually, of his father, mother, brothers and sweetheart.

In the south of Chile there are placer deposits of gold which have been reported upon favorably and otherwise. I have no first-hand knowledge of them, except that none is being worked on a large scale. At one time a number of dredges were built and failed, and the gold is still there. The usual small lots are brought in by the Indians, but whether they would pay to work in the California way is a question.

The accompanying illustrations will give a good idea of some of the districts, but the local conditions can only be known by investigating them. Even then we might not agree.

The reader will remember that once upon a time Chile was the largest producer of copper. The districts are still here; and as lower grades of ore can be treated profitably, there are still opportunities in copper mining. Americans are here now, even during these hard times for copper, making drillings and taking options on likely properties.

The Andacollo copper mines offer one example of a property that has produced copper for a long time and which has not yet found a buyer. Just now it is in liquidation and would be an opportunity for someone who thinks he can see into the ground. It has been drilled and sampled carefully and rejected by one American company, but the price might have had something to do with the final results.

A large smeltery has lately been built at Guayacan to replace with blast furnaces the usual reverberatory furnaces of Chile. This plant at Guayacan was built mainly as a custom plant and was on the way to success when the market for copper dropped.

All but one of the blast furnaces in Chile have basic converters, and this one would have had the basic equipment if the results attained by shipping matte were not better in that particular case than by converting.

Even a set of small, hand-operated converters have been lined with basic brick, and with no other change except the lengthening of the tuyeres is making copper as successfully as the large plants.

Taking everything into consideration, Chile is a fine place to live in at present. The people pay their debts, the laborers give more in proportion to the money they receive than elsewhere on account of the low value of the money, the mines can be operated without any adverse conditions and the government is secure. The only objection to the country—and it is a serious one—is that it takes 23 days to reach New York. If it were possible to land freight and passengers here as quickly as in Nevada, it would be ideal, since what this country lacks could be easily obtained in New York.

⁂

Crude Borate Production for 1913 in the United States amounted to 58,013 tons, all of which comes from Inyo, Los Angeles and Ventura Counties, Calif., according to the U. S. Geological Survey. In addition 135,315 lb of miscellaneous refined borax products were imported.

Status of Alaska Coal Land Leasing

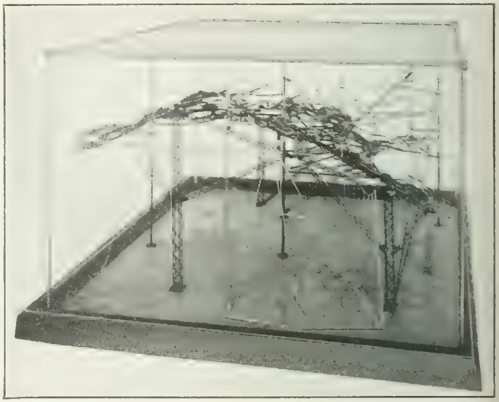
Secretary Lane said recently that he was receiving a great many inquiries with respect to the date when operations could be commenced under the Alaska coal-leasing act, passed at the last session of Congress, and that evidently the provisions of the law were not generally understood, especially with respect to the several preliminary steps necessary to be taken before the coal lands of the territory could be properly offered as subject to lease. He called attention to the fact that under the statute he is directed to survey the coal lands in the territory, with preference given to the Bering River, Matanuska and Nanana coal fields, such surveys to be executed in accordance with existing laws, rules and regulations governing the survey of public lands, with permission to adopt and use any surveys heretofore made under the authority and approval of the Department; that before any lands are offered for leasing the President of the United States is required to designate and reserve from use, location, sale, lease or disposition not exceeding 5120 acres of coal-bearing lands in the Bering River fields and not exceeding 7680 acres of coal-bearing lands within the Matanuska fields. The unreserved coal lands are thereafter to be divided by the Secretary into leasing blocks or tracts of 40 acres each, or multiples thereof, in such form as will permit the most economical mining of the coal in such blocks, but in no case exceeding 2560 acres in any one leasing block or tract. The lands having been thus divided into leasing blocks, the Secretary under the act is then authorized, and not before, to offer such blocks or tracts for leasing, and award leases thereof through such plan as he may adopt, either by advertisement, competitive bidding or otherwise.

It is therefore apparent that until such time as the surveys have been extended over the coal fields, with a full report as to the extent and location of the coal deposits therein, he will be unable to divide the lands thus surveyed into leasing blocks or tracts, in such form as to secure the economical mining of the coal, a duty which is specially imposed upon him by the statute. He said, however, that it was his intention to expedite the work in every way consistent with securing the proper data upon which to base his subsequent action, and to that end parties were already on their way to the field. He also expressed the opinion that it would not be necessary to await the return of the surveys in order to declare the reservations required by the statute, as existing approved surveys could be used for that purpose, subject to such adjustment as might later be required under the survey now being made. These reservations will be announced at an early date, and thereafter parties interested in the Alaska coal fields will have opportunity to make such personal inspection of conditions as they may desire, and thus acquire such knowledge as will enable them to consider leasing propositions when the lands are finally offered to the public for such purpose. The extent of the work in the field, the shortness of the Alaska season, and other matters considered will not permit the opening of these lands to leasing until the beginning of the season of 1916, but prior thereto ample notice will be given, through the papers and otherwise, of the plan by which these lands will be opened to leasing, with such other information in connection therewith as may then seem appropriate.

Mine Models in Tonopah Apex Litigation

In the recent litigation between the West End and Jim Butler, in Tonopah, a mine model was exhibited to the court in which all of the workings were represented by square copper wire, which could be easily bent to conform to the courses of the drifts. The stopes were carved from wood. The workings were supported on slender columns over a base, on which was shown the usual mine map, with all of the workings superimposed. The model was inclosed by glass sides and a glass top.

During the trial it was necessary to refer to three surfaces of the earth over the territory where the vein in dispute now is: The present surface; the surface that existed just before the materials which form the present surface were deposited; and the surface which existed prior to the erosion which left this latter surface. For the benefit of the court, a block model was prepared, showing the contour of the ground as at present. Lifting off the top block of this model left the model showing the surface as it was before the material which forms the present surface was deposited; and lifting off still another block showed the surface which existed prior to the erosion.



Tonopah Mine Model

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Tin Output of Siam Increases

A feature of the tin-mining industry which centers around the Straits is the increased production obtained from Siamese Malaya and Siam itself, says the London *Mining Journal*. For the last financial year, 1913-1914, eight dredges were at work, which produced black tin yielding 1800 tons of metal from 4,700,000 yd. of gravel treated. This number has been added to since, and there are now 13 dredges at work and more are under construction. Apart from the dredging industry, the output of metal would probably show a declining tendency. The output for the last four years in metal is as follows: 1910-1911, 4900 tons; 1911-1912, 5900; 1912-1913, 6600; 1913-1914, 6800 tons.

⁂

The Mineral Production of South Australia in 1913 was as follows, the items being arranged in order of descending value. Copper, 7161 tons; iron ore, 60,658 tons; gold, 6556 oz.; limestone, 41,300 tons; phosphate rock, 5950 tons; silver, 2660 oz.; silver-lead ore, 153 tons; all else, £68,909.

Indexing and Filing Technical Literature

By Alvin R. Kenner*

SYNOPSIS—When stripped of frills and unnecessary time-consuming practices, filing pays. The system described is one which was devised and used for seven years by a mining engineer for mining needs. Superiority of the topical system over others and the weakness of the Dewey system are shown.

The great majority of mining engineers, especially those technically trained, have considered the filing of technical information. A smaller percentage, though still a majority, have started a technical file, but the number of those who have followed the practice for any length of time is comparatively small.

The two most potent reasons for this latter condition are the adoption of a poor system and the comparatively small benefit derived at the beginning.

Anyone who weighs the advantages and disadvantages of a technical file during its first year or so will probably come to the conclusion that filing is a delusion and a snare. Adding to this the probability of a poor system, which entails a correspondingly greater amount of work, the average engineer is apt to dismiss the idea for all time as theoretically feasible but economically impossible.

Filing, like anything else, can be carried to extremes. In too many cases it becomes a fad. Much clipping, folding, pasting, cross-referencing and general fussing are indulged in, and all sense of an economical expenditure of time is lost sight of. However, when stripped of all unnecessary frills and close attention is paid to every means f reducing the time and tediousness involved, the prac-ice is to be commended and will well repay the time xpended.

Filing is practiced more extensively in other lines of ngineering than mining, yet there is no field of engineer-ng so varied, so progressive or more in need of the prac-ice. Not to file is to lose the greater part of the bene-t to be derived from technical periodicals.

A technical file is properly divided into: (1) The ndex or key, which is used in marking or referring to rticles, and (2) the file, in which the articles are kept or future reference.

Methods of Indexing

All methods of indexing are included in some one of e following systems: Alphabetical—as in the semi-nnual index of the Engineering and Mining Jour-AL; combined alphabetical and topical—as in the month Mining Index of the Engineering and Mining Jour-AL and Crane's *Index of Mining Engineering Literature*; pical—as in the Dewey decimal classification, which is rgely used by libraries.

Of these methods the topical is the best for the indi dual's use. The most widely known example of this i e Dewey system, which is an attempt to divide the world's knowledge topically. Although such attempts have been made from the time of Lord Bacon to the present day, Melvil Dewey was the first to work out a classification sufficiently meritorious to warrant its general adoption.

Defects of the Dewey Classification for Mining Literature

The Dewey classification is a most excellent one for libraries, for which purpose it was primarily devised, but is not adapted to the individual's use, although frequently employed. The principal objections are as follows: The headings pertaining to mining engineering, when considered separately from the rest of the classification, are not logically arranged from the engineer's point of view.

The original Dewey classification was published in 1876, since which time the progress in mining has been most notable. Naturally a classification made 40 years ago will not adequately meet present needs, even though considered from an equal-value-to-all-knowledge basis. Considered from the particular viewpoint of the mining engineer—to whom, when filing, all knowledge other than mining must be subordinate—the arrangement is far from satisfactory.

The author of the Dewey classification has encountered difficulty in satisfactorily expanding the subject of mining engineering because its headings covering this industry are not properly subdivided. While extensive subdivision is not of much importance in filing books, it is most important in the case of articles; otherwise the labor of both filing and finding them is greatly increased.

The adoption of the Dewey classification in order to obtain conformity with the system used in libraries is apt to prove a disadvantage rather than an advantage. To maintain a private file in conformity with the Dewey classification is impossible. If used for filing articles it must be more extensively subdivided. Any subdivisions made by the engineer are not likely to correspond with future expansions by Dewey.

The advantages of following the Dewey classification are more imaginary than real, anyway. In many libraries only the alphabetical and not the numerical, or topical, catalog is open to the public. Furthermore, the library staff (usually feminine) develops strange ideas regarding engineering subjects; and though mistakes are compensated for in the alphabetical catalog by exhaustive cross-referencing, they cannot be avoided in the numerical catalog. The cataloger of one important Western library has placed metallurgical books under *mining engineering* instead of under *chemical technology*, where Dewey intended them to be placed. This and similar changes will prove disastrous where dependence is placed on a knowledge of the Dewey system. The contents of technical journals are not indexed by libraries according to the Dewey system, and it can only be used in reference to books, which are as readily found in the alphabetical as in the numerical catalog.

A further disadvantage of the Dewey classification in a private file is the increased amount of cross-[illegible].

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due to the illogical order. It offers no advantages to offset all these drawbacks.

Individual Classifications Preferable

An original classification drawn up to conform with the individual's need and viewpoint will prove the most satisfactory in the end. In such a classification the headings should be arranged in a sequence logical enough so that the position of every heading can be readily recalled.

Any attempt to use a ready-made classification is likely to prove unsatisfactory, not only because of a difference in the point of view but also on account of the emphasis placed on some subjects as compared to others. Suggestions, however, may be obtained from other classifications. To illustrate the principle involved in topical indexing, a classification is given below which I have used for seven years.

No attempt has been made in this classification to divide the entire subject of mining engineering into its theoretical subdivisions. The subject is viewed from the standpoint of the metal miner, and therefore not enough importance is given to coal and nonmetallic products. Placer mining and the fire-metallurgy of metals have not been expanded because of my limited requirements in those lines.

The avoidance of cross-references has been an important factor in governing the grouping of headings. For example, bucket-dumping headframes and buckets, skip-dumping headframes and skips, etc., are grouped, as they are interdependent and frequently described in the same article. If any article treats of two or more subdivisions—such as a comparison of the efficiency of steam and compressed air in hoisting—it is filed under the nearest main division (in this case 141-11), thus avoiding the necessity of cross-referencing.

Such subdivisions as "Silver only" (351-1), "Shaft plumbing" (183-11) and similar single subdivisions are used because sufficient articles on these subjects were accumulated to warrant separate subheadings; while there were so few articles on the remaining possible subheads that they may all be conveniently filed under the one head. While extensive subdivisions are advisable from the start, nothing is gained, and the index is unduly lengthened by carrying expansion to extremes. Aside from placer mining and fire-metallurgy, the classification given is as completely subdivided as the average engineer requires.

Any such outline as here given appears disjointed and almost meaningless unless an attempt is made to draw up a similar one. Words must be used where phrases are necessary to express the scope of each heading, and in many cases better words might possibly be chosen. However, the relative positions in the outline, as much as the words themselves, serve to indicate the ground covered by each heading.

Classification

1	**MINING.**
11	**Prospecting** (11)
111	SURFACE, MAGNETIC SURVEYS (111)
112	UNDERGROUND, BORE-HOLE DRILLING (112)
.1	Metal and Coal (112-1)
.2	Oil (112-2)
12	**Mine Examination and Report** (12)
121	MINE SAMPLING (121)* (including mine dumps)
123	FORM OF REPORT (123)
125	MINE VALUATION (125)
13	**Winning or Breaking Ore** (13)
131	SYSTEMS OF BREAKING GROUND (131)
132	BREAKING GROUND (132)
.1	Drilling (132-1)
.11	Compressed-Air Drills only (132-11)
.12	Other Machine Drills. Hand-Operated Drills (132-12)
.13	Placing and Gaging Holes. Setting Up (132-13)
.19	Drill Steel. Sharpening, Tempering, etc (132-19)
.2	Blasting (132-2)
.21	Composition of Explosives (132-21)
.22	Storing and Thawing of Explosives (132-22)
.23	Crimping. Tamping. Spitting (Caps. Fuse (132-23)
.25	Electric Shot Firing (132-25)
.3	Mucking (132-3)
133	TIMBERING AND METHODS OF HOLDING GROUND (133) IN
.1	Shafts (133-1)
.11	Solid Ground (133-11)
.12	Running Ground. Excessively Wet Ground (133-12)
.2	Drifts. Cross-cuts. Tunnels (133-2)
.3	Stopes (including Sand Filling) (133-3)
.4	Raises (133-4)
.8	Preservation of Mine Timbers (133-8)
.9	Substitutes for Mine Timbers (133-9)
14	**Handling Ore** (14)
141	HOISTING (141)
.1	Hoists (141-1)
.11	Motive Power (141-11)
.111	Steam (141-111)
.112	Electricity (141-112)
.113	Compressed Air (141-113)
.12	Hoisting Engines (Geared. First Motion, etc.) (141-12)
.18	Counter Balancing (141-18)
.19	Koepe and Whiting Systems (141-19)
.2	Head Frames and Dumping (141-2)
.21	Bucket Dumping Frames and Buckets (141-21)
.22	Skip Dumping Frames and Skips (141-22)
.23	Cage Head Frames and Cages (141-23)
.29	Interchanging Skips and Cages (141-29)
.3	Safety Devices (141-3)
.31	Cage Guide Catches (141-31)
.32	Bucket Cross-heads and Catches (141-32)
.33	Overwinding (141-33)
.35	Landing Chairs (141-35)
.36	Gage Gates. Shaft Gates and Coverings (141-36)
.4	Ropes and Cables. Care. Strains (141-4)
.5	Signaling and Communication (141-5)
.51	Electrical Signaling (141-51)
.52	Non-Electrical Signaling (141-52)
.58	Mine Telephones (141-58)
.59	Signal Codes (141-59)
142	HAULAGE (142)
.1	Systems (142-1)
.11	Electrical (142-11)
.12	Compressed-Air (142-12)
.13	Gasoline. Mules. Man (142-13)
.18	Endless Rope and Tail Rope Haulag (142-18)
.2	Trackage. Dumping (142-2)
.21	Trackage. Switches. Turntables. etc. (142-21)
.22	Dumping (142-22)
.221	Mechanical Dumping and Cars (142-221)
.222	Other Methods of Dumping and Car (142-222)
.23	Inclined Planes (142-23)
.231	Gravity (142-231)
.232	Other than Gravity (142-232)
143	AERIAL TRANSPORTATION (143)
.1	Cableways and Overhead Tramways (143-1)
.11	Gravity Operated (143-11)
.12	Power Operated (143-12)
.2	Traveling Bridges and Cranes. Loade (143-2)
.9	Conveyors (143-9)
144	CROSS-COUNTRY (SURFACE) TRANSPORTATION. ROADS (144)
.1	Hauling (144-1)
.2	Packing (144-2)

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*For the sampling of placers see (39). For the sampling of bedded ores or coal, see (31[illegible]-7). For the sampling of ore lots or mill flow see [illegible]

- 145 SURFACE ARRANGEMENTS FOR ORE HANDLING. SORTING (145)
  - .1 Sorting (145-1)
  - .2 Surface Bins. Ore Gates or Chutes (145-2)
- 15 **Ventilation** (15)
  - 151 FANS. BLOWERS (151)
  - 152 FURNACE. STEAM JETS. HYDRAULIC, ETC. (152)
  - 156 MEASUREMENT AND TESTING OF AIR (156)
- 16 **Drainage** (16)
  - 161 PUMPING (161)
    - .1 Steam Installations (161-1)
    - .3 Electrical Installations (161-3)
    - .4 Air Lift Installations (161-4)
    - .8 Cornish Pumps (161-8)
    - .9 Miscellaneous (161-9)
  - 162 HOISTING WATER (162)
  - 163 LESSENING INFLOW. REDUCING AMOUNT HANDLED (163)
    - .1 Dams. Watertight Linings. Cementing Channels (163-1)
    - .2 Water Rings (163-2)
- 18 **Surveying** (18)
  - 181 SOLAR OBSERVATIONS. ADJUSTMENT OF INSTRUMENTS, ETC. (181)
  - 182 SURFACE SURVEYS (182)
    - .1 Claim Surveying (182-1)
    - .2 Topographical Surveying (182-2)
    - .3 Other Surface Surveying. Reconnaissance Surveys (182-5)
  - 183 UNDERGROUND SURVEYS (183)
    - .1 Mine Workings (183-1)
      - .11 Shaft Plumbing (183-11)
    - .2 Bore Holes (Surveying only) (183-2)

2 **GEOLOGY OF MINING** (2)

- 21 **Mineralogy** (21)
  - 211 CRYSTALLOGRAPHY (211)
  - 212 BLOW-PIPING (212)
  - 213 MINERALS (213)
- 22 **Lithology** (22)
  - 221 MICROSCOPICAL PETROGRAPHY (221)
  - 222 ROCKS (222)
- 23 **Paleontology** (23)
- 24 **Physical and Dynamical Geology** (24)
  - 241 PHYSICAL GEOLOGY (241)
  - 243 STRUCTURAL GEOLOGY (243)
    - .1 Outcrops. Surface Indications of Ore Shoots (243-1)
    - .2 Faulting (243-2)
    - .3 Anticlines and Synclines (243-3)
    - .7 Dikes. Intrusion of Eruptives (243-7)
  - 249 GENERAL SUGGESTIONS FOR GEOLOGICAL WORK. TOOLS. FIELD EQUIPMENTS, ETC. (249)
- 25 **Economic Geology** (25)
  - 251 THEORIES OF ORE DEPOSITION. CHEMISTRY OF PROCESS (251)
  - 255 OCCURRENCE OF (255)
    - .1 The Metals (255-1)
      - .11 Gold and Silver (255-11)
        - .111 Gold only (255-111)
        - .112 Silver only (255-112)
      - .12 Copper (255-12)
      - .13 Lead and Zinc (255-13)
      - .14 Iron (255-14)
      - .19 Other Metals (255-19)
  - 55
    - .2 The Nonmetals (255-2) (Genesis also)
      - .21 Coal (255-21)
      - .22 Petroleum (255-22)
      - .23 Diamonds (255-23)
      - .24 Other Gems (255-24)
- 6 **Geographical Geology** (26)*
  - 61 NORTH AMERICA (261)
  - 62 SOUTH AMERICA (262)

CONVERTING ORES INTO MARKETABLE PRODUCTS (3)

- 1 **Ore Dressing. Individual Operations** (31)
  - 11 COMMINUTION (311)
    - .1 Theory, Laws of (311-1)
    - .2 Crushers (311-2)
    - .3 Rolls (311-3)
    - .4 Stamps (311-4)
    - .5 Tube-Mills Ball-Mills (311-5)
    - .7 Roller Mills (Huntington, Chilean, etc.) (311-7)
    - .8 Arrastras. Pans (311-8)
    - .9 Miscellaneous (311-9)
  - 312 SIZING (312)
    - .1 Screening (312-1)
    - .2 Hydraulic Classifiers (312-2)
      - .21 Laws of Classification (312-21)
  - 313 JIGGING (313)
    - .1 Theory, Laws of (313-1)
    - .2 Jigs (313-2)
  - 314 CONCENTRATION (TABLES, VANNERS, ETC.) (314)
    - .1 Theory. Laws of (314-1)
    - .2 Sand (314-2)
    - .3 Slime (314-3)
  - 315 THEORY, LAWS AND MACHINES OF OTHER OPERATIONS (315)*
    - .1 Magnetic (315-1)
    - .2 Electrostatic (315-2)
    - .3 Flotation (315-3)
    - .4 Pneumatic (315-4)
  - 317 ACCESSORY MILL APPARATUS (317) (Elevators, Weighing Devices, Automatic Feeders, Driers, Etc.)
  - 319 MISCELLANEOUS MILLING (319)
    - .1 Construction of Mill Buildings (319-1)
    - .2 Ore Testing. Increasing Extraction (319-2)
    - .5 Disposal and Storage of Tailings (319-5)
    - .7 Sampling Bedded Ores, Slimes, Tailing (in place) (319-7)
    - .8 Sampling Ore Lots or Mill Flow (319-8)
      - .81 Hand only (319-81)
      - .82 Machines (319-82)
    - .9 Miscellaneous Information (319-9)
- 32 **Mill Flowsheets. Combined Operations** (32)
  - 321 GOLD AND SILVER ORES (321)
    - .1 Lixiviation only (321-1)†
      - .11 Sand and Slime (321-11)
      - .12 All Sliming (321-12)
    - .2 Concentration and Lixiviation (321-2)
      - .21 Cyaniding (321-21)
        - .211 Tailing only (321-211)‡
          - .1 Sand and Slime (321-211-1)
          - .2 All Sliming (321-211-2)
      - .22 Chlorination (321-22)
    - .9 Refractory Au and Ag Ores (321-9)§
      - .91 Containing As and Sb (321-91)
      - .92 Containing Tellurides (321-92)
      - .93 Containing Manganese (321-93)
      - .94 Containing Copper (321-94)
  - 322 SILVER AND SILVER-LEAD ORES (322)
    - 1 Silver (Cobalt) (322-1)**
    - .2 Silver-Lead (Idaho) (322-2)
  - 323 LEAD-ZINC-COPPER ORES (323)††
    - 1 Silver-Lead and Zinc (British Columbia; Broken Hill) (323-1)
    - .2 Gold,‡‡ Silver, Lead and Zinc (Colorado) (323-2)
    - .3 Lead and Zinc (Wisconsin; Joplin) (323-3)
    - .5 Lead, Zinc and Copper (323-5)
  - 324 COPPER AND COPPER-PYRITE ORES (324)
    - .1 Gold, Silver and Copper (324-1)
    - 2 Copper only (native; Lake Superior) (324-2)
    - 6 Copper-Iron Sulphide (Eastern States) (324-6) (no precious metals)
    - .8 Pyrite (324-8)
  - 325 IRON (and manganese) ORES (325)
  - 329 MISCELLANEOUS ORES (329)
    - 1 Tin (329-1)
    - 2 Tungsten (329-2)

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*General descriptive articles and laws of foreign countries n be marked "General" and "Law" and conveniently filed nder subdivisions of this heading.

*Note that these are operations depending upon purely physical properties of the ore. Descriptions of mills using these processes go under (32), the theory and the description of single machines are included here.

†Cyaniding, chlorination, etc.

‡Flow sheets of mills cyaniding both concentrate and tailing are filed under (321-21)

§Refractory ores, involving more than simple lixiviation and concentration, in which the gold and silver values are the important minerals, but extraction is complicated by small amounts of the metals mentioned.

**Typical districts are mentioned after some of the headings to give a clearer idea of their meaning.

††Ores containing two or more of these three metals.

‡‡Gold generally indicates the presence of and the necessity for saving some carrier such as iron pyrite. The precious metals gold and silver, although only recovered indirectly through carriers, yet influence the treatment and extent to which the recovery of sulphide can be profitably carried. For example, the absence of gold and silver in the Wisconsin and Joplin districts means a lower percentage of extraction, and a corresponding difference in mill design from that encountered in Western lead and zinc districts where precious metals are found.

33	**Metallurgy of** (33)
331	GOLD AND SILVER (331)
.1	Amalgamation (331-1)
.2	Chlorination (331-2)
.3	Cyaniding (331-3)
.31	Chemistry (331-31)
.32	Sand Treatment (331-32)
.33	Slime Treatment (331-33)
.331	Agitation (331-331)
.332	Filtering (331-332)
.1	Vacuum (331-332-1)
.2	Pressure (331-332-2)
.336	Settling Slimes, Slime Thickeners, etc. (331-336)
.1	Decantation, Intermittent (331-336-1)
.2	Continuous Decantation (331-336-2)
.7	Types of Slime Thickeners (331-336-7)
.9	Lime and other alkalies (331-336-9)
.35	Zinc Room (331-35)
.351	Precipitation (331-351)
.1	By Zinc (331-351-1)
.11	Shavings (331-351-11)
.12	Dust (331-351-12)
.2	Other Methods (331-351-2)
.352	Clean-Up and Melting (331-352)
.353	Refining Bullion (331-353)
.37	Miscellaneous (331-37)
.372	Electro-cyaniding (331-372)
.373	Cyaniding Stored Tailings (331-373)
.375	Cyaniding Concentrates (331-375)
.4	Other Processes (Leaching, etc.) (331-4)
332	COPPER (332)
333	LEAD (333)
334	ZINC (334)
337	IRON (337)
338	OTHER METALS (338)
339	MISCELLANEOUS (339)
35	**Chemical Analysis and Assaying** (35)
351	GOLD AND SILVER (351)
.1	Silver only (351-1)
352	COPPER (352)
353	LEAD (353)
354	ZINC (354)
357	IRON (357)
358	OTHER METALS (358)
359	MISCELLANEOUS (359)
.2	Laboratory Equipment (359-2)
.21	Assaying only (359-21)
.22	Chemical only (359-22)
39	**Placer Mining** (39)
4	**MARKETING PRODUCTS** (4)
5	**FINANCING** (5)
6	**MISCELLANEOUS** (6)
61	**Office. Administration** (61)
611	MANAGEMENT. ORGANIZATION (611)
.1	Military Type. Departments (611-1)
.2	Task Management. Taylor-Gantt Methods. Gilbreth (611-2)
612	LABOR (612)
.1	Peculiarities and Customs of Different Classes (612-1)
.2	Wage Systems (612-2)
.5	Welfare Work, Sick and Death Benefits, Clubhouses and Hospitals (612-5)
613	BOOKKEEPING (613)
.1	Mine and Mill (613-1)
.2	Smelter (613-2)
.5	General Bookkeeping. Graphic Methods, etc. (613-5)
614	ENGINEERING RECORDS. MAPS. MINE MODELS (614)
.1	Drafting (614-1)
.11	Mine Maps (614-11)
.15	General Drafting Hints (614-15)
.2	Mine Models (614-2)
.5	Systems of Recording and Filing Engineering Records (614-5)
617	GENERAL MINING AND METALLURGICAL COSTS (617)*
63	**Law** (63)
631	MINING (U. S. only) (631)†
.1	Title to Mining Lands (631-1)
.2	Contract Forms (631-2)
.5	Liability for Debts and Injuries (631-5)
632	METALLURGICAL (632)
65	**Power, Etc.** (65)
651	POWER PLANTS (651)
.1	Steam (651-1)
.11	Engines. Types. Care and Efficiency of (651-11)
.12	Boilers (651-12)
.121	Firing (with Wood, Coal, Oil or Gas) (651-121)
.122	Boiler Scale. Feed Water Purification (651-122)
.123	Condensers, Injectors, Superheaters, Separators, etc. (651-123)
.124	Boiler Testing. Recording Instruments (651-124)
.13	Steam Distribution and Transmission (651-13)
.131	Laws of Flow. Condensation. Friction in Pipes (651-131)
.132	Piping and Connections (651-132)
.133	Utilization of Exhaust Steam (651-133)
.2	Gas and Oil (651-2)
.21	Gas Producer Plants (651-21)
.22	Gasoline and Oil Engines (651-22)
.3	Hydro-Electrical (651-3)
.31	Water (651-31)
.311	Measurement of Water Flow. Hp. Calculations (651-311)
.312	Flume Lines, Ditches, Large Pipe Lines (651-312)
.313	Dams (651-313)
.316	Water Wheels. Hydraulic Motors (651-316)
.32	Electrical (651-32)
.321	Generators (651-321)
.322	Motors (651-322)
.325	Transmission. Wiring (651-325)
652	MECHANICAL TRANSMISSION OF POWER (652)
.1	Shafting, Bearings, Journals, Clutches (652-1)
.2	Toothed Gears and Cams (Chain Gearing) (652-2)
.4	Machinery and Mill Gearing (652-4)
.41	Belt Transmission (652-41)
.42	Rope (hemp and wire) Transmission (652-42)
.43	Pulleys. Sheaves (652-43)
.44	Friction. Gearing. Direct Connection (652-44)
.9	Lubrication. Lubricants. Friction (652-9)
653	AIR COMPRESSION (653)
.1	Air Compression Plants (653-1)
.11	Mechanical. Precooling (653-11)
.12	Hydraulic (653-12)
.2	Compressed Air Transmission. Reheating Storage (653-2)
69	**Miscellaneous**
691	ACCIDENTS AND DISEASES (691)
.1	Diseases (691-1)
.2	Poisoning (691-2)
.3	Electrical Accidents (691-3)
.4	Explosion of Mine Gases (691-4)
.5	Mine Fires. Sealing and Flooding Working (691-5)
.6	Helmets and Hoods (691-6)
692	ILLUMINATION. LIGHTING (692)
693	BLACKSMITHING. REPAIRING MACHINER (693)
694	CONCRETE WORK. MACHINERY FOUNDA TIONS (694)
698	UNCLASSIFIED (698)
699	COAL (699)
.1	Mining (699-1)
.2	Cleaning and Washing (699-2)

Explanation of This Classification

No attempt will be made to explain the reason for a the headings, but an explanation of the relation betwee the main divisions will give an idea of how a certain s quence connects them so that the relative position is rea ily recalled.

The primary divisions—Mining, Geology, Preparin Ores for Market, Marketing Products and Financing are well-recognized divisions of mining and scarcely a mit of any other arrangement.

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*The costs of individual operations, such as crushing, filtering, pumping, etc., are filed under their corresponding headings. Only general costs are included here.

†Mining laws of foreign countries are marked "Law" and filed under the subdivision of heading (26).

In mining, prospecting is the first step. Following this, sampling and data such as are gathered in a mine examination are necessary to direct intelligently future operations, and if a prospect or small mine is to be extensively developed some kind of examination and report is usually required before the money for its exploitation can be obtained. Then follows the development or winning of the ore and its removal. Since ventilation, drainage and surveying may continually enter into consideration at any time, these three heads are placed last.

Geology of Mining begins with the subjects necessary for the study of ore deposits, followed by the heads covering the subject proper. The subdivisions under Geographical Geology are not given, as they can be readily supplied. In dividing the United States, division into states and these again into single districts will be found preferable to the plan used by the U. S. Geological Survey, mainly for the reason that the longitude and latitude of a district are not always given in technical articles.

In Converting Ores into Marketable Products first comes the consideration of the individual machines for ore-dressing, followed by mill flowsheets showing how the individual machines are combined to obtain the best results. When information along this line is desired it usually concerns a particular class of machinery, the laws governing its operation and its efficiency in comparison with other machines, or the combination of machines that will give the best results on a given ore—i.e., the flowsheets of modern mills or how similar ores are treated. The first information is found in (31) and the second in (32). The metallurgy of ores follows their dressing or preparation. Chemistry and assaying are accessory subjects, essential in Converting Ores into Marketable Products.

Placer mining might properly be considered as made up of both mining and the preparation of ores for market, and an attempt might be made to divide the subject between these two heads. However, the nature of all articles on placer mining is such that this plan would require a large number of cross-references and be unsatisfactory. Amalgamation, or at least the collection of gold on an amalgam plate, depends upon physical properties; but when it is remembered that the head includes retorting and the chemical actions of substances on plates and in pan amalgamation, it is not out of place under metallurgy.

The remainder of the classification, Marketing Products, Financing, and the miscellaneous headings Organization, Law, Power, Misc., are purely arbitrary in the general arrangement.

METHODS OF FILING

Three systems are commonly employed in filing technical articles—namely, vertical files, letter files and scrapbooks.

Of these, the first is undoubtedly the best. Scrapbooks involve an enormous amount of trimming, pasting and folding; while letter files necessitate folding, are cumbersome, bulky and cannot be sectionalized like a vertical file. Scrapbooks and letter files have been discarded so long ago by commercial organizations in a similar class of work that they do not deserve serious consideration.

Either an ordinary open-at-the-end folder or a tension envelope (closed at the ends, but without a flap) should be used. The latter is to be preferred, as it keeps its shape and permits articles to be filed more rapidly.* The legal-cap-size folder or envelope is preferable to a smaller size; the folding of articles is avoided.

CROSS-REFERENCING

Under any system of filing cross-referencing is necessary. Much of it could be obviated by a little coöperation on the part of technical publishers. Cross-[illegible], caused by poor arrangement in this respect, has discouraged a considerable number of engineers in efforts at filing.

There are four or five ways of cross-referencing in use, but 3x5 cards will be found much the best.† The cards should not be filed in the folders but kept separate in a 3x5 box or drawer.

GENERAL SUGGESTIONS

In writing the key number on articles a short dash every three numbers will assist in reading off the number readily.

The numerals corresponding to a cross-reference should be inclosed in parentheses to prevent confusion in filing. Pages bearing numerals referring to cross-references should be filed in the front of the folder and pages containing single articles in the back. In this way a cross-referenced article may be located in about one-fifth of the time usually necessary.

Articles that clearly belong under a certain minor heading, but do not fall within any of its present subdivisions, should be filed under that heading, and no special subheading made for them until a sufficient number have accumulated to permit intelligent subdivision. Articles that cannot logically be filed under any heading or subheading can be filed by a scheme similar to the relative index used in the Dewey classification. For 99% of articles, however, no relative index is necessary and is a waste of time.

If weight is an objection, the heavy pressboard guides, customarily used with legal size folders, can be dispensed with by placing adjustable index-tabs on some of the folders.‡

Although the number of headings in the classification or key may run into the hundreds, a very small number of folders may be used. As the number of articles increases the folders may be increased. A small arrow in red ink following the number on any folder will indicate that additional folders have been added for the subdivisions. The proper number for an article can be read off in a few seconds if inks of different colors are used to bring out the relative value of the headings and subheadings on the index. Two pieces of stiff cardboard at right angles, two small blocks of wood to hold them, and a weighted spindle will make a revolving stand that eliminates unnecessary handling of the index pages.

The Institut International de Bibliographie of Brussels has adopted six or eight symbols which are employed in a most ingenious manner.§ Their use is not advisable in an individual file, but they are interesting as showing how distinctions can be made when a large number of articles are filed, as in indexes of technical libraries.

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*A folder manufactured by the Library Bureau of Boston, Mass. (No. 5219), is very satisfactory, although it holds more articles than the average heading requires.

†The Library Bureau, Boston, Mass., manufactures a conveniently ruled card (No. 33014) of durable light-weight stock.

‡A convenient tab is made by the Yawman & Erbe Manufacturing Co., of Rochester, N. Y. (Everlasting Index Tab No. 70).

§A full description of these symbols in Engl[illegible] in a pamphlet entitled "A Systematic Code a[illegible] Electrochemistry and Allied Subjects (1906)," by [illegible] Voge, of the Concilium Bibliographicum, Zurich, [illegible] A brief description is given in the seventh edit[illegible] of the Dewey Decimal Classification.

It is not necessary to read all articles filed. Such a practice is based on the supposition that everything filed is referred to later, which is a fallacy. The title, synopsis and the beginning of one or two paragraphs are generally enough to determine the gist of an article, and also its value. If its merit is questionable, the first time it is read for reference it can be thrown out of the file. Technical journals should not be looked over and then laid aside for filing. With a pencil at hand, articles of no merit can be marked out, and it will save time to index articles worth saving at once. An extra 20 or 30 minutes should suffice to index the contents of any periodical.

The tedious part of filing—the tearing out of articles to be preserved, making out cross-reference cards and placing the articles in the file—can be left to any assistant of ordinary intelligence, if the topical system is used.

DOES IT PAY TO FILE?

The main sources of information, aside from that gained through practical experience, are: (1) Books; (2) technical periodicals—(a) bound technical journals, (b) personal file.

While everyone makes use of the first source for the accumulated knowledge of the past, there is a difference of opinion among engineers as to whether bound volumes or a personal file can be used to greatest advantage in supplementing books. This difference of opinion, however, will often be found to depend upon an engineer's location and line of work. Situated in large cities, with adequate technical libraries and bibliographical indexes at hand, it is doubtful if the advantages gained will offset the time spent in filing. Theoretically, at least, it will not. But those who have hastened to a library to obtain information urgently needed, and spent hours, if not days, in a tedious search, realize that it is preferable to collect such information by degrees rather than exhaust the faculties in a wearisome and often fruitless search when they are needed for the problem in hand.

If years are spent in the same line of work in a district where the local practice is long established, filing offers few advantages, for such improvements as can be applied to the work in hand can usually be adopted at the time they appear in the technical press.

There are, of course, some engineers who use neither bound volumes nor a personal file. These must depend upon books and memory. Books are always behind the times. When facts are incorporated into book form they are common property and little credit redounds to the engineer who then and only then puts them into practice. The age of standard books varies from a few months to a dozen years. Upon the death of an author of a standard book in some line there is often a lapse of 10 to 15 years before the intervening progress is again adequately treated. The present average age of books in representative lines, dating from last revision, is four years.* Some years ago it was nearly seven years. The intervening period cannot be ignored by the engineer who pretends to be well informed. In stamping a man as poorly or well informed it often assumes an importance out of all proportion to the information already published in book form. It may be conservatively estimated that at least 20% of the information worth while found in technical journals never appears in books. Authors of books sometimes endeavor to conceal the source of their information, and in doing so, often so obliterate or alter the original data that their value is materially reduced.

Memory can seldom be relied upon, even in the most limited lines, to recall published data. The question narrows down to a choice between a personal file and bound volumes.

The personal file entails more work to maintain; but none at the time the information is desired. The time and labor necessary in referring to bound technical journals result in their being consulted only as a last resort. Their use becomes increasingly rare and reliance is soon placed solely on books. The information in a personal file is also better arranged. No one can index technical information for the engineer as well as he himself. The personal file will also contain notes collected in practice that cannot be found in any technical journal. Where bulk and weight must be taken into consideration, the personal file has a marked advantage.

The question as to whether filing will pay depends upon so many factors that each engineer can only decide the matter to his own satisfaction by trying it. If done with intelligence and patience, it would prove profitable to a great many engineers who now depend upon bound volumes or upon not much of anything.

In the case of the young engineer just starting in his work it is safe to generalize and say that filing will pay if the topical method is followed. It will give him an insight into the correlative value of various subjects that he would be slow to get in any other way. If he draws up a classification with care, so that the arrangement is logical, it will serve as a framework for mentally classifying and retaining the appreciable amount of information which is necessarily absorbed in filing technical information. It is a well-known psychological law that logical arrangement greatly facilitates the powers of memory.

A good file, like everything else worth while, require some effort. It offers no royal road. The topical systen will not fully meet all the situations that arise, althougl it is superior to other methods. Articles are writte from so many different viewpoints, and progress intro duces so many new phases, that even the best classificatio will not be all that could be desired. Classification is no an exact science, but rather a continual compromise. I will never be possible, by any practical system, to file ever article with the same finality of two plus two makes fou yet the results that may be obtained will well repay th labor required.

The more general the practice of filing among techn cal men the higher will the standard of engineerin practice be maintained.

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South Australian Mines' Outpu

The official figures for the 1913 mineral production South Australia, arranged in order of descending valu are as follows: Copper, 7161.1 tons; salt, 65,000; ir ore, 60,658 tons; gold, 6556 oz.; limestone, 11,300 ton phosphate rock, 5690; gypsum, 7150; silver-lead or 153 tons; silver (not in previous item), 2660 oz.; else, 26189.

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*This is an unusually low average due to numerous revisions and new publications within the last few years

The Australian Zinc-Ore Contracts

The status of the controversy over the Australian zinc-ore contracts is reported by the London *Mining Journal* as follows:

In the House of Commons, on Apr. 20, the Secretary for the Colonies was asked whether the Australian Government had, since the outbreak of war, made any representations to the imperial government in regard to he cancellation of contracts under which Australian minng and metal companies were compelled to supply their ores and concentrates to a metal combine in Germany until 1921; whether any proposal was made for uniform action on similar lines for the whole empire; and, if so, in what vay did his Majesty's government propose to assist the Australian Government to effect its purpose.

Mr. Harcourt replied that representations have been nade by the commonwealth government since the outbreak f war to the effect that a large proportion of the output f base metals in Australia has been during recent years nder German control, and that it is desired to free from h control the copper, zinc, lead, and tin industries. e commonwealth government has suggested concerted ion as between itself and his Majesty's government h a view to the cancellation of contracts for the disposal base metals to a German combine. The proposals of commonwealth are receiving most careful consideron, but the matter is one of great complexity. Mr. rcourt called attention to the recent passing of the al Proceedings against Enemies Act, which provides lities for any doubts which may exist as to the effect he war on contracts of the kind in question to be ex- itiously resolved by the courts.

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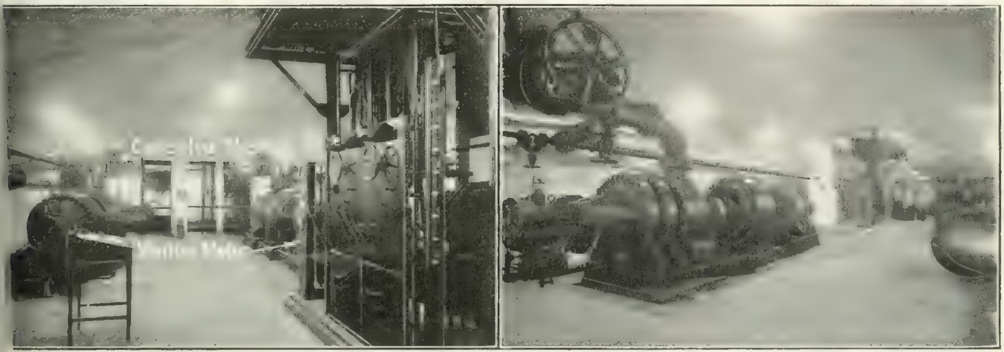
Mineral Output, Northern Territory, Australia

he value of the mineral output of the Northern ritory of Australia, which is now administered by the monwealth (its production being reported separate- was for 1914: Gold, $51,633; tin, $72,960; copper, 328; silver-lead, $2616; wolfram, $19,320; mica, 16—total value, $172,873. A decrease in the number ineral rights held by Chinese is reported. No immiion of Chinese is permitted, and it is believed that in the country are gradually dying off.

Multistage Centrifugal and Cornish Pumps in Chapin Mine

By L. E. Ives

The amount of water pumped from the Chapin mine at Iron Mountain, Mich., operated by the Oliver Iron Mining Co., is approximately 3000 gal. per min. Previous to October, 1912, 2000 gal. per min. of this water was encountered in the No. 2 Hamilton shaft at the 965-ft. level, the remainder coming from other parts. Before the installation of the "C" Ludington shaft all pumping was done at the No. 2 Hamilton, and the water was handled as follows: 1300 gal. per min. was pumped from the 16th, or 1300-ft., level to the surface by a 22&36x30-in. Riedler triplex tandem compound condensing crank-and-flywheel pump, with $9\frac{5}{8}$&$6\frac{7}{8}$-in. differential plungers, operated by steam; 1200 gal. per min. was pumped from the 12th, or 965-ft., level by a steam-operated 15&23&39&$9\frac{1}{4}$x24-in. stroke, triple-expansion duplex direct-acting Prescott pump; 500 gal. per min. was pumped from the same level by an 18&34&10x24-in. stroke, compound, direct-acting duplex Prescott pump operated by compressed air furnished by the Quinnesec Falls hydro-pneumatic plant.



Pump Station at 12th Level, Chapin Mine

Use of Electricity Decided Upon

When the "C" Ludington shaft was sunk a large Cornish pump was installed there, which was operated by steam and could handle 2000 gal. per min. from the 1500-ft. level to the surface. When this pump was in operation, it was necessary to operate only the direct-acting pumps on the 12th level, with compressed air. In order to realize the economies which would result from operating these mine pumps with electricity generated by water power, it was decided further to improve the hydraulic plant at the upper Quinnesec Falls on the Menominee River and to install a hydro-electric plant and a transmission line $3\frac{1}{2}$ miles long to the mine. While these plans were being prepared a drift on the 16th level tapped the water-bearing strata connecting with the 12th level. This necessitated a revision of plans, so that all the water should be pumped from the 16th level to surface.

Electric Centrifugal Pumps

The pumping installation consists of two 3-stage Worthington centrifugal pumps, having a capacity of 2000 gal.

per min. against a head of 112 ft., each direct-connected to a 450-hp. G. E. 2200-volt, 60-cycle induction motor, operating at 1200 r.p.m. Each pump is capable of handling the entire mine flow from the 16th level to a reservoir on the 12th level, a 392-ft. vertical lift. On the 12th level were installed two 6-stage Worthington centrifugal pumps, of a capacity of 3000 gal. per min., against a head of 1000 ft., each direct-connected to a 1050-hp. G. E. 2200-volt, 60-cycle induction motor, operating at 1200 r.p.m. Each of these pumps has a capacity sufficient to handle the entire mine flow from the 12th level to surface, a 965-ft. vertical lift.

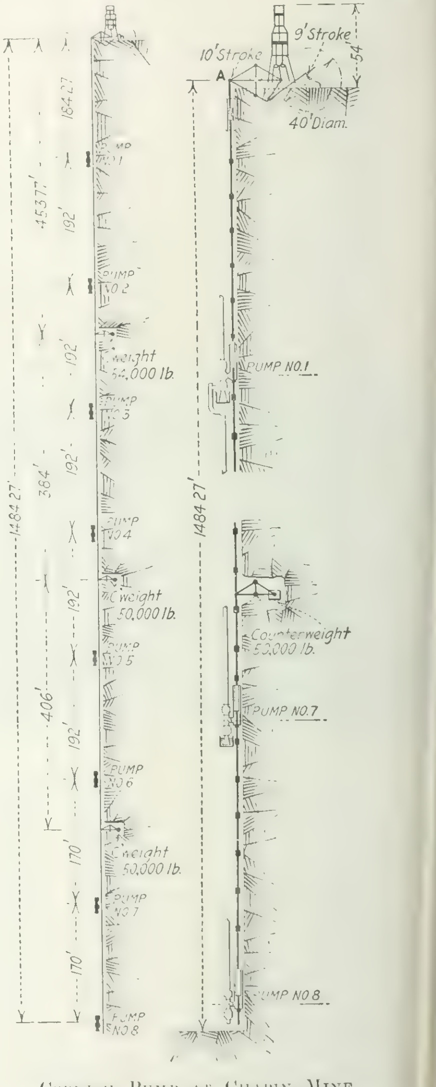
Under normal conditions only one pump on the 16th level and one on the 12th level will operate simultaneouslly. There are, however, two independent discharge-column pipes, making it possible to operate both pumps on both levels simultaneously, thereby providing a maximum capacity of 6000 gal. per min. from the 16th level to surface. These pumps are of the multistage turbine type, built in units of three stages each. The 16th-level pumps consist of one unit of three stages, mounted on a common cast-iron bedplate with the motor; the 12th-level pumps each consists of two 3-stage units mounted on a common cast-iron bedplate, each unit being connected to one end of the motor shaft. The four 3-stage units are identical in design and dimensions, so that all parts are interchangeable, except the impellers. The electrical pumping plant on the 12th level has been in operation for several months, and during a 30-day operating period the overall wire-to-water efficiency was 72%, as shown by the integrating watt meter, the Venturi meter, and the pressure gage at the discharge of the pump. This efficiency also includes the losses in the cable from the substation down the shaft to the pumps, as well as approximately 2.6 continuous kilowatts for lighting.

In the No. 2 Hamilton engine house is installed a relay steam-driven electric plant, consisting of an Allis-Chalmers, high-pressure 2400-kw. maximum capacity, steam turbo-generator set, with steam turbine-driven and motor-driven exciters, and an Alberger spiroflo high-duty condenser, with centrifugal tail and rotative dry-air pumps. This steam turbine will furnish power for operating the pumps in case of accident to the hydro-electric plant or transmission line.

CORNISH PUMP

There was originally installed at the "D" Chapin shaft, about 25 years ago, to pump from a depth of approximately 600 ft., one of the largest pumping engines in the United States, built by the E. P. Allis Co. Soon after its installation, however, the shaft began to get out of alignment, and it was necessary to abandon the shaft and dismantle the pump. Seven years ago this pump was reinstalled at the "C" Ludington shaft to pump from a depth of 1513 feet.

The engine is a 50x100x120 in. steeple compound condensing machine, and on its main shaft is mounted a flywheel 40 ft. in diameter and weighing 160 tons. The height of the engine from the top of the foundation to the top of the high-pressure cylinder is 54 ft. This engine operates, through a walking-beam, a series of eight 28x120-in. stroke, single-acting plunger pumps, located in the shaft at intervals of about 200 ft. The pump rod is solid openhearth steel, 8 in. in diameter for the top 800 ft. and 7 in. for the lower 700 ft. The plungers are 28 in. in diameter, and the displacement is practically 295 gal. per rev. The total weight of the engine is 600 tons; the total weight of the moving parts in the shaft is 325 tons. During a 12-month period this pump operated 99.5% of the entire time at a rate of 6.63 r.p.m., pumping 1922 gal. per min. against a head of 1513 ft. The average livered horsepower was 736, and the average indica horsepower, 831, making the mechanical efficiency 88.6 The duty performed was 86,200,000 ft.-lb. of work 1000 lb. of steam, including all auxiliaries.



CORNISH PUMP AT CHAPIN MINE

⁂

Copper-Bearing Pyrites Deposits are stated by recent sular reports to have been found about 18 miles from Eli betpol in Southeast Russia. One deposit is being worke a small way, 18 or 20 tons a day being taken out and ship to acid works at Baku. Other deposits are reported to in the district

First Aid at the Old Dominion

EDITORIAL CORRESPONDENCE

I attended the first-aid meeting of the Old Dominion Copper Co. on May 4 and was surprised at the large gathering. The total number of employees is 535, and the attendance was 93. The first lesson, which was covered, consists of the preliminaries and ends with the control of hemorrhages by the application of bandages to various pressure points.

The second lesson embodies the triangular bandage and its uses; flesh wounds, and use of compresses. At this lesson "The First-Aid Book," Blakiston's Miners Edition, is given. Lesson 3 treats of the roller bandage and its use, fractures and their early care, ending with those of arms and ribs.

Lesson 4 takes up fractures of the leg, and stretcher and basket drill; lesson 5, pulmotor, artificial respiration and transportation of wounded.

These five lessons cover the course, ending with a strict examination conducted by the physician and assisted by First-Aid Instructor Orr Washburn. Those who pass are given a button, a red cross on a white ground, with the words "Old Dominion First Aid," gold filled. No one is given a button who has not passed the examination.

The helmet instruction is under the same instructor and is held apart from the first-aid lessons. There are 25 men at present under instruction, all selected, 11 of whom are qualified to wear helmets and were awarded a helmet fob.

The instructor, well known through his former connection with the Bureau of Mines, does no other work except supervision of ventilation.

Apart from this a mine inspector is employed, Bert Fallon, who spends all his working hours underground. The company pays each new man for two days spent underground with this inspector, sending three men at a time. Throughout, this system of first-aid and mine inspection is most complete and should be adopted at all the metal fields.

⁂

Chino Copper Co.

The report of the Chino Copper Co. for the first quarter of 1915 shows a production of 11,732,508 lb. of copper—3,563,618 lb. in January, 3,722,803 lb. in February and 4,446,087 lb. in March. A total of 406,000 tons of ore was treated, with an average of 2.1851% copper. The average extraction was 66.12% equal to 28.898 lb. of copper per ton of ore milled. There was a production of 21,401 dry tons of concentrates, containing an average of 27.411% copper.

The cost per pound of net copper, after allowing for smelter deductions, and without allowing any credits from other sources, was 7.04c. Allowing for the credit for gold contained and crediting income from miscellaneous sources, the cost would be reduced to 6.38c. per lb. These costs include all operations, administration and general charges, and 30c. per ton of ore treated for the extinguishment of mine development and stripping expense.

The total income from milling operations and miscellaneous sources was $890,638. A dividend of $434,970 was paid, leaving a surplus of $455.668. Earnings are based on a price of 14.37c. per lb. for copper. The per ton costs are the lowest that have been made since the property began full operations, amounting to $1.888 per ton.

⁂

Chronology of Mining for April, 1915

Apr. 1—Spain placed embargo on iron, steel, tin, sulphur, aluminum, antimony, mineral oils and ammonia.

Apr. 3—Power house and pottery of American Zinc, Lead & Smelting Co., Caney, Kan., destroyed by fire.

Apr. 4—Knight Christensen mill at Silver City, Utah burned. Loss, $75,000; no insurance.

Apr. 5—In Butte municipal elections every Socialist candidate defeated, which, it is expected, will add to the prosperity of the district.

Apr. 7—Alaska-Juneau Gold Mining Co. offered 400,000 shares capital stock at $10 per share.

Apr. 10—President Wilson announced the route of the Alaska Railway.

Apr. 12—Alaska-Juneau stock offering oversubscribed four times and trading on Curb begun at $13 to $15 per share.

Apr. 13—Bethlehem Steel stock reached high price of 155.

Apr. 14—Plant of Western Zinc Oxide Co., Leadville, Colo., started operation.

Apr. 15—Work resumed at East Butte mill.

Apr. 19—New pumping machinery for draining downtown district of Leadville, Colo., started operation.

Apr. 26—Mining Corporation of Canada, controlling Townsite, City of Cobalt and Cobalt Lake properties, started its new cyanide annex to treat slime products from above-mentioned mills.

Apr. 29—Work begun at Ship Creek on construction of Government railroad in Alaska.

⁂

Tin Smelting Plant to Be Constructed in Chile

According to Commercial Attaché Verne L. Havens of Santiago, the Compañía Estañífera de Llallagua has decided to organize a separate company for the purpose of constructing a tin-smelting plant in Arica or Mejillones. The capital will be 50,000 shares of a par value of £1. The Llallagua company will itself subscribe for 20,000 shares and will offer 30,000 shares to its own stockholders.

⁂

Dissolution of Amalgamated

Amalgamated purposes to dissolve, giving each shareholder two shares of Anaconda for each share of Amalgamated; the right to subscribe to one share of Anaconda at 25 for each six shares of Amalgamated held; the May 31 dividend of 50c. per share, and a cash bonus of $3. The annual meeting will be held on June 7, and action will be taken at that time on the question of the dissolution of the company.

⁂

Asphalt Deposits at Tacloban, Leyte Province, in the Philippine Islands, are to be developed by the Leyte Asphalt & Mineral Oil Co., organized at Manila with $15[illegible] capital. The company has 656 hectares of land near the [illegible] ments can be made by water at small expen[illegible]. The asphalt has been sold to the Government for use on roads. The asphalt is said to extend along the coast [illegible], outcropping at intervals. The company will also prospect for oil on its property.

Details of Practical Mining

Drifting with a Stoper

By G. E. Wolcott[*]

The stoper, which has come into such general use for overhead work, has, principally through the requirements of the leaser and small operator, been adapted to drifting. It has not been adopted for this purpose to any great extent by the larger companies because in their case the cost of a piston drifting machine is not generally felt. In the case of the leaser, however, low equipment expense is imperative. It is this fact rather than any advantage of the machine itself that is responsible for its use for drifting.

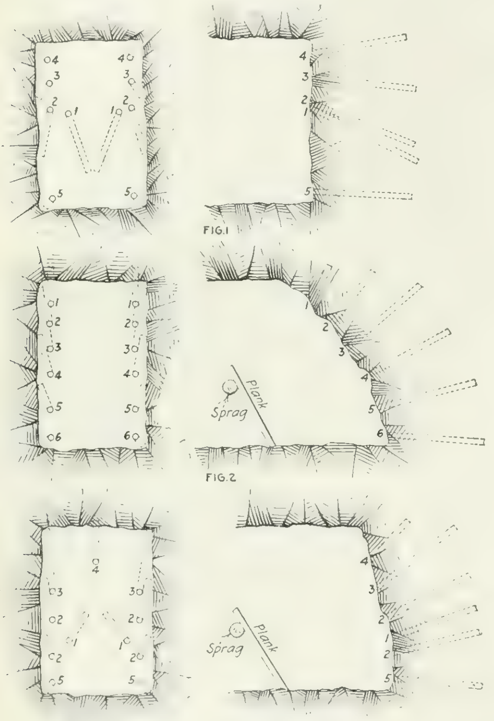


FIG. 1

FIG. 2

FIG 3

Piston-Drill and Stoper Rounds in Drifting

In the Cripple Creek district the drifts are usually from 3½x6½ ft. to 5x8 ft., and the arrangement of holes for a piston machine in average ground is generally as shown in Fig. 1. When the stoping machine is used for drifting, holes are placed differently. Since flat and down holes are drilled with difficulty by this machine, as many holes as possible are inclined upward, and as a rule only the two lifters are drilled looking down. In Fig. 2 is shown the general arrangement of holes. A setup is made by using a plank leaning against a sprag as shown. The stinger of the machine is placed against the bottom of the plank for drilling all holes except the lifters; for the latter it is raised a foot or more, as desired. The face of the drift is not ordinarily kept vertical, because the holes are more readily drilled with an inclined breast as shown. The holes do not, however, have a good show to break to start the round, and in order to keep the back to the required height it is necessary to drill the holes deeper than they will break. A better arrangement, and one requiring fewer holes, is shown in Fig. 3, in which the cut holes are bottomed as near the center of the breast as possible, where they have the best chance to break. With the stoper it is impossible to obtain as good a cut as with a piston machine, and in hard-breaking rock this must be offset by an increased number of holes.

A drawback to the use of the stoper for drifting is the fact that the muck must be thrown back farther from the breast to make room for the machine. The ordinary stoper requires not less than 6 ft. between the point of the stinger and the breast. If the stoping bar is shortened, too many changes of steel are necessary.

*

Rock-Drill Nicknames

By J. R. McFarland[*]

Rock drills, like human beings, acquire nicknames. Some were derived from those of the pioneer drill manufacturers, others were originally trade names of the drills and gradually became accepted as representing that entire type of drill. In other cases the names are descriptive of the action of the machines.

The pioneer in the rock-drill field in this country was the Burleigh drill, introduced in the Hoosac Tunnel in 1866 by the Burleigh Rock Drill Co., of Fitchburg, Mass. This was one of the first large engineering undertakings in this country, the object being to tunnel the Green Mountains, the natural barrier to traffic between New York and the New England states.

The Burleigh rock drills, later used in the Western mines in considerable numbers, were quite heavy and required two men to handle them.

When the smaller, one-man drills were introduced, the runners still continued to call all heavy, two-man drills "burleighs," irrespective of make.

Opposed to the "burleigh" is the "chippy," the name given to all piston machines lighter in weight and running more rapidly. As the demand on one-man drills in recent years has been for more and more speed and strength, the machines have increased in weight to such an extent that the application is now hard to see.

The "Waugh" was one of the first stoping drills to appear. In some of the Western camps the miners still commonly refer to any stoper as a "waugh." Down South a stoper is commonly known as a "warrior," a peculiar development from the original name, explainable only by the calloquial peculiarity. For a similar reason, or lack of reason, the hollow-steel hand-hammer drill is commonly called a "murphy." The name "jap" is also sometimes applied to this type of drill, and is derived from the trade name "Little Jap."

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[*] Box 818, Cripple Creek, Colo.

[*] 510 Kimbark Ave., Chicago, Ill.

Among the highly colored names sometimes heard among the miners for the stoping drill are the "wiggle-tail" and the "widow-maker." The "wiggle-tail" is very descriptive of the operation of the machine, and the "widow-maker" refers to the unhealthy effect the dust has on the miners' lungs.

Fortunately, the introduction of sprayers, bags and atomizers for laying or catching the dust at the mouth of the hole and the enforcement of the use of them by some state laws are a start in the right direction toward making the last-mentioned name inapplicable.

When the first self-rotating hammer drill was introduced in this country, several years ago, it was given the name of "Jackhamer" by the manufacturer. This name had taken such a hold by the time competitive self-rotating hammer drills appeared that it was found quite difficult to apply any other name which would be accepted and adopted by the drill men.

With the one-man piston drills and the use of hammer drills for drifting it appears only a question of time until the "burleigh," or heavy two-man piston drill, will be used very little underground.

When the self-rotating stoper becomes fully developed and generally adopted no more use will be had for the tail or the "wiggle-tail," and this creature will die a natural death.

It would seem that, with the tendency toward lighter-weight hammer drills and self-rotation in stoping drills, the miner of the future will have an easy time of it.

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Methods for Laying Dust in Mines

The Transvaal Chamber of Mines has published a memorandum[1] giving details of the most efficient dust-laying appliances used for dust prevention in the mines of the Rand. Water sprays of various kinds are still used largely, and where the water is clean and the pressure is sufficient they give satisfactory results. Atomizers have in some cases superseded sprays because they break the water up into finer particles, and the resulting cloud of mist is carried much farther than the fine streams of the spray. Atomizers are not as likely to get out of order as the spraying devices generally used. Another type of apparatus for accomplishing this result is called the "water blast," in which the water is discharged in the dusty portion of the mine in much greater quantity by means of suitable connections with the compressed-air main, the air acting through an ejector nozzle. In using atomizers it has been found that it is possible to break the water up into a too finely divided mist so that it will evaporate so rapidly as to be ineffective in laying the dust.

There are places above ground which are very dusty and come within the regulations requiring spraying devices, such as the main crusher stations, sample grinding and sample quartering rooms, etc. Sprays and atomizers as means of eliminating dust in crusher stations have not proved entirely successful. The crushers have been completely housed in, and a considerable amount of the dust from crushing has been drawn off by an air blast. In addition, sprays are used at both the feed and discharge ends of the crusher. It is also a very useful place to scatter over the floors of sample crushing and quartering rooms damp sawdust, as this tends to retain any dust which may settle.

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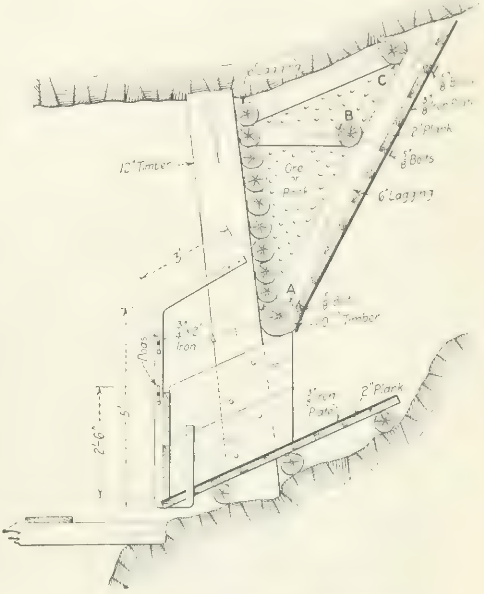
[1] "Appliances and Methods for Laying Dust in and about Mines," Transvaal Chamber of Mines, January, 1915.

⁂

A Substantial Ore Chute

By H. H. Hodgkinson*

When ore is dumped into most ore chutes it strikes a direct blow at almost right angles to the front of the chute. The chute shown in the accompanying sketch is so constructed that it receives a glancing blow, rather than the full impact, and will resist a great deal of pounding and banging because it is loaded behind with rock or ore.



Ore Chute of Rugged Construction

The stulls and horizontal timbers *A*, *B* and *C* are placed in hitches and carry the chute and the weight of the ore in the chute. Timber *A* is bolted to the stulls as shown, while a layer of 6-in. round lagging is spiked in a horizontal position to the stulls. A layer of 6-in. round lagging is spiked to the horizontal timbers *B* and *C*, while the lower ends are supported by timber *A*. The lagging is trimmed so that a layer of 2-in. plank which is spiked to it fits smoothly, thus insuring a good surface upon which to place the $\frac{3}{8}$-in. wrought-iron plates so that they will not buckle and tear loose because of a [illegible] underneath. The iron plates are 4×8 ft. and [illegible] countersunk holes for ⅝-in. bolts, which pass through the main timbers *A*, *B* and *C*, as shown, clamping the front of the chute firmly together, in addition to securing the plates. Iron plates are bolted on the sides of the planks at the mouth of the chute and also to the bottom. The timbers are stulled to stiffen the chute, and the space between the front and back of the chute is filled with ore or rock, which gives solidity to resist shock.

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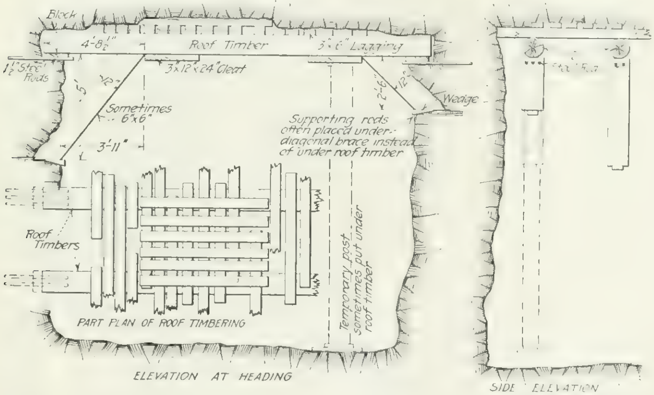
*Mining engineer, Franklin Furnace, N. J.

Although the initial cost of this chute is somewhat greater than that of the average chute used, its life is many times longer. A number of these chutes have been in use constantly for four years and have probably received as much banging and bumping as any other chutes used, yet no repairs whatever have been necessary and they are as good as when first installed, except for a little wear at the lower ends of the iron plates.

⁂

Roof Timbering in Milwaukee Tunnel

At the Linwood Ave. intake tunnel of the Milwaukee water-supply system great difficulty was experienced in maintaining the timber sets in proper position at certain points because the material encountered, Hamilton shale, disintegrated and scaled off soon after being exposed to the air. This scaling deprived the timber sets of their supports, the side hitches in the shale collapsing. Lee G. Warren* in *Engineering News*, Apr. 8, describes the method shown in the figure for supporting the flat roof in shale.


Block
4'-8½"
Roof Timber
3"×6" Lagging
1½" Steel Rods
3×12×24" Cleat
5'
½"
Sometimes 6"×6"
3'-11"
2'-6"
12"
Wedge
Supporting rods often placed under diagonal brace instead of under roof timber
Roof Timbers
Temporary post sometimes put under roof timber
PART PLAN OF ROOF TIMBERING
ELEVATION AT HEADING
SIDE ELEVATION

Method of Supporting Roof Timbering in Shale; Linwood Ave. Intake Tunnel

Into the base of each side hitch cut for the roof timber three 1½-in. holes, 3 ft. deep, were drilled with a pneumatic hand-drill, and then a 1½-in. steel rod, 3 ft. long, was driven into each hole. On the set of three rods was placed a block 2x10x12 in. The round roof timber, of maple, 12 to 14 in. in diameter, was then laid on the small blocks resting on the rods. Finally, slanting braces of maple 6x6 in. were fitted to the roof timbers, these braces resting in hitches that were cut in the side of the excavation. Frequently the supporting rods are placed at the hitches for the slanting braces instead of at those for the roof timbers.

The timber sets were placed 2 ft. c. to c. Since inaugurating this new timbering method no roof timbers have fallen and no roofs have collapsed. Numerous instances have occurred where the excavations have scaled off beneath the hitches, leaving the steel rods entirely exposed for 1½ ft., but they showed no signs of failing.

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Sand Filling*

Sand filling was introduced in the mines of the Rand in 1910, and at the present time 15 mines there have installed hydraulic equipments for filling the worked-out stopes with tailings from the various milling plants. The tailings are taken from the old dumps, or direct from the cyanide tanks, and discharged into a box-shaped receptacle at the collar of the shaft, from which the pulp is conveyed through 6-in. cast-iron pipes to the desired destination underground. In the larger installations two pipes are used in the shaft, one being plugged and held in reserve. When one pipe wears through or bursts the other pipe is brought into commission. Both pipes are connected to the same pipe line at the bottom of the shaft. At other mines the sand is washed direct from the old tailings dump by means of water at high pressure delivered by hydraulic monitors using 3-in. nozzles. The pulp then flows through launders to a small shaft, at the bottom of which are launders which convey it to the desired stopes. When the tailings can be discharged from the cyanide tanks direct to the shaft the cost of stacking the tailings on the dump is eliminated. Mining regulations prevent any tailings containing more than 0.005% of total cyanide being sent underground. In this system the ore hoisted from the mine is returned again, about a fortnight later, minus its gold contents. A ton of ore which occupies a space of 12 cu.ft. in the mine yields about the same volume of sand—50% of sand and slime—for return underground. Boreholes put down either with a jumper drill or with a shot drill are also used for conveying this material to the underground workings.

Ordinarily cast-iron pipes, wood-lined pipes and, to a small extent, porcelain-lined pipes have been used for conducting the pulp to its ultimate destination. Conveying in launders, however, is preferable to using pipes whenever the gradient is suitable. When a stope is to be filled with this material, barriers have to be built to hold the sand in the required position; but they are so constructed as to allow drainage of the water. When the mines are very deep—3000 ft. to 4000 ft. a heavy expense is incurred for pumping all of the extra water which is needed to flush these tailings into place. During a period of four months the Robinson Deep sent 103,261 tons of sand back into the mine—which represented 98.1% of the total production at the mine—at a cost of less than 20c. per ton of sand.

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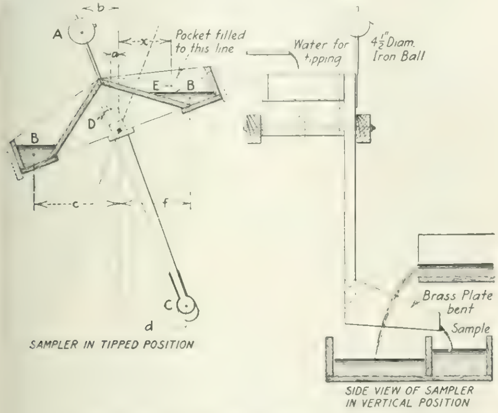
*Resident engineer, Linwood Ave. Intake Tunnel, Milwaukee, Wis.

*Transactions of the North of England Institute of Mining and Mechanical Engineers, November, 1914.

Details of Milling and Smelting

Siphons on Solution Samplers

Many difficulties were encountered in placing siphons on a sampler of the Copper Queen Consolidated Mining Co., Bisbee, Ariz. Small particles would collect in the siphon and cause the sampler to stop working. The balance weight had to be placed so far from the center of rotation that its fastenings became loose. This led to an investigation with the view to changing the sampler to avoid trouble. It was thought best to take the siphons off, which was done. The absence of the siphons of course allowed a certain amount of water to remain in the sampler, but at the same time the weight had to be moved toward the center of rotation in order to make the sampler tip when the pocket had filled. Thus the twofold purpose was accomplished—the siphons gave no more trouble, since they had been removed, and the weight also was less bother. The jar on the mechanism was less, since the ball had been moved closer to the axis of rotation, and its energy thereby decreased, and the water remaining in the pocket was not fixed rigidly to the mechanism and did not tend to carry it in the direction of rotation.


b
A
x
a
Pocket filled to this line
E
B
D
B
c
f
C
d
SAMPLER IN TIPPED POSITION
Water for tipping
$4\frac{1}{2}''$ Diam. Iron Ball
Brass Plate bent
Sample
SIDE VIEW OF SAMPLER IN VERTICAL POSITION

SOLUTION SAMPLER WITHOUT SIPHON

The foregoing conclusions can also be drawn in a theoretical manner about as follows: Assume that

A = Weight of the ball.

B = Weight of the water remaining in a pocket when siphons were not used.

C = Weight of lip.

D = Weight of sampler (wooden part).

E = Weight of new water added to make sampler tip when siphons are not used.

Note that the amount of water, $B + E$, was necessary to fill the pocket and tip the sampler in each case—when siphons were used and when they were not. When the siphons were used, the amount of water, $B + E$, was added each time the sampler tipped. When the siphons were taken off, E was the only water that was added each time to fill the pocket, since the amount of water B remained there constantly. It might be added that at places where water rates are high a sampler without siphons would be an economic advantage, since clear water is required for a sampler with siphons.

The small-letter dimensions on the sketch give the distance of the center of gravity of the respective weights to the vertical axis. For conditions of equilibrium the instant before tipping in either case, $E\,M = O$.

The moment equation without siphon is,

$$(Ab + Da + Be) - (Bf + Cd) = Ex.$$

Note that the weight of water B, after tipping, is the same on each side, but on account of the position of the sampler the water on the up side is shallower than that on the down side. Therefore, the center of gravity of the up-side water is nearer the vertical axis. We have, consequently, $Be > Bf$.

When siphons are used, the equation of moments becomes

$$(Ab' + Da) - Cd = Ex + Bf, \text{ or,}$$
$$(Ab' + Da) - (Cd + Bf) = Ex.$$

Equating equations of moments with and without siphons, we obtain

$$A\,(b' - b) = Be.$$

This last equation shows that if siphons are used, the ball must be moved up until its increased moment equals the moment of the water which remained in the pocket after tipping when siphons are not used.

As a matter of information it might be added that the above-described sampler now cuts a sample of 3 cu.ft. of water in 24 hr. If a smaller sample is needed, the tipping water is cut down. If a larger sample is desired, the ball is moved nearer the center of rotation.

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Matte Assay by Furnace Foremen

At many places, particularly where it is necessary to run the blast furnaces by physical criteria, the furnace foreman must be able to gage the grade of the matte. This is sometimes done by an examination of the fracture of a small sample button. At Mt. Lyell, George F. Beardsley introduced a simple determination which could readily be made by the furnace foremen. At the New York Section dinner of the American Institute of Mining Engineers Robert Sticht described this proceeding as follows: The shift bosses take a dip sample of matte four or five times a shift and analyze it for copper. They are given a bottle of standardized solution of cyanide of potassium from the laboratory. They weigh out a certain amount of the ground-up matte on a coke balance and dump it into a beaker of water, put a little nitric acid on it, boil and dilute with water, add ammonia, stir, and titrate direct from an ordinary burette until the color disappears, filter and titrate again to finish. Then they read on the burette the number of cubic centimeters used and multiply that by the figure given on the cyanide bottle by the chemists. The determinations are within 1%, which is near enough to serve as a guide, and in addition it makes the furnace work more interesting for the men. When this work was started the foremen were given a "bush" balance, constructed of bits of wood, glass rod, wire, a needle and paper. These worked quite as well as the present pulp balance—when the wind was not blowing.

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Method of Treating Carnotite Ores

A new method of treating complex carnotite ores has been suggested by Charles W. Danforth, William P. Samuels and W. T. Martersteck (U. S. pat. 1,126,182). The ore is crushed to pass about a 40-mesh screen. It is then subjected to a plain oxidizing roast with a temperature of about 1100° F. Roasted ore is now treated with a strong solution of sulphuric acid, or a warm solution may be used. This fixes all the radium with the sands and the barium which may be present in the ore in the form of sulphates, while the vanadium, about 90%, and all the uranium are contained in the solution. Precipitates and insoluble matter are settled and the supernatant solution is decanted or filtered off. Vanadium and uranium may be recovered by various methods, depending on the form in which it is desired to market the final product.

Some complex ores are preferably treated directly after the roasting, while still warm, with a solution of sulphuric acid of about 1.3 sp.gr. at a temperature of about 80° C. The extraction is completed in about 40 min., according to the temperature of the solution. More than 90% of the vanadium and all of the uranium present are dissolved, and the solution may be separated from the residues by gravity, filtration, or by means of a suction filter. Vanadium and uranium are recovered from this solution in any desired marketable form.

If complex ores are to be worked which, according to preliminary tests, contain a low percentage of uranium, then the sulphuric-acid solution will contain in the main vanadium, uranium, lime, magnesia, alumina and iron. In this instance the acid solution may be neutralized far enough with an alkali so that the vanadium is completely precipitated, while a considerable amount of the other metallic compounds remains in solution.

For recovering the radium, the residues containing barium and radium are washed with water until they are free from soluble sulphates and sulphuric acid. The residues are then treated with a mixed solution of caustic soda and sodium carbonate, the strength proportions of the components being regulated according to the amount and proportions of silicates and sulphates of barium and radium. This alkaline solution transforms the barium and radium compounds so that the sulphate and silicate radicals are rendered soluble in the form of sodium salts, while the barium and radium form carbonates which remain with the residues. After separation, the residues are treated with dilute hydrochloric acid, dissolving all the barium and radium salts. The solution is then precipitated with sulphuric acid, these raw sulphates separated and obtained in a clean condition, transformed into chloride, and the separation and concentration of radium chloride accomplished by well known methods. When raw sulphates of barium and radium are precipitated with sulphuric acid, sufficient barium salt must be present, and if not, some barium salt must be introduced to secure the proper ratio between radium and barium salt, thus insuring the complete precipitation of the radium sulphate.

⁂

A Suspended Car Dump for Tailings

In dumping sand tailings from a car onto the dump it is often found difficult to empty the car on account of the tailings stacked around and close under the track. The general method of obviating this difficulty has been to build a trestle and run the cars out on it, dumping between or alongside the track and covering up the trestle bents. On the inclined dump, however, this may be avoided by building the small truss shown in the accompanying illustration and fastening it by means of the wire ropes shown, which are anchored to stakes in the solid hillside to the rear. By using this device the car has always a clear dumping space beneath it, making dumping easy and rapid, and the truss itself serves indefinitely, since it can be moved out to secure constantly new dumping space. The device is in use at the mill of the Wasp No. 2, near Deadwood, S. D.

SUSPENDED DUMP FOR TAILINGS

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Matte Smelting for Tin

An extension of the matting process to tin is proposed by Jan Rueb of The Hague, Netherlands (U. S. pat. 1,124,174), who advised smelting oxidized tin ores, tin scrap and stanniferous junk of all sorts with pyrite to form a tin-iron matte. This is with the object of avoiding the usually great metal losses incurred in the fusion and reduction of these materials in either blast-furnace or reverberatory smelting.

The tin-iron matte thus produced is leached with alkaline sulphides, and these solutions are electrolyzed. This leaching need not be a clean one, as the residue can g back to the matting furnace. The author states that with tin-copper-iron mattes it may be well to roast the matte and leach out the copper before leaching for tin, although one would naturally suppose that the procedure would be reversed.

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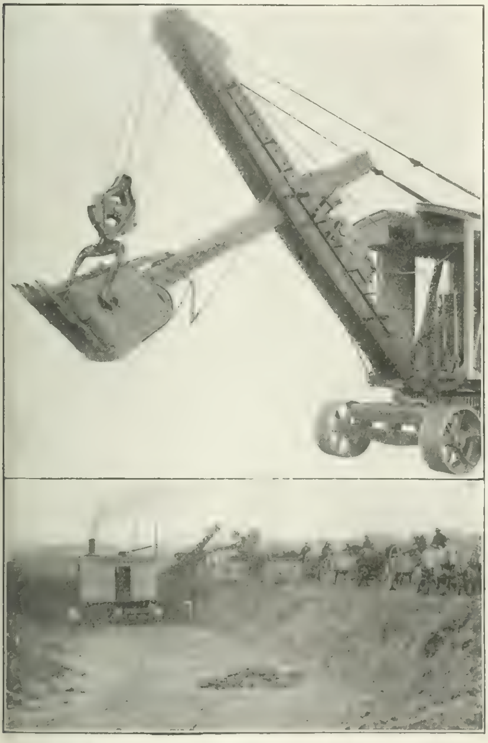
Slag Settling at Mt. Lyell is carried further than at most smelting plants. Robert Sticht, at a meeting of the New York Section of the American Institute of Mining Engineers reported that the slag stream from the Mt. Lyell furnaces runs over forehearths for 50 or 60 ft. before it is discarded into the granulating launder; a little matte is caught in each compartment. The average assay of the slag ranges from 0.3% to 0.45% Cu, varying with the grade of the matte. The ratio of concentration is high, about 20:1, a 45 to 50% matte being made in a single smelting.

Mining & Metallurgical Machinery

New Revolving Steam Shovel

A ¾-yd. steam shovel built along the standard lines of the revolving type, but having certain unusual features, is now being manufactured by the Ball Engine Co., Erie, Penn., for light contracting work. The most striking feature is an automatic crowding device, by means of which, if the automatic-control latch lever has been set in the proper notch, the crowding engine works in such relation to the hoisting motion as to cut a level floor without further manipulation. This relieves the operator of the necessity of constantly playing one engine against the other.



Erie Steam Shovel for Digging Level Floors

The automatic device is fitted to the ordinary crowding mechanism, in which power is applied by a pair of direct-connected reversing engines rotating a shipper shaft which carries a gear engaging a rack on the dipper handle. When the engines operate they move the dipper handle out or in. The automatic control works as follows: A small pinion on one end of the shipper shaft operates a small auxiliary rack which travels in or out as the dipper handle moves in or out. On the end of this auxiliary rack is a small roller traveling on a miniature track, representing the floor bottom to be cut, which is connected to the control valves of the crowding engines and to the operators' crowding-lever as well by a simple system of levers which governs the relative movement of the hoisting and crowding engines.

To cut a level floor the automatic-crowding latch-lever is dropped into the proper notch on the quadrant, which corresponds to this grade. This operation sets the roller track in a certain position. Now by starting the hoisting and crowding engines the dipper will crowd out along a level line. Placing the automatic lever in the second notch results in a cut slightly downgrade; in the third notch the dipper teeth cut farther below grade. When the latch lever is in the notch nearest to the operator, the automatic device is not in action and the crowding motion becomes the same as on any shovel equipped with a standard shipper shaft and crowding engine.

The manufacturer claims that cuts of 12 in. in depth can be excavated at the rate of 25 to 35 cu.yd. per working hour. The shovel can be used for giving roads an even crown.

The "Erie" shovel is operated by three hand-levers and a foot-brake. One lever controls the crowding engines and another the swinging engines. The weight of the shovel is 41,000 lb. The boom is 17½ ft. long and 17 ft. 11 in. high in working position. The maximum width of cut at floor level is 35 ft. The machine is designed so that either traction or standard-gage car wheels are interchangeable in the same truck frame. It can also be equipped with a special boom or auxiliary apparatus for adapting the machine for locomotive-crane service, or for clamshell, orangepeel or dragline work. It is claimed that the machine will handle a 32-ft. locomotive-crane type of boom and a ½-cu.yd. grab bucket.

Increasing Demand for Large Crushers

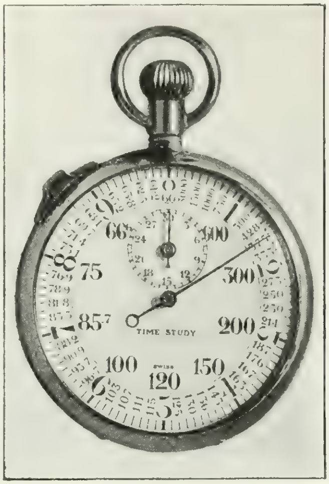
The Power & Mining Machinery Co., 115 Broadway, New York, reports that it has built for the Bethlehem Chile Iron Mines a 60x84-in. receiving-opening jaw crusher, sectionalized to a 30,000-lb. limit to facilitate handling at destination. The total weight is 525,500 lb.

The service in this instance is particularly severe, as the compressive strength of Tofo iron ore is close to 44,000 lb. per sq.in., while that of the hard trap rock of the United States is variously estimated at from 35,000 to 40,000 lb. Immediately following this initial breaker and taking the 10-in. product from it, there will be installed three No. 9 McCully all-steel gyratory [illegible]ers.

This company recently shipped a 66x84-in. [illegible] opening jaw crusher to a firm on the Coast, an[illegible] through its shops at the present time another [illegible] size, which will also be shipped to the Far W[illegible] stated that the first 60x84-in. machine of thi[illegible] built for the Birdsboro Stone Co., of Birdsboro, Penn., and installed five years ago, demonstrated their feasibility. Approximately 2,000,000 tons of trap rock has been put through this crusher with no expense for repairs other than renewal of the lower tier of crushing plates.

Decimal Time-Study Watch

The time study of various movements in the operations of mining is becoming increasingly common. We therefore illustrate herewith a time-study watch, of which the dial is divided into tenths and hundredths of a minute and, in addition, contains figures spaced two-hundredths of a minute apart. It is so arranged that at any point of elapsed time there is indicated what the corresponding output per hour is. For example, if it requires 0.76 of a minute to perform one operation, as shown by the stopping of the large hand, the reading, 78.9 directly under it, is the corresponding output per hour.



Decimal Time-Study Watch

To start the watch, the slide on the edge is pushed toward the stem; reversing of the position stops it. The hands are brought back to zero by pushing down on the crown. This watch is a recent product of M. J. Silberberg & Associates, Peoples Gas Building, Chicago, Ill.

Automatic Section Insulator

Pat. No. 1,126,092 has been recently granted to William Schaake, of the Westinghouse Electric & Mfg. Co., on an automatic section insulator.

These insulators are inserted in trolley wires where it is desirable to energize a section when the trolley passes onto it and to deënergize it when the trolley passes off. They are used extensively in mining installations where a branch is to be energized only when the locomotive is on that branch. Leakage losses and dangers of contact by persons passing under the trolley wire are thereby averted when the locomotive is not on the branch.

The circuit is opened and closed by a switch-blade mounted on a rocker that the trolley operates. In one position the blade connects with copper contactors; in the other there is no connection. A brass plunger pressing against a steel roller gives a position-centering action and prevents the rocker from remaining in an intermediate position. There is no arcing at the switch contact, because the rocker is always energized and the switch connection is always opened or closed while the trolley wheel is on the rocker.

Cement-Gun Furnace Repairs*

Practically all furnaces, coke ovens, blast furnaces and the like usually develop cracks in the lining, which are repaired in a crude manner by making balls of siliceous or other refractory materials and throwing them into the cracks by hand while the furnaces are hot, or by rebuilding the furnaces after allowing them to cool off. Thus the inconvenience of putting them out of commission for repairs results in a loss of time, as well as of the heat, all of which can be obviated by the use of the cement-gun.

A special nozzle for this class of work has been evolved for use with the regular cement-gun, so that those already equipped with the apparatus need only acquire this new nozzle, thus finding a wider field of usefulness for the apparatus. A special cement-gun has already been brought out to fill the necessities of mining companies, gas companies, smelting and reduction works, which will meet practically all their requirements in the application of Gunite (the product of the cement-gun, resulting from a mixture of ordinary building sand and portland cement) to the lining of mine tunnels and shafts, for building stoppings, etc., for the protection of tipples and other steel structures from corrosion or fire and for the building of miners' cottages.

By simply changing the nozzle the same machine can be used for applying silicrete to lining and repairing furnaces, coke ovens, retorts, etc. The word "silicrete" has been coined to distinguish the product of the cement-gun when used in this particular field—that is, in repairing or lining of all kinds of furnaces with a mixture of fine silica sand and ground fireclay fused by the heat of the oven. It has been found in practice that a mixture of 85% of fine silica sand and 15% of ground fireclay gives the best results. The dry mixture is placed into the hopper of the cement-gun; compressed air at about 35 lb. pressure is used for forcing the mixture to the nozzle, where a small amount of atomized water is added; the aggregate being forced into the cracks immediately fuses, bonding itself to the walls of the furnace and sealing the crack absolutely.

These special extension nozzles can be had in sections 6, 12 and 18 ft. or more long, according to the siz of the furnace to be repaired. Where large repairs ar necessary the nozzles may be water-jacketed; but fo ordinary repairs this is not essential, as the action is rapi and the capacity adequate to make a satisfactory patc before the heat melts the nozzle.

The machine is portable and weighs about 400 lb. an can easily be pulled by one man from one part of th plant to another. The principle and the construction the machine are identical with the regular cement-gu with the exceptions of the nozzle and that only one hopp or air lock is provided, which makes it necessary to sto the operation between charges. This only takes a fractio of one minute; but where continuous operation is desir we recommend our No. N-1 machine, which has tw hoppers and air locks.

For repairing furnaces, etc., it is advisable for t operator of the nozzle to use an asbestos mask and glov Two men are needed to operate the machine, one at t gun and one at the nozzle. The machine is furnish by the Cement-Gun Co., Inc., 30 Church St., New Yo

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*From information furnished by the manufacturers.

The Assayer and Chemist

Qualitative Analysis of the H_2S Group

The shortcomings of the ordinary methods of qualitative analysis for metals of the H_2S group are well known, the chief being the partial solubility of copper sulphide in ammonium sulphide and the insolubility of tin sulphide under certain conditions in the same reagents. Louis J. Curtman and Joseph K. Marcus have described a method for the analysis of this group (*Journ. Am. Chem. Soc.*, June, 1914), of which we abstract only the essentials.

The filtrate from group I is treated with sulphuric acid and alcohol in order to separate the alkaline-earth metals and most of the lead. Boil down the filtrate from this separation, add 3 or 4 c.c. HCl (to hold up the antimony) and add 75 c.c. saturated SO_2 solution and boil. This oxidizes stannous tin and reduces pentavalent arsenic. The metals are then completely precipitated with sulphureted hydrogen.

Boil this precipitate with 25 c.c. of 25% caustic-potash solution. Dilute with 35 c.c. of cold water and pass in a few bubbles of H_2S to throw down any traces of lead. Filter through a double filter. The residue, after washing with hot water, is analyzed for Hg", Pb, Bi, Cu and Cd. To the clear filtrate, add 30 c.c. 3% H_2O_2 and boil gently for one minute with constant stirring. If a black precipitate appears, filter on a separate filter and test for Hg by dissolving the precipitate in aqua regia and adding $SnCl_2$.

Boil down the filtrate from the H_2SO_3 treatment to 50 c.c. with stirring to get rid of the peroxide. While hot, quickly neutralize with concentrated HCl and add 10 c.c. in excess. Heat the solution to boiling till clear. Add 50 c.c. of a saturated SO_2 solution and heat for 20 to 25 minutes. Boil down to about 70 c.c. Make slightly alkaline with concentrated NH_4OH and then just acid with dilute HCl. Add exactly 2.5 c.c. HCl (1.19), heat to boiling and pass in H_2S for a few minutes. Dilute the mixture to 120 c.c. with cold water and again saturate with H_2S until precipitation is complete. The precipitate of As, Sb and Sn is treated in the usual manner.

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Volumetric Determination of Sulphurous Acid

The volumetric determination of sulphurous acid is described by H. Sander, *Chem.-Zeit.*, p. 1057, 1914; abstr. *Journ. Soc. Chem. Ind.*, Mar. 31, 1915.

In sulphurous-acid solutions which contain other substances capable of absorbing iodine, the former may be titrated with sodium-hydroxide solution using methyl orange as indicator; phenolphthalein cannot be used. The sulphuric acid resulting from the oxidation of sulphurous acid by hydrogen peroxide may also be titrated in the same manner. When sodium bisulphite is treated with mercuric chloride before titration, 1 molecule of SO_2 requires 2 molecules of NaOH, as the hydrochloric acid, liberated according to the equation: $NaHSO_3 + HgCl_2 = NaSO_3HgCl + HCl$, is also titrated. For the determination of sulphurous acid in the presence of sulphuric acid see *Journ. Soc. Chem. Ind.*, p. 442, 1914.

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Analysis of Crude Sulphur[1]

The author examined the methods available for the determination of sulphur in crude sulphur, especially as applied to low-grade Sicilian sulphur contaminated with bituminous matter. The method of Carius does not yield accurate results, and combustion in a current of oxygen, though serving well for the purer kinds of sulphur, is tedious and less accurate when applied to samples containing notable quantities of bitumen. Satisfactory results are obtained by the method of Fresenius and Beck (*Z. anal. Chem.*, 1903, Vol. 42, p. 21), in which 10 grams are heated at a little above 200° C. to volatilize the sulphur, the residue weighed and then incinerated to determine the bitumen. Accurate results can be obtained by oxidation with nitric acid and bromine by adopting the following method: About 0.2 gram of the sulphur is weighed directly into a 100-c.c. conical flask, which is then fitted, by means of a ground-glass joint, with a reflux tube. The flask is immersed in cold water and while held in an inclined position 10 c.c. of fuming nitric acid (sp.gr. 1.52) and 5 drops of bromine are introduced successively through the reflux tube. The flask is shaken occasionally until most of the sulphur and bromine is dissolved, whereupon a further 5 c.c. of nitric acid are added, and after heating for ½ hour on the water-bath, the flask is again immersed in cold water, the solution diluted with 50 c.c. of water added in small portions through the reflux tube, and the sulphur determined as barium sulphate in the usual way. With low-grade sulphur the determination should always be made with the sulphur separated from the original sample by extraction with carbon bisulphide.

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Detection of Carbonate in Presence of Sulphites

A method is given by J. Petersen (*Zeit. anorg. Chem.*, p. 234, 1914; abstr. *Journ. Soc. Chem. Ind.*) for the detection of carbonates in the presence of interfering compounds, especially sulphites.

To the mixture of carbonate with sulphite, etc., hydrochloric acid and a few strips of zinc are added, and the gases evolved are passed at the rate of 2 to 3 bubbles per second through a wash-bottle containing 3% hydrogen peroxide and then into a fairly large volume of limewater; the solubility of calcium sulphite in water being 1 : 800, the small quantity formed from the traces of sulphur dioxide remaining in the gas will be dissolved, and any precipitate will be due to the presence of carbon dioxide. If chlorine is evolved the dilute hydrogen peroxide is replaced by potassium-iodide solution.

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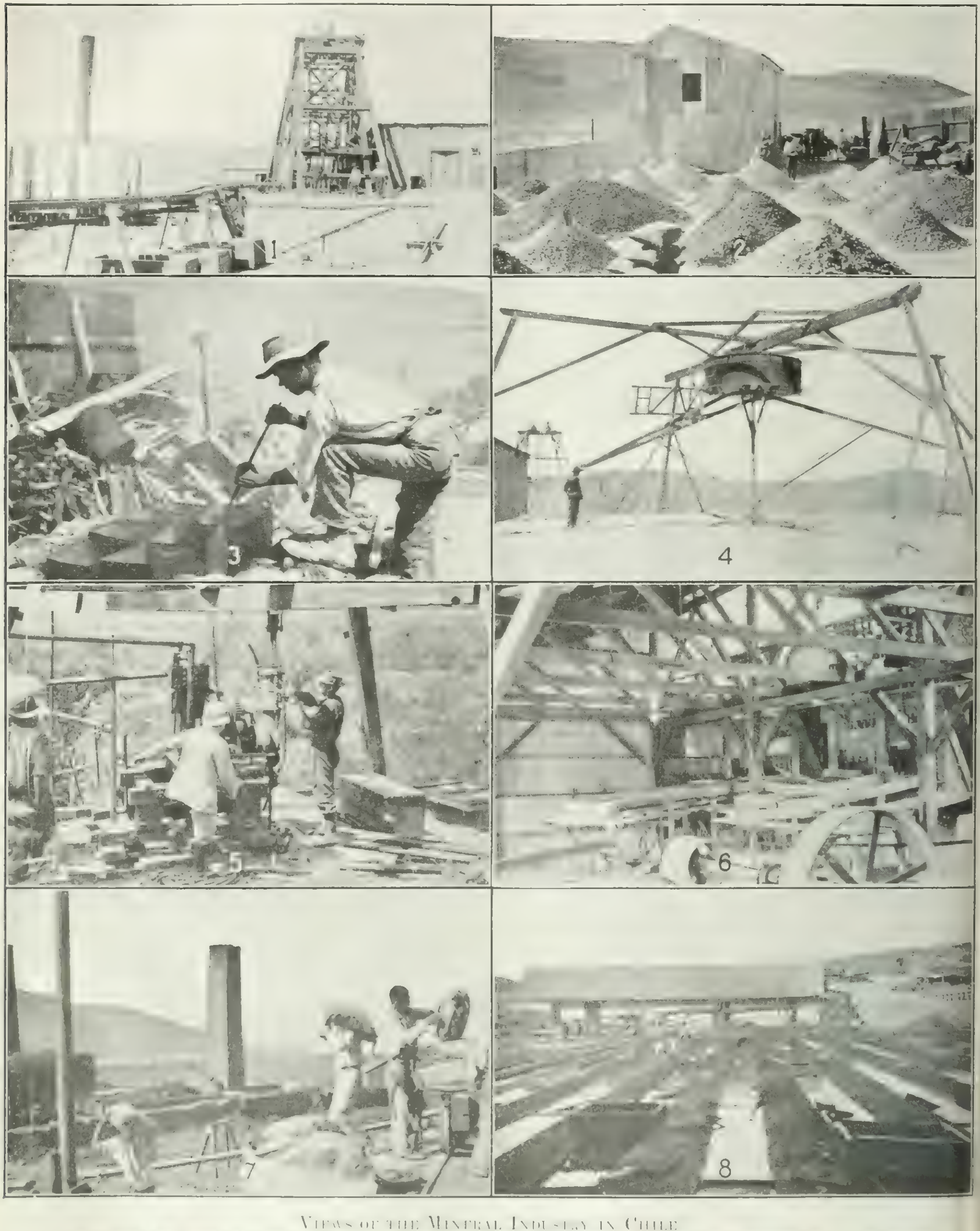
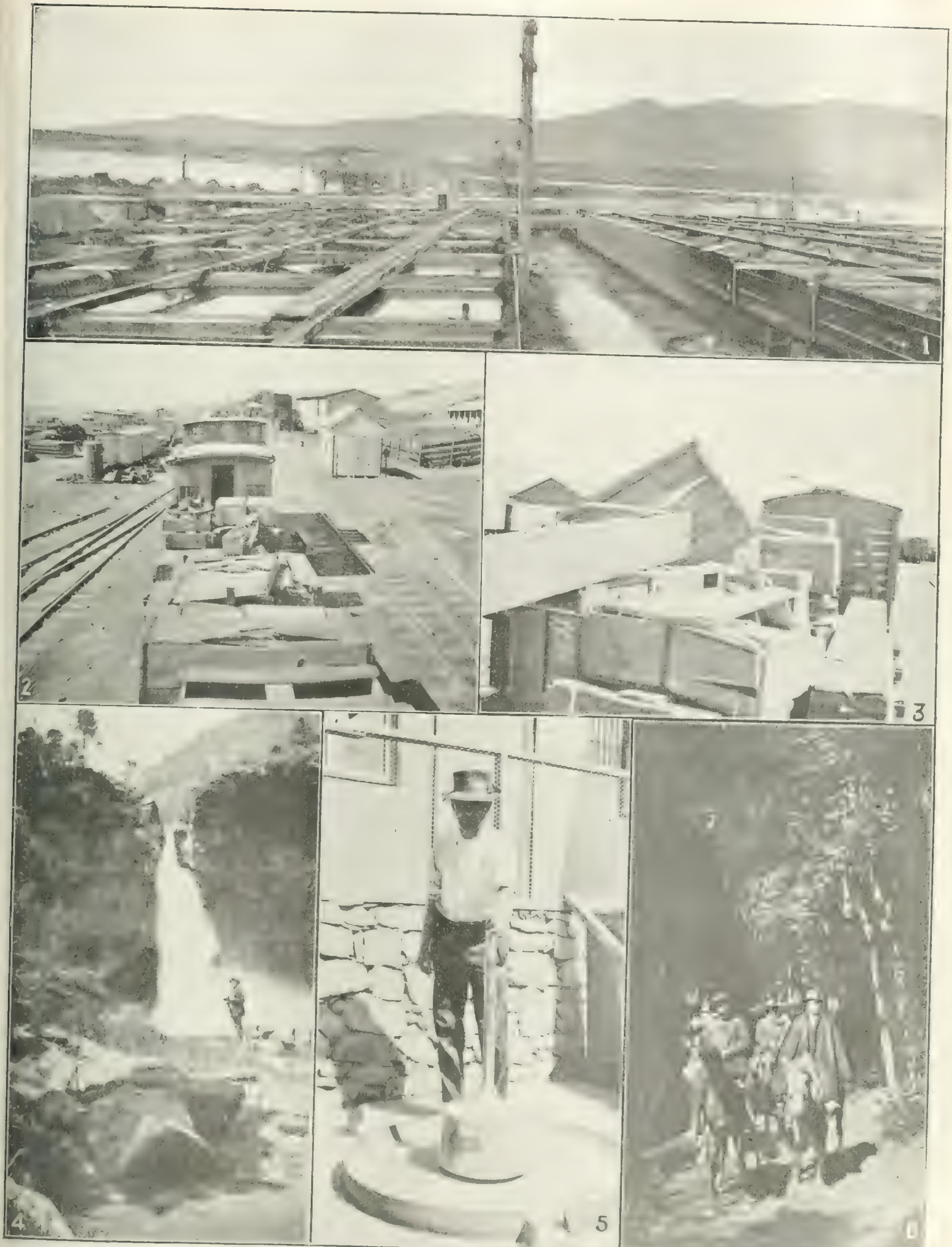
[1] Abstract in "Journ. Soc. Chem. Ind.," Mar. 1[illegible] of an article by M. G. Levi appearing in "Annali Chim. Appl.," January, 1915

Photographs from the Field



VIEWS OF THE MINERAL INDUSTRY IN CHILE

1. Headframe and tanks at Cachinal, Taltal. 2. Purchased ore at Condoriaco. 3. Drying precipitates at Condoriaco. 4. Horse whim. 5. Diamond drilling for copper. 6. Loma Blanca mill near San Rafael. 7. Making stockpiles, Central Chile Copper Co., Panulcillo. 8. Copper precipitation at Andacollo leaching plant.



VIEWS OF THE MINERAL INDUSTRY IN CHILE

1 Copper precipitation plant at Guayacan. 2 and 3 Machinery [illegible] at the mines, conditions resulti[illegible] picking. 4 Waterfall near Chillan. 5 Old fashioned bucking board. 6 In the forests of southern [illegible]

NEW PUBLICATIONS

CENTRIFUGAL PUMPS. By R. L. Daugherty. 5¾x9, pp. 192, illus.; $2. McGraw-Hill Book Co., Inc., New York.

SPRINGS OF CALIFORNIA. By Gerald A. Waring. Pp. 410, illus. Water-Supply Paper 338, U. S. Geological Survey, Washington.

RESULTS OF SPIRIT LEVELING IN MICHIGAN, 1911 AND 1913. By R. B. Marshall. Pp. 79; illus. Bull. 559, U. S. Geological Survey, Washington.

HANCOCK'S APPLIED MECHANICS FOR ENGINEERS. Revised and rewritten by N. C. Riggs. 5x7½, pp. 441, illus.; $2.40. Macmillan Co., New York.

GEOLOGY AND COAL RESOURCES OF NORTH PARK, COLORADO. By A. L. Beekly. Pp. 121, illus. Bull. 596, U. S. Geological Survey, Washington.

MINERAL DEPOSITS OF THE SANTA RITA AND PATAGONIA MOUNTAINS, ARIZONA. By Frank C. Schrader. Pp. 373, illus. Bull. 582, U. S. Geological Survey, Washington.

NORGES BERGVERKSDRIFT, 1913. (Statistics of the Mines and Mine Works in Norway in 1913.) Norges Officielle Statistik, Vol. 29, 6½x10, pp. 79. Det Statistiske Centralbyraa, Christiania, Norway.

FACTS AND FIGURES PERTAINING TO UTAH. Compiled by the State Bureau of Immigration, Labor and Statistics. 6x9; pp. 487; illus.; paper. Tenth Report of State Bureau of Statistics, Salt Lake City, Utah.

ANNUAL PROGRESS REPORT OF THE GEOLOGICAL SURVEY FOR THE YEAR 1913. A. Gibb Maitland, Government Geologist. 8¼x13; pp. 29; illus.; paper. Western Australia Geological Survey, Perth.

PRELIMINARY CONCENTRATION TESTS ON CUYUNA ORES. By William R. Appleby and Edmund Newton. 6x9; pp. 66; illus.; paper. Bull. No. 3, Minnesota School of Mines Experiment Station, Minneapolis, Minn.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1912. Part XI, Pacific Coast Basins in California. By H. D. McGlashan and G. C. Stevens. Pp. 442; illus. Water-Supply Paper 331, U. S. Geological Survey, Washington.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part XII, North Pacific Coast Drainage Basins. By F. F. Henshaw, G. C. Baldwin, G. C. Stevens and E. S. Fuller. Pp. 706, illus. Water-Supply Paper 312, U. S. Geological Survey, Washington.

MINES AND MINERAL RESOURCES OF IMPERIAL COUNTY AND SAN DIEGO COUNTY. Chapters of State Mineralogist's Report, Biennial Period 1913-1914. By Frederick J. H. Merrill. Pp. 113, illus. California State Mining Bureau, San Francisco, Calif.

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1913. (Short Papers and Preliminary Reports). Part I.—Metals and Nonmetals except Fuels. F. L. Ransome and Hoyt S. Gale, Geologists in Charge. Pp. 462, illus. Bull. 580, U. S. Geological Survey, Washington.

RULES FOR THE CONSTRUCTION OF STATIONARY BOILERS AND FOR ALLOWABLE WORKING PRESSURES. Report of the Committee to Formulate Standard Specifications for the Construction of Steam Boilers and Other Pressure Vessels and for Care of Same in Service. 6x9; pp. 114; illus.; paper. American Society of Mechanical Engineers, New York.

A TEXT-BOOK OF PRACTICAL ASSAYING. For the Use of Mining Schools, Miners and Metallurgists. By James Park. 5x7½; pp. 342; illus. Charles Griffin & Co., London; J. B. Lippincott Co., Philadelphia, Penn.

This is an elementary treatise on assaying and analysis, taught largely by simple experiments. It seems very well adapted for students in England and the British Colonies, though we believe there are other books better suited for the United States; and we cannot regard with great enthusiasm any book which does not adopt the assay-ton system.

REPORT OF TOPOGRAPHIC AND GEOLOGIC SURVEY COMMISSION OF PENNSYLVANIA, 1913-1914. Richard H. Hice, State Geologist. 6x9, pp. 232, illus. Topographic and Geologic Survey Commission, Harrisburg, Penn.

A report of the work for the two years ended May 31, 1914, together with a brief account of the work in progress. There are five appendices to the report, as follows: (A) List of publications of Pennsylvania Geological Surveys and U. S. Geological Survey relating to Pennsylvania; (B) list of completed topographic maps; (C) report on the South Mountain Copper development; (D) check triangulation net in Carnegie Quadrangle; (E) mineral production of Pennsylvania in 1912.

THE MINING MANUAL AND MINING YEAR BOOK FOR 1915. By Walter R. Skinner. 5¾x8¼, pp. 970; illus.; 15s. Published by the author, 11-12 Clements Lane, London, E. C., England.

The 1915 edition of this standard manual of registered British mining companies has just been issued. It covers completely over 750 mining companies, and includes a supplementary list giving the names of private and dormant companies or those which have ceased to be of public interest. The names of the companies are listed in alphabetical order instead of by sections, as formerly, an improvement over the old arrangement. In addition to particulars regarding officers, capital stock, dividends, financial condition, etc., of mining companies, the volume contains a list of directors and secretaries, with their addresses, and the companies with which they are connected. It also contains a dictionary of mining terms. The volume maintains its previous high standard as a reference manual, and is especially valuable at this time as a source of information regarding the effect of the European war on the mining industry.

THE PETROLEUM INDUSTRY OF CALIFORNIA. By R. P. McLaughlin. Pp. 519; illus.; separate folio of maps, compiled by R. P. McLaughlin and C. A. Waring. Bull. 69, California State Mining Bureau, San Francisco.

This report, published by the State Mining Bureau, is the finest contribution to the petroleum literature of the state that has ever been issued from any source. The text-book contains 519 pages, including a comprehensive table of contents and an excellent index. This is accompanied by a map folio containing 18 plates. The folio is well bound, and of hard, heavy paper, and is 22x18 in. The sequential order and grouping of the subjects are complete and comprehensive. The subjects are treated in eleven chapters and embrace three distinct divisions: (1) Extent and location of California oil deposits; (2) cost of extracting oil from the deposit; (3) marketing and financial conditions covering the oil industry. The bulletin is written chiefly to provide exact information to (a) the small producing companies and their stockholders; (b) the large marketing companies, and particularly the officers dealing with the public; (c) the state and national legislators dealing with the oil industry. But the bulletin and the map folio reach much farther than the author indicates. The report is at once a text-book for engineers, students, and the general inquirer regarding the oil industry. The special subjects treated include a financial review of the oil industry in 1913, presenting a summary of oil resources; ownership of proved land; geology in relation to the oil industry; operating cost; drilling and pumping; marketing and control and price; the productive capacity of oil lands; underground movement of oil; evaporation and loss of oil; temperature correction in measuring; physical and chemical properties of California oil; some commercial uses of oil; pipe lines; water transportation and exports; shipment by rail from California; reservoirs and tanks; specifications and cost; refineries; gasoline from natural gas; gas production of various kinds. The remaining chapters cover the location, topography, geology, history, productiveness, financial results and directories of operating companies and other information of great value embracing the several fields in the state. The text is well illustrated with photographic reproductions and charts numbering 78 figures.

The geologic record of California printed on the inside cover pages of the map folio is by James Perrin Smith of Stanford University. The 18 plates include correlation and characteristic fossils of geologic formations of the California Coast Range; the geologic and oil field maps; geologic cross-sections; gravity charts; topographical maps; plans for standard and rotary rigs; plans for earthern, concrete-lined oil reservoirs; and map showing portion of oil pipe line. These maps and charts cover the entire operating regions and were brought up and corrected to July, 1914. The entire work has been under the direct supervision of F. McN. Hamilton, state mineralogist, and is a credit not only to himself but to the Mining Bureau and the state. The text-book and folio are sold by the Mining Bureau at the low price of $2, which covers only the cost of printing.

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Power House of the San Luis Mining Co.

The power house of the San Luis Mining Co. in Sinaloa, Mexico, is of unusual interest. The Piaxtla River, in its course from the interior highlands to the sea, flows for many miles through barren, rainless foothills before reaching the moist belt of coast land. Somewhat more than 100 miles northwest of Mazatlan it makes a wide ox-bow curve, flowing for several miles between walls o solid rock, to return at one point to within a few yards of its earlier course. At this point the power house i built. A tunnel a little more than 200 ft. long, driven through solid rock, connects with the upper course. In the power house are two Pelton-Francis turbines. Th original power house is of adobe construction, but an addition, in which a third Pelton-Francis turbine is now being installed, is excavated from solid rock.

All of the machinery was sectionalized for mule-back transportation, and the greater portion of it was thus brought in. Some pieces that were too large for mule-back transportation were packed in by Indian carriers on a long pole resting on their shoulders, with the piece in question suspended from the middle.

The outcrop on which the San Luis Mining Co.'s workings are developed is associated in tradition with the source of gold exploited by the Montezumas before Cortez invaded Mexico.

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Two False Notions Concerning the Japanese

By Rossiter W. Raymond

Several years ago, during the visit to Japan of a party of members of the American Institute of Mining Engineers, I was honored by his Majesty, the late Emperor, with the order of the Rising Sun, conferred, as the accompanying letter to the American Embassy declared, in recognition of my services to the mining industry of Japan. Since, at that time, I had never seen a Japanese mine or smeltery, it was plain that the services thus generously estimated and rewarded must have consisted of the advice and assistance given by me (with the cordial coöperation of the members of the Institute) to Japanese mining engineers and metallurgists traveling or sojourning in the United States for the purpose of studying American methods and appliances.

Indeed, whether I deserved this distinction or not, it had been fairly earned by the Institute of which I was the representative. One of our members, Benjamin Smith Lyman, of Philadelphia, laid the foundation of the present Imperial Japanese Geological Survey, the work and the publications of which are not surpassed by any other nation. Two others, Raphael Pumpelly and William P. Blake, not only established the first school of engineering in Japan, but also, by way of practical illustration, showed the Japanese miners how to drill and charge a hole, and fire the charge with a fuse. Many other modern methods and appliances the acute and eclectic observers of Japan afterward adopted and adapted in their study of modern mining and metallurgy. And during more than half a century of professional practice I have had repeated proof of the erroneous character of two generalizations concerning the Japanese, to which, for a time, in company with all the other smart critics, I gave assent.

The first of these propositions was that, like other Orientals, the Japanese were able to copy, but not to originate or improve. I could give many interesting instances to the contrary from my professional knowledge. For instance, I could report a discussion which took place during our visit, at one of the largest copper mines in Japan, between eminent American mining engineers and the Japanese managei of the mine. They had copied our American method up to a certain point, and omitted to adopt what we regarded as its most valuable feature. And the visiting critics, having found few opportunities, thus far, for pointing out defects, were quick to seize upon this one. But after a few minutes of clear exposition from Japanese lips they recognized the futility of their criticism, and the fact that what they had mistaken for Oriental superficiality was in reality Oriental patience and thoroughness, rejecting as well as selecting, adapting as well as adopting.

The origin of our delusion on this point is easily discerned. The Japanese nation has passed in 50 years through a transition from feudalism to modern civilization which occupied our ancestors for three centuries. At the beginning, of course, it copied, to save time. So does every beginner. But the Japanese, having cast away their own hampering traditions and adoptetd ours merely as a starting-point, are now bolder than we to [illegible] everything; and he who denies their capacity to invent, originate and improve is like one who, having seen a row of school-boys laboriously learning to write, declares them all to be "mere copyists" and refuses forever thereafter to admit that they may have become authors. To the unprejudiced observer the wonder is that those new scholars have passed beyond the copy-book stage so rapidly.

The other generalization which experience has disproved for me is that which attributes superficiality and fickleness to the Japanese. I confess that, for a long time, I was more or less influenced by this tradition. I used to fancy that the Japanese were more mercurial and less reliable than the Chinese; and I accepted as proofs many seeming evidences of temporary fads and fancies in Japan.

Let me say here that I am no strong believer in ineradicable national, or even racial, characteristics. In every continent of the world I have found all kinds of people in every nation, and under every skin a common human nature. In a word, I believe profoundly that both Japanese and Chinese are what we would have become under the same environment. So I am not discussing here the comparative permanent characteristics of races (if they have any which I doubt), but simply the question whether the modern history of Japan shows the Japanese to be variable of purpose, as we used to think.

There is one overwhelming proof to the contrary, namely, the amazing transformation wrought in Japanese land-tenure, jurisprudence, government and industry, without bloodshed (save for a single brief rebellion, now forgotten) and without social disturbance, during a single human lifetime. When I was in Tokio, four years ago, the last of the Shoguns was still living, and sat contentedly in the Upper House, as a noble of the highest rank, under the rule of his hereditary foe, the Mikado. Such a transformation as that cannot be so peacefully and rapidly effected by a superficial and unreliable nation.

The question is therefore really, not, Are the Japanese fickle? but, How did they ever come to be so regarded?

I think the main source of this tradition has been the wonderful history already mentioned. The amazing modernization of Japan has been too generally accepted as a sort of miracle, and not further analyzed; whereas, in fact, it was a process like that of any other reform, only more rapid and less turbulent than usual. There was always a progressive party, with momentum enough to initiate new steps of progress; and there was always a conservative party, with inertia enough to hinder the immediate prosecution of such beginnings. Ultimately, the party of progress had its way; yet the delay and apparent vacillation effected by the conservatives were by no means an unmitigated public evil. For the enthusiastic progressives, it must be confessed, were [illegible] hasty and indiscriminate in their intiative, and a little delay did the country no harm. Yet these [illegible] changes of policy undoubtedly produced an [illegible] of national fickleness, though what they really showed was the alternate ascendency of conflicting parties, or the intervention of compromises, by which some proposed reforms were postponed, that others, deemed more important, might be effected without opposition.

I could give instances in the line of my own profession, in which the Japanese Government employed distinguished American experts, paid them high salaries, received their reports and plans with exuberant thanks and compliments—and, for the time being, did nothing more. But I will state only one case, which occurred in the '70s, and was reported to me by a friend, then residing in Tokio, and sufficiently illustrates my proposition.

There arrived in Tokio, one day, the agent of an American company manufacturing steam fire-engines. Tokio, with its long streets of wooden houses, lacking (at that time) any system of water-supply, was peculiarly exposed to the danger of conflagration; and the authorities readily consented to an exhibition of the power of the American engine. This was so impressive that a contract for the purchase of 10 engines was approved; but before the papers had been actually signed, some old public servant said he seemed to recollect that the same programme had been gone through before. And, upon search, there were found in a government storehouse several fire-engines of that manufacture which the progressives years before had had the courage to buy, but the use of which the conservatives, backed, no doubt, by the inertia and superstition of the populace, had been able to prevent.

Now, the alternate preponderance of one or the other party in a national or municipal government is a sign, not of "feebleness," but fighting. And the early and permanent victory of either party shows the temper of a community. Judged by this rule, Japan has shown itself to be exceptionally consistent, as well as persistent, in progress.

Franklin Guiterman

Franklin Guiterman died from pneumonia at his residence in New York, May 2, aged 58 years. He was widely known as an experienced and expert metallurgist, and had held important positions with the American Smelting & Refining Co. ever since its organization.

He was born in Cincinnati, Ohio, studied at the schools there, at Columbia University in New York and at the Bergakademie at Freiburg, Saxony, where he graduated in 1877. For several years he was employed as chemist, assayer and superintendent at mines in Georgetown and Leadville, Colo., and Hartville, Wyo. In 1885 he was superintendent of the Mingo plant of the Pennsylvania Lead Co., at Sandy, Utah. In 1888 he went to Denver as general manager of W. J. Chamberlain & Co., ore buyers and samplers, and later was made manager of the clearing house of the Associated Smelters of Colorado. In 1895 he was appointed manager of the Durango plant of the Omaha & Grant Smelting Co.; in 1900 he became general manager of the Pueblo plant of the American Smelting & Refining Co., and two years later was placed in charge of the Colorado department of that company, adding to the duties of that position those of president of the Carbon Coal & Coke Co. Four years ago he came to the New York office of the company, and besides continuing in certain duties with respect to the Colorado department, he became the head of the research department of the company and also president of the New River Collieries Co. and the Chesapeake & Ohio Coal Co. of West Virginia. He was a member of the executive committee of the American Smelting & Refining Co. and of the American Smelters' Securities Co., and was recognized as a man of marked ability.

Mr. Guiterman was a member of the Colorado Scientific Society and served as secretary and president of the society. He was a member of the American Institute of Mining Engineers and of the Mining and Metallurgical Society of America.

Mr. Guiterman was popular with the miners in his company's employ, and last year, when an explosion in one of the shafts of the New River Collieries mine at Eccles, W. Va., caused a great loss of life, Mr. Guiterman chartered a special train and rushed to the scene, where he personally superintended the rescue and relief work.

He is survived by a widow and one son, Kenneth S. Guiterman, chief chemist at the refinery of the American Smelting & Refining Co., at Perth Amboy.

The Zinc Industry in Japan

Yokohama Correspondence

The production of spelter in Japan in 1914 was 4750 metric tons, of which the Mitsui Ohmuta works produced 2950 and the Osaka works 1800. A small production was made experimentally in some other works.

No statistics of the Japanese production of zinc ore in 1914 are yet available, but it is estimated at about 35,000 metric tons, including what was produced in Chosen.

The exportation of zinc ore in 1914 from January to July inclusive was 14,300 metric tons. After the outbreak of the war in Europe no zinc ore was exported from Japan until March, 1915, when about 1000 tons was shipped to New York, which is supposed to be the first shipment of zinc ore ever made to America from Japan.

The importation of zinc, both in the form of spelter and sheet zinc, in 1914 was 4800 metric tons from January to July inclusive and 1000 metric tons from August to December inclusive, a total of 5800 tons for the year, compared with 10,900 tons in 1913.

At the present time the Mitsui Ohmuta smelting works is producing about 400 tons of spelter per month and the Osaka works about 200 tons per month.

Reported in New York

In the reactionary movement in the stock market last week, which culminated in the semi-panic of May 7 when the news of the sinking of the "Lusitania" came, the copper stocks behaved remarkably well. They suffered severe declines along with all other stocks, but rallied upon good buying, the market being full of orders at a few points below quotations.

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A movement has been started in northern Mexico to require the payment of wages in mines, mills and smelting works in silver instead of paper money. A conference of mining and metallurgical interests, which was attended by representatives of Villa, took place in New York on May 11 to consider this question.

Correspondence and Discussion

Do Not Buy Zinc Mines Now

Under the caption "Do Not Buy Zinc Mines Now" the ENGINEERING AND MINING JOURNAL in a late issue warned its readers that present prices for both zinc ore and spelter were abnormally high, and that it was advised by its Joplin correspondent that a press bureau was about to be organized in this district for the purpose of exploiting mining properties at high prices, etc.

We believe that this capable and reputable journal did not weigh carefully the unequivocal nature of the statement made in the headline above quoted. Its manifest effort and desire to warn its readers against an era of wildcat speculation either in the stocks of zinc-mining companies which are almost sure to be offered the public, or in the purchase of mining properties outright at inflated values, are most commendable and reiterate the "warning" sent out broadcast by us over two months ago: but the unqualified statement "Do not buy zinc mines now" is tantamount to arguing that people should not engage in any legitimate business during an era of exceptional prosperity.

While it is true that the price of spelter is abnormally high owing to the war, such is not the case regarding the price of zinc ore. With spelter selling at from $12 to $13 per 100 lb. in St. Louis and New York, a fair price for zinc ore in this district would be $100 a ton instead of the $60 to $65 basis for 60% concentrates at which it is now selling.

Of course operators owning good mines here are making large profits even at present prices, and would doubtless want an unusual price for their properties if asked to sell; but such properties are not the only kind of mines open for investment in this field, nor do they offer the best form of investment, as we have repeatedly asserted during the past 15 years, during all of which time we have consistently advised investors that the greatest safety and biggest profits were to be found in proven mines that had not reached the point of production but required capital for development, and where all the ore values were still in the ground. Such properties are to be had in this district, which will make large earnings not only on an unusually high market but on any kind of a market which justifies mining at all.

We therefore think that in justice to itself as well as to this district the JOURNAL should modify its statement, while continuing to lambast every undertaking that smacks of crookedness or wildcatting.

THE LYON INVESTMENT CO.

Joplin, Mo., Apr. 30, 1915.

[Yes, we think that our advice ought to have been qualified in about this way: Do not buy zinc mines now unless the investment figures rightly on the basis of 5c. for spelter. However, we find it hard to imagine any vender making such a presentation in these days, and it is best to let our advice go badly as we put it originally.

Our correspondent betrays the error in popular ideas when it states that with spelter selling at $12@13 per 100 lb. a fair price for zinc ore in the Joplin district would be $100 per ton instead of $60@65. Not so.

The high price for spelter is due only to shortage of smelting capacity. The spelter buyers of the world are paying great premiums for the use of smelting capacity, not for scarcity of zinc mines or zinc ore. The world is glutted with zinc ore.

The situation is abnormal. Nothing like it was ever known before; and probably never will be seen again. It can be nothing but ephemeral. The termination of the war will explode it, if it be not exploded earlier.

We have noticed in Boston papers the advertisements of brokers advising the public to buy zinc stocks. To advertise thus for the sake of petty commissions is like trying to steal candy from a baby.—EDITOR.]

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Protect the Mine Owner

In the JOURNAL of Apr. 24 is published an excellent letter from A. D. Boyd, under the caption "What Is the Matter with Mining?" Mr. Boyd calls attention to the practice of illegally holding possession of mining claims by physical force and the practice of "doing assessment work with a lead-pencil," as it is called in Colorado.

In the mining districts of Colorado and Utah this practice is commonplace. Indeed, it would appear that in some remote settlements the natives imagine they own the environs by some divine right, and by reason of their local political influence seem to receive more than an even break in the local courts.

Against these are the thugs and gunmen, professional claim-jumpers, the flotsam and jetsam of mine strikes, tramps and I. W. W.'s roaming the country in bands of 15 and 20 and ready for any outlawry. The specialty of this tribe is possession through violence first, by stealing the ore stacked up and ready for shipment, by intimidation, by trickery and quibbling, even sometimes with the help of shyster lawyers; the later stage of this tribe is similar to the Nevada outlawry, doing the assessment work by lead-pencil and bolstering up any weak points with expert perjury.

The insolence of these thugs passes belief. Only when in the county seat in consultation with their pettifogger do they make a pretense of any legal or moral right. The poor wife of an old prospector and miner reproached two of these Weary Willies for jumping her husband's claim. They shot back: "Ye're lucky we don't jump your garden." There is not the slightest effort to apprehend these ruffians. What protection had that old man against a roaming band of outlaws? Eventually he had practically to give away his claims to a big corporation. And yet our present vicious mining laws are presumably framed in the interest of the small mine owner!

The remedy is to repeal our present mining laws and adopt laws similar to those in Peru. Let the Federal Bureau of Mines set the metes and bounds of all the [illegible] claims; require a carefully regulated tax paid to the Bureau of Mines twice a year (part of this tax might go to the mining district), and require neither location nor assessment work. This has prevented outlawry, because physical possession of the property was of no value in law. Our present mining laws should be entitled "An Act to Encourage Murder and Fraud."

THOMAS F. V. CURRAN.

Denver, Colo., May 1, 1915.

* * *

Taxes in Colombia

The statement about municipal taxation in W. A. Prichard's report on the Pato property in the JOURNAL of Jan. 30, 1915, surprises me very much. My experience during seven years' practice has been so entirely different that I cannot refrain from communicating it to you.

As contractor on the Girardot Ry. I had to retain a lawyer in Bogotá. When I left railroading to start in mining my lawyer recommended me to a friend of his in Ibagué; but I soon found out that I had no need for a lawyer because both municipal and department governments treated me justly. That I am doing pioneer work here may have had an influence. I am the only one in the district risking money in deeper development, in spite of predictions that most of the veins in the department pinch out in depth, and that others carry sulphide ores without free gold below the oxidized outcrop.

Of course, taxes are charged everywhere, but I believe that no country which supports any kind of government taxes mining lower than Colombia. I own at present 51 lode claims (a Colombian lode claim is 600 m. long by 240 m. broad) and one alluvial claim. My tax amounts to just $52, which has to be paid at the national subtreasury at Ibagué by the end of the year. My farm—about 500 acres, half of it in pasture, *maiz*, vegetables, etc., the other half preserved as forest to assure the supply of mine timber—pays a yearly tax of $5 to the municipality. Besides these two—the mine tax of the national government and the land tax of the municipality—there is a road tax, which every grown-up resident, native or foreigner, has to pay. This is the tax of which foreigners are always complaining. But do not we foreigners travel over the roads as well as the natives? The public roads in Colombia have no other source of income than this tax, and this is the cause of the bad state of the roads.

My road tax is $2 a year, and each of my workmen has to pay $1 yearly or do two days' work on the roads. Laborers are only too willing to shirk this small duty, and, as a rule, think that they cannot be taxed while working for a foreigner or a foreign corporation. This tendency of the men to hide behind their foreign boss causes friction between the management of a concern and the authorities.

I proceed in the matter as follows: Every year when the road tax is called in the municipal collector sends me a list of those of my men who appear on the books of the tax collector. The men who only started work shortly before do not appear on the books, and the ones who have left are crossed off. After that I find out which parts of the roads are to be repaired. If the road leading to my work is on the repairing list, I send a few spare men every day until all have paid the tax in work. When necessary, I furnish explosives, the value of which is computed into days worked. When the roads in other parts of the district are to be repaired I pay the tax of all of my men in cash and deduct it from their earnings. The law does not oblige me to collect the tax, but this small exertion saves me lots of trouble.

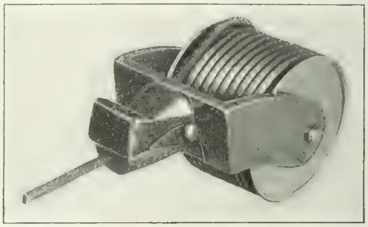
J. FRED DIEROLF.

Ibagué, Colombia, Apr. 8, 1915.

* * *

Spitting Fuses

In Correspondence and Discussion in the JOURNAL of Apr. 17, 1915, we notice an item by "Sourdough," Goldfield, Nev., on spitting fuses. We are entirely familiar with the methods which he there refers to, and particularly the one which he recommends—the old-fashioned way of spitting with a piece of notched fuse. It is our observation that this method is still used to a large degree in metal mining and doby work, and we quite agree that it is the most effective method which has been in use until quite recently.



LEAD-SPITTER FUSE LIGHTER COMPLETE

Following out the principle involved in this method, we have recently introduced what we call "Lead Spitter Fuse Lighter," which consists of a core of powder in a small lead tube, which we prepare in 25-ft. lengths on small tin spools which fit into a suitable cast-iron holder, on the feeding nose of which there is a knife which is used to cut off the spitter after the round of fuses has been lighted.

LEAD-SPITTER IN USE, SHOWING FLAME

The operator in using this lighter simply draws out through the nose 12 or 15 in. of the lead spitter and ignites the end of it with his candle or match. It then burns at a steady, slow rate and throws a long spit from the end which easily and quickly ignites the safety fuse in wet weather, wet workings, or under other adverse conditions.

The illustrations show the spitter complete and ready for use and in use.

THE ENSIGN-BICKFORD CO.

Simsbury, Conn., Apr. 27, 1915.

Editorials

The wicked destruction of the "Lusitania" has forced upon us a keen realization of the outlawry that has been produced by the war in Europe. We shall not discuss the feeble excuses for it but only express our horror over this monstrous deed and extend our sympathy to the families of several American engineers who went down with the ship.

World's Production of Copper in 1914

The appearance of the annual copper statistics of Henry R. Merton & Co., last week, excellent in form as usual, but a little more tardy than ordinarily, enables us to present a revised summary of the world's production of copper in 1914. Merton & Co. uses our figures for the United States and some other countries and we use its figures for Australia and the European countries. As between any two compilations of the world's production of copper there are likely to be discrepancies owing to differences in the bases adopted. Thus as to the production of Chile and Peru, there is often a considerable difference between the reckoning based upon the exportation from those countries and the reckoning based upon the arrival of the copper at the smelteries and refineries in England and America. Our own statistics are determined in the latter way.

The revised figures for 1914 are given in the accompanying table. The total is about 10,000 tons larger than we reported on Jan. 9, 1915, but the total is so large that this is only about 1% of it. It is indeed satisfactory that the production of copper, the conditions of which are quite complex, can be reported within 1% only a few days after the termination of the year reviewed.

WORLD'S PRODUCTION OF COPPER (a)

(In Metric Tons)

Country	1911	1912	1913	1914
United States	491,634	563,260	555,990	525,529
Mexico	61,884	73,617	58,323	36,337
Canada	25,570	34,213	34,880	34,027
Cuba	3,753	4,393	3,381	6,251
Australasia	(b) 42,510	(b) 47,772	(b) 47,325	(b) 37,592
Peru	28,500	26,483	25,487	23,647
Chile	33,088	39,204	39,434	40,876
Bolivia	2,950	4,681	(b) 3,658	(b) 2,743
Japan	(c) 52,303	(d) 62,486	(b) 73,152	(d) 68,058
Russia	(c) 25,747	(c) 33,550	(c) 34,316	(b) 31,938
Germany	(b) 22,363	(b) 24,303	(b) 25,308	(b) 30,480
Africa	(b) 17,252	(b) 16,632	(b) 22,870	(b) 24,135
Spain and Portugal	(b) 52,878	(b) 59,873	(b) 54,696	(b) 37,099
Other countries	(b) 26,423	(b) 29,555	(b) 27,158	(b) 25,176
Totals	886,855	1,020,022	1,005,978	923,888

(a) The statistics in this table are our own compilations, except where specially noted to the contrary. (b) As reported by Henry R. Merton & Co. (c) As officially reported. (d) Privately communicated to us from Japan.

The revised statistics show that in the January report the output of the United States was understated, while that of Spain-Portugal was overstated by about the same amount. The United States is the largest producer of the world and its copper industry is the most varied and complicated. Moreover, the latter part of 1914 was a troubled time, rendering the collection of statistics more difficult than usual. The reporting of the statistics for Spain and Portugal ought to be relatively easy, but this has not yet been organized so well as for most of the other important copper-producing countries.

As for the other countries of the world, the final figures reported in May are so little different from the preliminary figures reported in January that no special comment about them is now necessary. There was an important curtailment of the world's production of copper in the aggregate in 1914, which we now know to have been more than was really required. With the state of mind, of finances, and of all the industrial machinery of the world last August, however, there was probably nothing else to be done than what was done.

Affairs in Mexico

In Mexico at the present time there is no national government. The country has become divided into palatinates. Villa rules one, Zapata another and Carranza the third. In certain districts smaller barons prevail. Anybody seeking to do business in Mexico must make arrangements with the rulers of the respective sections. No one of them is strong enough, or intelligent enough, to establish good order, and crime is rife, but on the whole the natives appear to get on very well.

At present the currency question is exercising the several rulers, especially Villa. Gold and silver have been driven out of the north of Mexico, which is now on a paper basis. Villa is anxious to restore payments of wages in silver and has issued an edict to the mining, milling and smelting companies to that effect. The company managers are disturbed over what may happen if they pay their men in silver while Villa pays his soldiers in paper.

The Price for Spelter

A correspondent inquires of us why we quote the spelter market with a wide range, why we do not simply quote the spot price, and if we do not do an injustice to miners who sell their ore on the bases of our quotations.

We quote spelter according as it is sold, which, in so far as the bulk of the product is concerned, is on contracts for delivery ahead. The term "spot" spelter has no meaning of consequence except with respect to relatively insignificant speculative business. The great tonnage of spelter goes into consumption quite otherwise.

However, the matter of delivery is not open to discussion, inasmuch as we have repeatedly stated during many years that we quote the metals as ordinarily sold, regardless of time of delivery. Lately we have quoted the spelter market with a wide range for the reason that there has been such.

Our quotations for spelter during the first four months of 1915 were based on reports of sales aggregating upward of 50,000 tons, and the checks between selling averages and quotational averages were very close.

A large producer of zinc ore recently [illegible] the situation of the spelter market with the [illegible] whom his ore was contracted on sliding scale. The buyer showed that his sales of spelter had fallen short of realizing the quotational average and offered to tear up the ore contract and sell for the miner on commission or let him go elsewhere with his ore, as he saw fit. The miner did not want to do either.

We quote the spelter market just as it is and as we see it. If anybody has an ore contract based on our quotations and is dissatisfied we recommend that he ask the buyer to cancel the contract and arrange matters otherwise. Some ore buyers at least have found recent conditions rather hard to face and probably would not be averse to being released from terms which the recent events in the spelter industry have made both onerous and dangerous.

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Offering Ore for Sale

The question of selling the product of the mine is a most important one, but one to which the average miner gives little thought. The general feeling seems to be that any intrinsically valuable product must sell itself. From the standpoint of the neutral observer the wonder is that some of the miners ever sell anything.

A few days ago the following letter was shown to us by a great metal-buying house: "Dear Sir—I am mining ores. I wish you would give me prices paid and market conditions for minerals. Yours very truly, etc." There are, it is believed, better ways of writing such letters.

In the first place, if possible, send a sample of the ore or metal offered for sale. In the letter, state tonnage available, analysis, physical condition (lump or fine, wet or dry, etc.), and delivery. And make these statements exact. There is no use getting a firm offer on a 5000-ton shipload of bat guano and later showing up with fifty 100-lb. sacks, and expecting the same price. It can't be done.

Another point is, if competing bids are received—and these vary widely—don't immediately call the sender of the lower bid a pirate. It may be that his works are overstocked with what you have to offer and the other bidder's works are bare of it. Another time the conditions might be reversed.

There is probably no large metal buyer who does not realize keenly that every enemy he makes is a liability, and that every raw deal put over by him would be one more producer who would never come back. Inasmuch as most of them are in business to stay, a reasonable degree of fairness is forced upon them by necessity.

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Oversupply of Labor

There is an enormous oversupply of labor in the northern sections of the country. Official warning has gone out from Butte that the city has a large number of unemployed; and although the mines are running at almost full capacity and times are prosperous there, the unemployed element is numerous and there is no opportunity except for skilled labor. A similar warning is being sent out from the Lake Superior copper country, for the renewed activity and increase in wages is attracting a great number of men who are finding hard times there in the midst of apparent prosperity. Many of these men have come to the Lake country from the Michigan and Minnesota iron ranges, where operations have not yet been resumed to capacity. In one of the iron-mining districts recently 1000 men were put to work in one week, without apparently decreasing the labor supply at that point. Most of these laborers are unskilled, which emphasizes the fact that although the mining industry has experienced a wonderful recovery, due to war orders, the general prosperity of the country at large, otherwise than that influenced by war conditions, is still at low ebb. An official estimate gives the total unemployed in New York City at the present time as almost 400,000 persons.

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Magnesium—Another Temporary Rarity

The course of magnesium prices is another unlooked-for result of the present war. In former times of peace the price of this metal was about $1.50 per lb., with a plentiful supply. Partly due to cutting off the German exports of the metal; partly due to smaller supplies of magnesium salts, since these also were received largely from Germany; partly due to the tremendously enhanced demand for the metal as a material for flying-machine parts, the price steadily advanced, until in one case, we believe, $7.50 per lb. was paid for spot metal.

As matters now stand, quotations can be had all the way from $3.50 to $6.50 per lb., but when one begins to talk delivery under these terms one finds that $3.50 apparently secures delivery 90 days after a treaty of peace, and $6.50 secures it at seller's convenience.

At the present time it would appear that buyers in and around New York could absorb 10 to 15 tons of the metal and that total spot supplies do not exceed 200 or 300 lb., with those small quantities being jealously guarded against a day of really high prices.

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The Case of Leonard Worcester, Jr.

As a result of the efforts made by technical men on his behalf, Leonard Worcester, Jr., has been freed on bail. In a letter to the JOURNAL under date of May 2 he says:

"I was released on bail in the sum of $1000 on Apr. 21, and I believe that my release was due to the representations made to the Villa authorities by the State Department, which was impelled to these efforts by the publicity given my case in the JOURNAL and the press in general and the pressure exerted by you and my friends upon the Department."

We are glad, of course, that Mr. Worcester is free, and we sincerely hope that there will be no occasion for other efforts of a similar nature. The Mexican authorities gain nothing by senseless attacks on American citizens and interests.

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Several brands of high-grade or intermediate spelter are now being offered, which the sellers claim to be practically the same as "Horsehead," these new brands being made by redistilling common spelter, zinc dross, etc. This subject was discussed in an editorial on "The Kinds of Spelter" in the JOURNAL of Feb. 6, 1915. The matter of high-grade spelter is an interesting one at the present time, the output of the New Jersey Zinc Co. being insufficient to supply the demand of the Allies for cartridge metal. The maximum limits of impurities in high-grade spelter are 0.07% lead, 0.03% iron and 0.05%

cadmium, the total to be not over 0.10%, which means a zinc content of 99.9%. We hear, however, that several brass manufacturers have been satisfied with a slightly lower percentage of zinc, namely, 99.75%, the impurities being about 0.10% lead, 0.02% iron, and 0.12% cadmium. Such a spelter is in purity far above the minimum limit of intermediate, except in the matter of cadmium content, and save for the latter is not far below the standard of high-grade.

BY THE WAY

The proposed indictment of the Allis-Chalmers Co. in Wisconsin for conspiracy to commit murder, on the ground that it is manufacturing deadly missiles, is a novelty in law, and it is almost impossible that it can be maintained—although law has some queer kinks in Wisconsin, and elsewhere. If the proceedings should be sustained it looks as if they could put an end to war by going back to the source and overhauling some conspicuous offenders—the Krupps in Germany, for instance, and the Armstrongs in England. For that matter the United States Government is one of the greatest sinners of all in this country, since it is the largest producer of death-dealing implements. And then let's go back to the original sources of trouble and indict the miners.

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The enormous inquiries for copper, lead, spelter, etc., attributed to foreign governments and reported in the Wall St. journals are not always to be taken at full face value. There have been cases of such alleged sales being made and the copper going into warehouse. Later it developed that the copper had not been bought by Russia, but by some wily speculators, who subsequently resold it at a profit. The war orders and the quasi war orders have introduced in the metal trades many persons previously unknown, who are not always to be taken seriously. One of these recently called upon a lead producer and stated his business thus: "I represent the —— government. I want to buy 25,000 tons of lead for immediate delivery. What is your price?" The lead producer replied: "I'll have to consider this before I can quote you a price. I do not suppose there ever was such an order for lead in the history of the world." The inquirer did not come back. We have heard of a 10,000 ton transaction in lead, and there may have been larger ones, but the dealing in such blocks is not common. Of course there are contracts over long periods that run into larger quantities.

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The New York Metal Exchange is a curious institution. It has a high-sounding name, but in fact neither the important producers nor the important consumers of copper, lead or zinc are represented on its floor. However, there are some persons who frequent the room and apparently derive some amusement out of vociferously making bids and offers so long as there is nobody on hand to take them up. Not long ago when spelter was being bid up to an extravagant figure a producer instructed a broker to sell some for his account. This was done, but when the buyer was requested to put up margin according to the rules of the exchange he did not want to do so. There being no "binder," the trades were canceled. Bids and offers were made more cautiously for a while, but soon they began to appear again. A producer once more instructed a broker to sell 100 tons for each delivery at the price bid, and if unable to sell at the price bid to offer the same quantities at ¼c. less. When it appeared that there was somebody present who was willing to sell, the previously reckless bidders drew into their shells, and when offers to sell at lower prices were made there was nobody who wanted to buy.

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The "Lusitania" Losses

The heavy toll of American lives taken by the sinking of the "Lusitania" last week included several engineers and others connected with allied industries.

Perhaps the most notable loss was that of Frederick Stark Pearson, of Boston and New York. He was 54 years old, born in Lowell, Mass., and a graduate of Tufts College. After some years as an instructor he was engaged as a mining engineer in the United States and Brazil, but from 1890 on he was chiefly occupied in electrical work, except for a few years after 1893, when he was engaged in developing coal mines at Cape Breton and in organizing the Dominion Coal Co. and the New England Gas & Coke Co. He was chief engineer of the Metropolitan Street Ry. Co. in New York, and for years past had been consulting engineer of many large railroads and power enterprises.

Carlton Thayer Brodrick, Harvard, 1908, who was one of the passengers, was a son of Alfred H. Brodrick, president of the Chadwick-Boston Lead Co., was 28 years old and was graduated from Harvard University in the class of 1908. He had been for four years a mining engineer in the employ of an English company operating a Siberian concession and was on his way back to Russia after a vacation of several weeks spent with his parents.

With him was Richard R. Freeman, Jr., of Wollaston, who was 29 years old and a member of the Harvard class of 1909. He took a post-graduate course and then went West to follow his profession of mining engineer. He was in the employ of the company for which Mr. Brodrick worked and was accompanying him to Siberia.

A dispatch from Queenstown dated May 10 says that Lindell T. Bates, son of Lindon W. Bates, of New York, vice-chairman of the American Commission for the relief of Belgium, was arrested at Kinsdale May 9 on a charge of espionage while searching for the body of his brother, Lindon W. Bates, Jr., who also was on the "Lusitania." Newton B. Knox, an American mining engineer who was with Mr. Bates, was taken into custody at the same time. The sergeant who made the arrest accused them of being officers of a German submarine. After being taken before a captain, they were detained at the barracks a half-hour until United States Consul Frost at Queenstown vouched for their innocence. Their search of the coast revealed no trace of the body of L. W. Bates, Jr., who is now given up as lost. He was a civil engineer, a graduate of Yale, a traveler and author of note, and was an intimate friend of H. C. Hoover, with whom he was closely associated in the Belgian relief work.

Among the other passengers lost was [illegible] V. Trumbull, head of the Trumbull Brothers Manufacturing Co. at Plainville, Conn., large manufacturers [illegible] and mining machinery. W. S. Hodges, [illegible] years with the Baldwin Locomotive Works, of Philadelphia, was also lost.

PERSONALS

Arthur Thacher, of St. Louis, has been in Denver on business.

J. V. N. Dorr, of New York, will be in Denver during the month of May.

J. A. Houser, of the zinc mines at Mascot, Tenn., has been in St. Louis on business.

W. Rowland Cox has removed his New York office to the Equitable Building, 120 Broadway.

H. R. Lyman, manager of the Seneca Superior mine, has returned to Cobalt, Ont., from Florida.

Kirby Thomas, of New York, has been for several weeks in Virginia and Tennessee, examining iron and zinc properties.

G. L. Sheldon, of Ely, Nev., recently spent two weeks in Lander and Humboldt counties, Nevada, on professional business.

Frank H. Sistermans, of El Paso, Tex., is leaving for South America on professional business and expects to be absent for several months.

H. W. Hardinge has left New York for an extended trip to the West and Alaska. Mr. Hardinge expects to be gone about six weeks.

C. H. Palmer, Jr., and Frank A. Keith, of Los Angeles, Calif., are inspecting the United Eastern Mining Co.'s property at Oatman, Arizona.

Andrew W. Newberry, of Los Angeles, has left for a trip into central Alaska on professional work. He will probably remain until next winter.

Capt. A. M. Daniels, manager of the Lumsden Mining Co., Cobalt, Ont., who went to the war as an officer of the 48th Highlanders, is reported missing.

Lloyd B. Smith of the Associated Geological Engineers has returned to Pittsburgh, after spending three months in the oil fields of Mexico and Central America.

Guy V. Morton, manager of the Aspen Sampling Co., and Charles E. Anderson, manager of the Smuggler Leasing Co., Aspen, Colo., have been in Denver on business.

C. Herbert Poirier, manager of the Vipond mine, Porcupine, Ont., was married to Miss Grace Barber at Toronto, Apr. 30. They went to Ottawa Valley for their honeymoon.

January Jones, who shipped the first ore out of Goldfield and at one time was Goldfield's most extensive operator, has opened offices in Reno and will operate in Virginia City.

Will H. Coghill, after seven years in the practice of ore testing in Chicago, has removed his laboratory to El Paso, Tex., where he will continue in the same line of work.

John H. Hall has discontinued his practice as consulting engineer, and on May 1 became associated with the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., as metallurgical engineer.

Charles Camsell, of the Canadian Geological Survey, will have charge of a party which will leave next month to make an examination of the new Fond du Lac silver field in Saskatchewan.

J. A. Buissen, formerly on the mining engineering staff at the Consolidated Mining & Smelting Co.'s Center Star group of mines, Rossland, B. C., is now with the Mines Branch, Department of Mines, at Ottawa.

W. D. Crawford, president of La Belle Iron Works, Steubenville, Ohio, has resigned. R. C. Kirk, secretary and treasurer of the company, has been elected to the presidency and to the directorate to fill the vacancy

Dr. R. B. Moore, in charge of the Denver branch of the U. S. Bureau of Mines, delivered a popular lecture, Apr. 27, on the occurrence and uses of radium, under the auspices of the Tuesday Reading Club, Central City, Colo.

Captain Arthur Bennetts of the Quincy copper mine in Michigan resigns to accept a position as head captain at the Mass mine, succeeding the late Captain W. L. Ninness, killed a month ago. Captain Bennetts, while a comparatively young man, is one of the best mining men in the district

Dr. Lucien I. Blake, of Boston, has concluded a series of lectures, given on successive Monday evenings in Denver, under the auspices of the Teknik Club. The course was exceptionally interesting as it presented in non-technical language the latest discoveries and theories regarding astronomical phenomena and cosmic physics.

Bradley Stoughton, of New York, secretary of the American Institute of Mining Engineers, was the guest of honor at a luncheon given by Charles W. Goodale at the Silver Bow Club in Butte, May 4. After luncheon Mr. Stoughton visited the North Butte, the Butte & Superior mines and the School of Mines and left Butte in the evening for San Francisco.

At the International Smelting Works, Tooele, Utah, several changes were made on May 1, in the operating department. A. B. Young, formerly head of the testing department, is now superintendent of blast furnaces; B. L. Sackett, who was chief chemist, is head of the testing department. Carlos Bardwell has been promoted to chief chemist. At the general offices, J. D. Wood has been made cashier; E. L. Sowerwine, chief clerk; and A. D. Hunter, assistant clerk. R. H. Page is in charge of the new time office.

The degree of D. Sc. (Honoris Causa) was conferred by the University of Alberta, Edmonton, Apr. 28, on W. F. Ferrier, mining engineer and geologist of Toronto, in recognition of his many years of work in mineralogy and practical geology. Mr. Ferrier is well known for his field work in western Canada and the United States, his work as an officer in the Geological Survey of Canada and for his interest in museum work. He has contributed largely to the Geological Museum collections at the University of Alberta and has assisted in arranging the museum collections.

A. E. Guy, chief engineer of the pump department of the Providence Engineering Works, has been in Leadville, Colo., the past two weeks installing new centrifugal pumps in the Penrose shaft as part of the Downtown pumping project. April 22, he delivered an open lecture in the Elks Opera House on the history of centrifugal pumping. May 1, he gave the same lecture in Denver before the Colorado Scientific Society. Later still, he repeated it in Leadville before the members of the Colorado School of Mines senior class who are on their extended inspection trip preceding graduation.

With Secretary Lane's approval, Director Smith has designated H. D. McCaskey as geologist in charge of the Division of Mineral Resources of the U. S. Geological Survey to succeed Mr. Parker. Mr. McCaskey brings to his new position experience, not only as a geologist of the Geological Survey since 1907 and section chief since 1912, but also as a mining engineer in the Philippine Mining Bureau from 1900 to 1903, and as chief of that bureau from 1903 to 1906. Mr. McCaskey will also continue his work upon the metallic resources of the United States and another geologist will be designated to take up the coal work specialized on by Mr. Parker.

Secretary Lane has accepted the resignation of Edward W Parker of the United States Geological Survey, statistician in charge of the Division of Mineral Resources and for many years the Government coal statistician. Mr. Parker leaves the Government service to accept a responsible position with the anthracite mining companies. In transmitting his resignation Director George Otis Smith goes on record as expressing his regret both personally and as a public official at "this termination of Mr. Parker's long and efficient service. As coal statistician of the Government since 1890 and as chief of the Division of Mineral Resources of the Geological Survey since 1908, Mr. Parker's contribution to the present standard of the annual report 'Mineral Resources' has been large and important. In the nature of public service should also be mentioned important work by Mr. Parker in studies of coal testing and conservation and the publication by him in the engineering press of many papers on coal mining and production. From his own standpoint, however, Mr. Parker is to be congratulated in his new connection with the anthracite coal interests, where he will continue his activities along lines on which he has long been regarded as authority." Mr. Parker also rendered valuable service as a member of the Commission which settled the great anthracite strike of 1902.

OBITUARY

Samuel Jones died at Chico, Calif., May 1, aged 84 years. He was born in Canada but went to California when a young man, being successful there as a miner and farmer. He was also concerned in mining in Mexico.

Thomas J. Watson, of Toledo, Ohio, died in Chicago, Apr. 28, aged 73 years. He was born in Ohio and began life as storekeeper, but was one of the pioneers in the oil busines in Ohio. He was president of the Craig Oil Co., which h organized 25 years ago.

R. H. Fagan, a prominent Duluth mining man, committe suicide in his office in that city, Apr. 26, having been in il health for some time previously. He owned a large interes in the Section Thirty mine on the Vermilion Range, als much undeveloped mining property and timber lands

Editorial Correspondence

SAN FRANCISCO—May 5

The Hawk Oil Claims in Kern County have reverted to the United States upon a decision recently rendered by the Secretary of the Interior. The property has been a large producer of oil, and the land office at Los Angeles a year ago found the petitioners entitled to patent. But the present decision reverses the former and holds that the Pacific Midway Oil Co. did not diligently prosecute the work of exploration for a period of six months.

New Comstock Ore from the 2650 level hoisted on Apr. 28 is the first ore that has come from below the 2500 level in the past 30 years. This came from the north side of the Union first crosscut and the 12 tons hoisted assayed $13.65 per ton. The water is being steadily lowered and it was expected to have the workings down to the 2700 level cleared by May 1. This find of ore below the 2500 level was expected by the management of North End Comstocks, and it was this belief that induced the expenditure of money for the unwatering of the lower levels of the Mexican, Union, and Sierra-Nevada. The fact that the early-day management deepened the mines without exploring the possible orebodies did not discourage the present management, as the existence of such bodies was known, though their extent could only be surmised, and as to their value there was no way of learning except to clear the water and prospect.

A Department of Petroleum and Gas of the State Mining Bureau, provided for by Senate Bill No. 916, introduced by Senator Maddux, will be created. The bill passed the senate unanimously and only one opposing vote was recorded in the assembly. This is the provision for state control of the regulation of oil and gas wells respecting protection from waste and destruction through improper operation. The work of the department will be performed by an appointee of the state mineralogist, to be designated as state oil and gas supervisor. The supervisor will appoint deputy supervisors and other necessary assistants. The work shall be done with a view to advising operators as to the best methods of protecting oil and gas sands and aiding supervisors in ordering experimental and repair work. Data collected and filed in the offices of the field deputies will be open to inspection of persons authorized by operators and state officers. Funds are to be provided by a tax upon operators and owners of oil and gas wells and lands. It is expected the governor will approve the bill.

BUTTE—May 6

The Section Tributary to Twin Bridges has taken on a new lease of life, and indications are that there will be much development work done on some of the promising claims during the coming summer. Work has begun on the Bielenberg & Higgins mines in Bear Gulch and a contract has been let for 300 ft. of additional tunnel on these claims. In the Silver Star district the American mine is being worked by leasers who have struck a vein of good milling ore of considerable extent, running between $10 and $20 in gold per ton. The Iron Rod mill is included in the lease, and will commence to treat the ore in a short time. Development work is also being done in Hulburt Cañon on the Lester claim.

Activity in Helena Mining District is due to the efforts of the Helena Mining Bureau, which has brought the district to the attention of investors in all parts of the country and within the last month a dozen large concerns or individuals have had experts looking over the field. Negotiations are now pending for the development of several properties in the district by large firms and they are expected to come to a head within the next six weeks. The Scratch Gravel district is going ahead. The Valley Forge is doing considerable profitable work. The porphyry dike in the Rimini district is being profitably exploited, across the Missouri River near York two properties are operating and at Marysville the Piegan-Gloster mines of the Barnes-King Development Co. as well as several other properties are ready to begin work as soon as the electric power reaches the camp, probably within the present month. The Helena Mining Bureau is doing considerable development work on its Blue Bird mine in Scratch Gravel district and at the Hawkeye group in the southeastern part of Helena. At the latter mines several tons of ore have been extracted and shipped which ran from $11 to $48 to the ton.

The Butte Duluth Receiver has sent out the following notice:

Since the first of August, 1914, the Butte Duluth Mining Co. had been operated under an arrangement with its laborers whereby one-half of the payroll had been paid in cash, and the remaining one-half in the form of due-bills to become due at a later date not specified. The business depression continuing longer than had been expected, the delay in resuming full payment of the payroll caused some of the workmen to become restive, and they were on the point of placing liens on the property to secure their claims. Owing to this state of facts it was deemed advisable to place the company in the hands of a receiver, until its affairs could be arranged, and all creditors be paid in full without further complications. Upon the appointment of the receiver, some of the workmen consulted an attorney who advised them to file a petition in bankruptcy against the company, which latter has been done, and the cause is now pending in the Federal Court. It is recognized by all the local creditors that this course will be adverse to the best interest of all creditors, as owing to the fact that there is a bond issue of $500,000 secured by a mortgage on the property, it would require at least that amount to handle the property at a forced sale, which figure makes it improbable that there would be much left to distribute to the creditors. All the largest creditors are located in Butte, and on advice of counsel have signed the petitions. If it meets with your approval we would be pleased to have you sign and return both petitions. Will state for your information that the property represents a value well in excess of all obligations, and if the company is permitted a reasonable time will doubtless meet all obligations in full. Negotiations are now being carried on in the East looking to this end, in order to gain the time necessary to accomplish this purpose it will be necessary to prevent action on the petition until the complaining, as well as all other creditors' interests can be fully protected.

Decision Handed Down by Judge Bourquin of the Federal Court May 1, in the suit against the Anaconda provides that the Alice mining property sold some time ago to the defendant company shall again be offered for sale. The decision holds that the majority stockholders had a legal right to sell the property to the Anaconda company, and that the sale was legally conducted, but adds that the price paid may not have been adequate and that the minority stockholders have a right to be paid in cash instead of Anaconda stock if they so elect. The Alice mine has been worked for silver in the early days of the Butte camp. These operations finally failed and the company was in debt, its plant destroyed, its mines closed and flooded; an expense and unprofitable for about 17 years next prior to the sale. This sale was authorized by the majority stockholders and executed to the Anaconda company for a consideration of $1,500,000. The court's decision states that there was a question as to whether this was the highest price to be obtained, and that the minority stockholders have the right to have this determined by an offer of the property at public sale. The court holds that the majority could lawfully sell Alice, but that the minority's right was a fair sale for money to the end that each should receive in money the value of his equity in Alice property. The original sale is not unconditionally set aside, but unless the property can be sold for more, the interest of all the parties thereto require it shall not be disturbed. As a result of this decision, work at the Alice mine was suspended May 4. The Anaconda company had recently undertaken to repair the shaft to a depth of 300 ft. and it was intended to explore the property for zinc as well as for copper ores. As soon as matters are straightened out in accordance with the court decision, work will be resumed.

DENVER—May 7

Oil Flotation is promised in the Silverton district. The American Oil Flotation Co., recently organized, has leased and will remodel the Silver Lake mill to handle ore from leases on the Mayflower, Slide and Terrible mines. This company also controls the Champion group on Sultan Mt. and the Ben Butler group at Animas Forks. Mr. D. L. Thomas, formerly with the Butte & Superior company, Butte, Mont., is chief engineer and metallurgist.

Grade of Cripple Creek Ores is advancing, this being accounted for by general improvement with depth. Figures in support of this assertion are prepared by E. F. Smith, [illegible] of the Golden Cycle mill at Colorado City who has [illegible] beginning with the first of 1913. These show that the company, in 1913, handled ores having an average value of [illegible] per ton. In 1914, the average value per ton was almost $19, while during the first three months of the present year, this average has been over $25. It is admitted [illegible]

Cresson ore boosts this latter average but it must, nevertheless, be included. Another evidence of the improved tenor of ore shipped from this district is found in the increased tonnage shipped to smelteries, it being borne in mind that only higher grades can stand smelting charges. The American Smelting & Refining Co. received about 5 per cent. of the district's production two years ago but it now receives at least 8 per cent. and this proportion is also based on a much larger tonnage.

Total Metallic Production of Colorado for 1914 was compiled by Thomas R. Henahan and made public April 29 just prior to his withdrawal from office as state commissioner of mines in which office he is succeeded by Fred Carroll. According to these statistics, annual gross production was about $34,250,000, exclusive of tungsten, vanadium and other rare metals. This figure is slightly less than the corresponding production for 1913, the difference being accounted for by the decreased prices of metals. The increase in gold nearly compensates for the decreased production of the other metals. The gold ores produced were both greater in tonnage and of higher grade. The aggregate tonnage of ores of all kinds was substantially greater in 1914. Because of the increased interest now manifest in mining as well as because of the higher prices of base metals, he believes the 1915 production will run above $40,000,000. Teller County (Cripple Creek) is credited with 57% of the 1914 gold production while Lake County (Leadville) produced 45% of the silver. Gross production of tungsten and vanadium is estimated at $1,000,000.

SALT LAKE CITY—May 6

The Utah Copper Co. has received from Salt Lake County a refund of $31,790, this amount comprising excess taxes, costs and interest. The company some time ago brought suit for $35,000 alleged excess taxes, paid under protest, and was by the Federal court here awarded $29,000. The county appealed the case, which was retried by the circuit court of appeals, which rendered a judgment of $27,000. The March output of the company is given at 10,200,000 lb. copper.

The Name of Goldstrike has been given to the Bull Valley mining district in Washington County, 38 miles south of Modena. At present there is a good deal of activity there. The Goldstrike Mining & Leasing Co. is doing work on the Hamburg claim, where it is operating a three-stamp mill. A shipment of gold bullion will be made to Salt Lake soon. This lease is reported to have produced $10,000 or $12,000 in six weeks. The La Vore Gold Mines Co. is driving a tunnel; work is being done on the claims of the Bee Bee Gold Mining Co. The Red Bull Mining Co. will soon begin work on the Evans group of claims east of the Hamburg. The camp now numbers about 1000, with more coming in.

A New Mill to Treat Tailings will be built at Atkinson, seven miles north of Park City. More than 800,000 tons of tailings accumulated here from the various Park City mills between 1875 and 1905 were purchased a year ago by the Big Four Co. Tests have been in progress to determine the best method of recovering the zinc, lead, silver, and gold. Straight concentration has been decided on as most satisfactory with a minimum outlay of capital. The mill has been designed by Kirk & Leavell of this city, who will have charge of construction. The capacity will be 150 tons daily. Tables and vanners will be used. There will be a tube mill to regrind middlings. The tailings run in the neighborhood of $5 a ton, the value being about equally divided between zinc and lead-silver.

SEATTLE—May 5

Quartz Mining in the Fairbanks Creek District has taken a distinct boom as a result of the erection of the Heilig custom mill. The first run was on 14 tons from the Mizpah claim and returned $81 a ton. The Mizpah is developed by an 85-ft. shaft and about 75 ft. of drifts; it is owned by Thompson, Gius & Hess. The mill crushed the 14 tons in 18 hours, which is a good showing for the small Huntington. Other lots of ore to be milled as soon as possible include 25 tons from the Goyette & Ward property, 30 tons from the Hoover workings on the Helen S. claim, 25 tons from the Cook Bros. property, 25 tons from the Pioneer vein, and 150 tons from the Huddleston-McNeil mine.

Larger Alaska Tin Output is expected this year as a result of renewed activities of tin dredgers in the territory. The Union Construction Co. of San Francisco, which has a dredge operating on Buck creek, is expecting to take out practically double what it did last year. The American Dredge Building & Construction Co. has during the winter constructed, at a cost of $150,000, three dredges for the American Tin Can Co. of Portland which are now being shipped into the York district where the company has 37 claims. The American Gold & Tin Dredging Co. and the York Tin Mining Co., which own extensive property in the Hot Springs district, are preparing to open up their ground on a large scale. The American Tin Plate Co. has had three dredges constructed for the handling of the tin in the Nome district, making a total of five dredges this company will have working this summer in that district. The dredges are equipped with double flumes so that no time will be lost in cleaning up; a special device to separate the fine particles of gold from the tin nuggets being installed. Some samples of tin ore found on a stream last summer between Fairbanks and the Iditarod showed excellent values and the discoverers have announced that fuller investigations will be made this year with a view of installing a dredge. The largest production is expected from the Nome and York districts though considerable will be brought out from the Hot Springs district. In the latter district production is necessarily slow on account of the frozen gravel in which the tin lies but the values run in such large quantities that it is expected more operators will be busy there this summer.

JUNEAU—May 1

That Every Saloon in Southeastern Alaska will be put out of business is freely predicted. A census will be taken of every male and female resident within two miles of any saloon district and at an election to be held May 24 there must be cast a vote, which will constitute a majority of those enumerated in the census, in favor of the saloons, or else the latter will have their licenses rejected. In other words, all persons not voting at the election May 24 will be counted on the side of the "drys."

HOUGHTON—May 8

More Men are Employed in the mines of this district than before the strike, 15,000 being on the payroll which will amount to over a million dollars a month, the biggest payroll in the history of the district.

An Influx of Workingmen into the Michigan copper country just at this time is unfortunate. But the stories of the renewal of operations at the copper mines, the full-time tales and the increases in wages voluntarily announced by the mining companies have been so generally printed all through the country that every train is bringing in more and more workingmen. Large numbers of these are incompetent. Larger numbers come from the iron-mining districts, where conditions have not picked up as they have in this mining section. The truth is that while the mines here are today employing more men at better wages than ever before in the history of the district there is no opportunity for the inexperienced miner. Neither is there any chance for the preacher of red anarchy. And unfortunately there are many men who are here without jobs and without the price to get out of the district and some of them are going from door to door seeking food.

GALENA, KAN.—May 1

The Promoter Company is operating the New Century ground which is developing into one of the best in the Galena district. Since the water was removed a few months ago there have been several mines started and many of the richest strikes in the district have been made on that ground. The filling of the drift under Main St. has commenced. The work of removing a large pillar from under the street has just been completed by Williams & Co., who contracted to pay for the refilling if permitted to remove the pillar. A drill hole has been put down and the filling is being put through it. City Engineer Ricksecker is overseeing the work. This will be a decided improvement to the street at this place and will be without expense to the city. The ground will be safe permanently after it is filled with gravel, it is believed. The pillar was rich, having assayed 22% lead as it was hoisted from the ground; $7000 was realized from it.

TORONTO—May 2

A Process for Making Steel in the electric furnace direct from magnetic iron ore is being experimented with in Ottawa for which tests the Canadian Parliament has appropriated $10,000. The experiments are being conducted by the Mines Bureau.

The Importance of the Mining Industry in Ontario is indicated by the annual statement by the Government for 1914 which shows receipts by the mining bureau of $196,103, as follows: Mining leases, $16,469; Crown leases, $10,755; miners' licenses, $24,160; miners' permits, $860; miners' reading fees $29,144; miners' royalties, $71,685.

The Reservation of Mining Rights on the lands granted t the Grand Trunk Pacific Ry. has been cancelled by an Order in Council issued by the Canadian Government. The land had previously been withdrawn from mining entry in orde that the company might not be embarrassed in the construc tion of the road. The road being now completed, the compan takes over the land grant with mining as well as surface rights.

The Mining News

ALASKA

ALASKA-GASTINEAU (Juneau)—Duplicate of big Nordberg air compressor already in use will be installed at portal of Sheep Creek adit. Will be driven by 540-hp. G. E. motor and will have displacement of 28,000 cu.ft. of air per min. Capacity of two machines expected to be sufficient for daily output of 12,000 tons of ore from mine. The Gastineau company will also start work soon to develop 12,000 hp. of hydro-electric power from Annex and Carlson creeks. Lake at head of Annex Creek will be tapped this summer and will yield 4000 hp. Eventually a large concrete dam will be built and water power developed to capacity.

ARIZONA

Cochise County

MASCOT COPPER (Dos Cabezos)—Will soon finish construction of Mascot & Western Railroad which run from Wilcox, Ariz., to Mascot townsite. President of company states that it has approximately 1,500,000 tons of copper ore blocked out and will begin shipping to Copper Queen smeltery about 200 tons per day as soon as railroad is finished.

Gila County

MIAMI (Miami)—Trial of Minerals Separation suit in Delaware for flotation infringements entered its seventh week.

OLD DOMINION (Globe)—Has advanced wages on sliding scale with copper advances. Affects 1000 men. April production 1,300,000 lb. copper.

SUPERIOR & BOSTON (Globe)—Is employing about 100 men; continues shipments of copper ore to El Paso smeltery. Force of employees is being increased.

IRON CAP (Globe)—Is shipping four cars weekly to El Paso smeltery; ore averaging 10% copper. High-grade ore, averaging between 25 and 30% copper, being stored; about 200 tons already on stock pile. Collar of shaft has been concreted to depth of 18 ft.; shaft retimbered 200 ft. below concrete.

Greenlee County

ARIZONA COPPER (Clifton)—Will remodel mill. Norman Carmichael, manager, at present in Edinburgh discussing and arranging details.

MAYFLOWER DISTRICT (Duncan)—Reports from Mayflower mining district that gold ore of high grade is being found. Six men are at work on property in Mayflower district 10 miles from Duncan churn drilling for copper and ore averaging 1½% has been encountered.

Mohave County

GOLD ORE (Gold Road)—Has begun sinking shaft from 350-ft. level to the 550. Property lies north of Gold Road and is receiving air from that property for operation of its drills.

VICTOR-VIRGIN (Oatman)—Orion company has taken over Victor-Virgin group and has begun unwatering. A crosscut is to be driven from the 500-ft. level of the Victor to Treasure Key.

UNITED WESTERN (Oatman)—A 60-hp. hoist and a 300-ft. compressor with proper distillate engines have been ordered. Shaft will be sunk 400 ft. before crosscutting to catch extension of United Eastern vein.

McCRACKEN (Yucca)—Old mines of McCracken Hill have been bonded to Eastern capitalists, who propose to develop entire group on large scale, commencing within 30 days. Railway is projected to Yucca or Haviland. Property has produced about $3,000,000.

Pinal County

KELVIN-SULTANA (Kelvin)—Concentrator was put in operation on May 1. Work has been resumed in the mine. Most of the ore being treated in mill now comes from stock pile accumulated during past two years and from old stopes.

MAGMA COPPER CO. (Superior)—Has almost finished campaign of building and equipment that has covered several months. Narrow-gage railroad 30 miles long has been built between town of Superior and Webster station on Southern Pacific nine miles northwest of Florence. Another shaft from 1200 level to surface almost completed, has been cut mainly by a series of raises and winzes. Shaft is two compartments, but will be widened immediately to three compartments when present raising is through to surface. New hoist will be Nordberg with capacity of 10,500 lb., hoisting speed of 750 ft. per min., 2000 ft. capacity drums.

Yavapai County

COPPER CHIEF (Jerome)—Has been announced will build its own reduction works four miles south of Jerome. Mill will have capacity of [illegible] tons per day and will include stamps, tube mills and cyanide plant.

CALIFORNIA

Amador County

IONE COAL & IRON CO. ([illegible])—Factory for manufacture of coal briquettes has been established.

ARGONAUT (Jackson)—Monthly production reported to [illegible] $60,000. Inclined shaft has reached the [illegible]200 ft. point.

Inyo County

PITTSBURG LIBERTY ([illegible])—Old mill will be overhauled and reconstructed on modern lines.

Kern County

SAN ANTONIO (Randsburg)—Recent cleanup yielded $600 gold, $270 silver.

PHOENIX (Johannesburg)—Cleanup from Phoenix-C[illegible] shaft for April netted $2050.

YELLOW ASTER (Randsburg)—Twentieth anniversary of operation of this mine was Apr. 23, in commemoration of which "Randsburg Miner" published special number.

SAN ANTONIO M. & M. (Bakersfield)—New corporation with $25,000 capital stock organized by E. L. Foster of Bakersfield and E. V. Reed and F. L. Binford of Los Angeles. Company owns claims in Red Rock district.

Kings County

KINGS QUICKSILVER MINING (Parkfield)—Reported that orebody disclosed on first level has been stoped 150 ft. long and 50 ft. wide. Ore is being treated in a Scott furnace with satisfactory returns. Concentrates and 6-ft. Huntington mill with a capacity of 100 tons in 24 hours being installed.

Mendocino County

MANGANESE DEPOSIT discovered in Potter Valley in vicinity of Ukiah. Property is owned by Leo Lambert. Reported that J. O. Hays of San José is considering disposition of options on property. Further reported that manganese has been found on Hoppe Ranch.

Modoc County

MODOC MINES (Fairport, High Grade District)—Reported that $50,000 will be devoted to equipment and that shaft will be deepened to 500 ft. Modern reduction plant designed to treat both company and custom ore will be installed. N. E. Guyot, manager.

Nevada County

POLAR STAR (Grass Valley)—New headframe being installed and mine being made ready for immediate operation. Shaft is down 300 ft. and good ledge about 4 ft. wide has been disclosed. Mine well equipped with machinery. Walter Byrne of Salt Lake is owner.

UNION HILL (Grass Valley)—Ten stamps in commission now running on low-grade ore. Connection from 800 level to intersect Union Hill vein continued. Development of Georgia vein in upper workings is also proceeding. Large output in summer months is expected.

EMPIRE (Grass Valley)—Ore is being developed on the 4600 level of the Pennsylvania vein which was recently disclosed. The new mill is giving good results. Reported that old 40-stamp mill will be replaced with modern equipment corresponding to new unit recently completed, which consists of twenty 1370-lb. stamps. Reported that the apex question between the Empire and North Star has been tentatively settled.

CLEVELAND (Grass Valley)—James Hawke, owner of placer mine in Deer Creek two miles west of Grass Valley, contemplates installation of dredge of dry land type. The gravel will be dug with clamshell bucket and dropped into sluices. The tailings of coarse gravel will be carried by conveyor belt. Steam power will be used with wood fuel.

Sierra County

JUMPER—(Downieville)—At this quartz claim an arrastra is running steadily on pay ore and second one will be added soon.

GOLD STANDARD—Active work has been commenced on this quartz property in Slate Castle Ravine, owned by J. W. Henderson and G. P. Moore of San Francisco.

SIERRA CITY (Downieville)—A strong vein over two feet wide of milling ore averaging $30 per ton has been uncovered at Keystone mine, in virgin area in lower adit.

FOREST (Downieville)—North Fork mine sulphurets have become arsenical with depth and both gold and silver have steadily increased. A 5-stamp mill is to be installed. G. F. Stone is manager.

GIBRALTER MINING (Downieville)—Corporation organized to develop rich gravel property known as Gibraltar, has been granted permission by Blue Sky Commission to sell 100,000 shares of stock at 50c. per share.

COLORADO

El Paso County

U. S. REDUCTION & REFINING (Colorado Springs)—New president visiting old plants and says it is likely some will be remodeled and put in operation affording Cripple Creek district further reduction opportunities. Motion for dismissal of receiver filed at Denver.

GOLDEN CYCLE (Colorado Springs)—In sworn statement given to stock exchange, officials claim the mill to have yielded, to date, $[illegible] in bullion, that the Pike's Peak Fuel Co., one of company's large assets, has produced 1,117,1[illegible] tons lignite, that dividends for past 12 months totaled $1,0[illegible],000, that gross bullion production for April was $[illegible],000, the latter recovered from ore having average gross value of about $23 per ton.

Gilpin County

EAST WHITING (Central City)—S. A. [illegible] of [illegible] is [illegible] out, unwatering and reopening the [illegible].

[illegible] (Central City)—Shaft has been sunk [illegible] level, [illegible] continuous vein averaging [illegible] of [illegible] oz. gold ore. During [illegible] 100 tons of the [illegible] was treated in Smith m[illegible] of few [illegible] of country and this [illegible].

ment was done in search of that mineral though none was found in appreciable amount

Lake County

BIG FOUR (Leadville)—Rebuilding surface plant destroyed by fire in January. It is probable that shaft workings will be connected with Yak tunnel by driving crosscut from latter.

PENROSE (Leadville)—Pumps recently installed in shaft to unwater downtown mines soon developed defects and pumping was suspended a week to make changes and repairs.

Ouray County

WANAKAH SMELTERY (Ouray)—Will install sintering device to treat accumulated flue-dust.

Pitkin County

CONTACT TUNNEL (Aspen)—Has penetrated numerous rich streaks but no development given them as Manager F. D. Willoughby prefers to push breast to its projected object, a well-known silver-bearing contact.

San Miguel County

MOUNTAIN FLOWER (Telluride)—Delta crosscut, being driven to open Delta vein, now in more than 1000 feet

Teller County

SITTING BULL (Victor)—Shaft down 250 ft. will be relined and sunk to 1000 ft. under contract by Ladell and Martin.

JEFFERSON (Victor)—Denver men financing reopening of this pioneer mine in business portion of city, entirely in granite formation.

TRAIL (Independence)—Strike of 4-ft. oreshoot made on 1200 level and 2 carloads shipped. Property belongs to Elkton Consolidated Gold Mining Co. although it is separate from main holdings.

DOCTOR JACK POT (Anaconda)—Starkweather and Wilson production from Ingham vein during April was about $40,000. Vein is 25 ft. thick and runs about 2 oz. per ton without sorting.

AJAX (Victor)—Lease block 13, held by Worthington and Downer, has 9 ft. of high-grade, found behind what was heretofore thought hanging wall. Shoot now exposed more than 100 ft., its average content is nearly 10 oz. per ton. It has four streaks, each of which is from 1 to 6 in. thick and rich in tellurides.

EL PASO (Cripple Creek)—Heavy shipments being made to Golden Cycle mill, Colorado City, from numerous leases in upper workings. Leases being granted to several parties to screen and wash various large dumps that were created during early operations and presumably of good grade for present-day conditions.

ISABELLA (Independence)—Three-foot body of high-grade ore opened in Buena Vista vein, 1400 level. This ore runs high in silver as well as gold. About half of vein is of vuggy structure, rich in tellurides and assaying about 15 oz. gold and 70 oz. silver. On 900 level of Lee workings, leasers have exposed 3-ft. vein averaging $200 gold per ton. There are 45 sets of leasers working in these properties and showings are favorable. Mine will hereafter work night shift to do most of the hoisting and conserve steam during day shift for compressors.

KANSAS

PORTIA (Galena)—Running double shift now and is among best producers in district. Property has lain idle for several years until S. R. Ping and associates acquired control.

HARTFORD (Galena)—Running full time now after being partly down for some weeks repairing and timbering one of shafts, which become dangerous through removing a pillar in one of drifts.

TIWAGH (Galena)—Has been idle for some time, but recently mine was drained and new shaft was sunk and dirt is being hoisted from both shafts. Mine joins Diplomat on the south which has been and is now one of the best producers in district.

TEXAS (Galena)—Has taken over United Zinc Co. property at Badger, north of Galena, and will install heavy pumps to drain ground and rebuild dikes along Spring River banks. Expects to spend about $100,000 in improvements and development work.

CAVE SPRING LEAD & ZINC (Galena)—Has about completed its dam across Short Creek just above old Grass Root mines, with purpose of diverting water and making it possible to work these mines again. Grass Root was one of most profitable mines in district for small mine, fully $50,000 worth of ore having been extracted. Expect to erect modern mill.

MICHIGAN

Copper

ESTIMATED COPPER OUTPUT of Lake Superior district for April is slightly over 21,000,000 lb. net refined metal.

MOHAWK (Mohawk)—Important plans for more extensive use of electricity in Mohawk are under consideration

TAMARACK (Calumet)—-Equipment for regrinding plant for stamp mills is on way and will be set up with all possible dispatch upon arrival

COPPER RANGE (Houghton)—During 1914 the average refined copper per ton of rock was 21.95 lb. compared to 21.7 average for period of 10 years

WOLVERINE (Calumet)—Is building railway spur distance of 600 ft. to connect with Mineral Range and save great deal of teaming. Track now run to shafts

LA SALLE (Calumet)—There will be resumption of operations within three weeks. Men now at work pumping out the shafts and getting things in readiness. This will require considerable time

CALUMET & HECLA (Calumet)—Two million pounds of steel for new leaching plant at Lake Linden have been ordered for immediate shipment. Work begins July 1. Dredge at No 2 regrinding plant of mills goes into commission within 10 days. This will be first large test of rehandling of sands out of big tailings pile in lake

ISLE ROYALE (Houghton)—Turbine in new stamp mill is in place; at least one head in mill ready to go into commission about June 15. Turbine will be operated by exhaust steam from stamp head.

AHMEEK (Ahmeek)—Two additional shafts, North Ahmeek, will be ready to go into operation by June 1. They could hoist rock before that date if there was mill capacity ready for them. They were shut down when war started, so there is comparatively little work necessary to get them in readiness for hoisting.

QUINCY (Hancock)—Bottom drifts from Mesnard shaft, like those in other shafts, are showing better in copper. Faces of extreme north drifts from 51 level down, are in fair copper ground, more or less bunchy. Outlook is good for stamp rock to continue with depth in these lodes. Like those of other shafts, bottom stopes show slight improvement in copper contents. Copper rock sent to stamp mills from this shaft has shown higher copper content during last six months on account of its being mined freer of wall rock.

Iron

SOUTH JACKSON (Negaunee)—Cleveland-Cliffs Iron Co. has given orders for opening this pit mine. Crusher at property was started this week. About 50,000 tons will be shipped. The crusher also handles the ore from some of other soft ore mines of company on Marquette range.

BRISTOL (Crystal Falls)—Surface right to parts of Sections 24 and 25, T 43, R 33, has been purchased by this company. Part of tract is underlaid with ore. Mineral right has been held for some years. It is intention to charge course of Brial Hill Creek, as orebody follows river course for some distance. Lands are now being drilled.

CLEVELAND-CLIFFS IRON (Ishpeming)—President W. G. Mather, of Cleveland, was at the local offices this week. He stated that no large movement of ore is looked for this year. His company has over 3,000,000 tons of ore in stock on Marquette range, over 600,000 tons at Negaunee and Mass properties in Negaunee and over 500,000 at Stephenson mine at Gwinn.

MINNESOTA

Duluth

APRIL ORE SHIPMENTS from Duluth-Superior ports including Two Harbors, for April totaled 396,273 tons as against 86,886 tons in 1914.

Cuyuna Range

MAHNOMEN MINING CO. (Ironton)—Company recently incorporated by C. K. Quinn and others, Mesabi Range operators, to strip deposit owned by Cuyuna Iron & Manganese Ore Co., adjoining Pennington Pit. Contract for stripping been let to A. Guthrie & Co. Average depth of overburden 65 to 70 ft.

Mesabi Range

GRAHAM (Old Mesaba)—Tracks being laid to this property. Tracks were placed in 1912 and removed again in that year. One shovel will be put to work in pit.

BRUNT (Iron Mountain)—Shovel which has been stripping overburden is now in ore. Drying plant has been started. Ore is going forward to the docks. Fifty men are employed.

Vermilion Range

SIBLEY (Ely)—New shaft now down 133 ft. below surface. Crew at work raising from below. Shaft will be of steel, lined with concrete, 3-compartment, two skips and one cage. Upon completion of new shaft, in probably three months, old shaft will be abandoned, being located in the orebody. New shaft will be 600 ft. deep.

MONTANA

Beaverhead County

BANNACK CONSOLIDATED (Bannack)—Mill is to be constructed for treatment of some 200,000 tons ore in sight Will be amalgamation and cyanide with initial capacity of 100 tons daily. John M. Browning, of Ogden, is president of new company.

Deer Lodge County

TREASURE STATE MINERAL—Will resume operations at its placer claims for recovery of gold and sapphires. Property which is located in Déy Cottonwood Gulch, 18 miles northwest of Butte has been idle for nearly 15 years due to litigation For last 10 days men have been at work repairing big dredge that has been on ground for years and it is expected that it will be ready for operations within a few months. Has capacity of 2000 cu.yd. per day. The gold said to average from 17c to as high as $1.60 per cubic yard. Sapphires also are of goo quality and size.

Silver Bow County

EAST BUTTE (Butte)—Has resumed full capacity operations and will sink shaft now 1770 ft. deep to the 2000-ft level.

DAVIS DALY (Butte)—During quarter ended Mar. 31 shipped 1135 tons of ore averaging 3.7% copper and 7.2 oz. silver Picked up new vein on 2500 level containing some commercial ore but ultimate value not determined.

ANACONDA (Butte)—Output from all operating mines o company for April was 21,800,000 lb. of copper, an increas of 2,800,000 lb. over March. Judging from present indication May production will show gain over previous months and wi bring the company's output up to normal.

BUTTE & SUPERIOR (Butte)—Payroll for April will tot more than $155,000, largest in history of company. Outpu was in excess of March record which up to that time was als largest in history of company. April output was 43,500 ton of ore, with concentrates realized to the amount of 13,100 ton

NORTH BUTTE (Butte)—During quarter ended Mar. there were mined, shipped, and treated 55,683 wet tons of o and 24 tons of precipitates resulting in the production 3,358,325 lb. of copper, 179,568 oz. of silver and 180.6 oz. gold Report says that policy of extensive development wo will be continued

BUTTE-BALLAKLAVA (Butte)—Active operations we resumed May 1. Since February has only been operati through leasers in small way; 50 men were put to work taking out ore on all levels between the 800 and 1600 ft.; number will be increased steadily until about 125 men are employed. Output of mine will be about 150 tons per day, and this will be increased as additional men are put to work to reach approximately 350 tons. The ore is being sent to Washoe smeltery. It averages between 4½ and 5% copper.

Teton County

AMALGAMATED OIL COMPANY—Several well known Butte men have recently organized this company for purpose of drilling for oil in Sweetgrass Valley oil belt in northern Montana where company has number of leases. Company not entirely dependent on Montana, having secured similar leases in coast oil belt in Texas.

NEVADA

Clark County

AZALEA (Goodsprings)—Vein of high-grade zinc carbonate recently opened. Truck road has been constructed. Ore will be hauled to Jean by motor truck. Walden Kemp is Superintendent.

AKRON (Goodsprings)—High-grade silver ore recently discovered. Assays from 40- to 600-oz. silver per ton were obtained from cropping which also contains carbonates of lead and zinc. A shaft has been started on discovery.

POTOSI (Arden)—Eight motor trucks now being used for ore haulage from mine to Arden. Production approximately 800 tons of zinc carbonate. Calcining plant recently erected has proved successful, and has been recently overhauled and enlarged. Expected that this method of treatment will be used at some other properties in Yellow Pine district.

WHALE (Goodsprings)—This property has recently been bonded by the Nevada Whale Mining Co., composed of Salt Lake capitalists headed by W. P. O'Meara. A 10-ft. vein of zinc-carbonate ore has been opened by a tunnel and shaft. A small compressor has been installed and air drills will be used for further development. Thomas Varden is superintendent.

Elko County

GUARANTEE MINING & DEVELOPMENT (Elko)—Articles of incorporation filed, capitalization $2,500,000. Principal place of business, Farrington Building, Elko, Nevada.

RIP VAN WINKLE (Elko)—Lease let on this property 30 miles north of Elko and work will begin at once. This property sold recently to Alaska Improvement Co. for $25,000. Ore, silver-lead of good grade.

Esmeralda County

SANDSTORM-KENDALL (Goldfield)—Crosscutting on 350 level started. Drifting on 500 level continuing in ore.

COMBINATION FRACTION (Goldfield)—Good-grade gold ore opened recently on 250 level near Florence end line. Work being done by leasers

JUMBO EXTENSION (Goldfield)—Ore from development work being shipped to local sampler. Development work under way in seven places. Stated ore reserves doubled in last three months.

SILVER PICK CONSOLIDATED (Goldfield)—Cutting station on 700 level begun. Ground at this point hard latite, eliminating trouble with swelling ground. Water increasing with depth, but pumping plant of sufficient capacity to handle it.

BOOTH (Goldfield)—Development work being done on 350 and 500 levels. Small tonnage good-grade ore developed. Connection made on 500 level with Laguna workings of Goldfield Consolidated for ventilation; raises now being lifted from this drift in vein showing seams of high-grade ore.

GREAT BEND (Goldfield)—Mining operations resumed by company; work for past two years done by leasers only. Leasing company on eastern part of property built mill some time ago and operated at good profit, making shipments of high-grade ore in addition. This lease taken over by company, development work resumed, and mill will be enlarged. Compressor, five piston drills and No. 8 Cameron pump ordered.

Humboldt County

ODDIE LEASE (Willard)—Ore shoot 2 ft. wide, assaying $62 in gold, opened in trenching; sinking now under way.

LEONARD CREEK PLACERS will be in operation soon. Good-grade placer ground on both Leonard and Tepee creeks.

NEW MILL AT ROCHESTER will be built soon by McIntosh-Pitt, Original Rochester Mines, Crown Point Extension, and Rochester Belmont properties.

FINLANDER (Willard)—Option taken recently by J. W. Willard. Property consists of two claims adjoining Honey Bee, original strike of district. Vein exposed for length of 1200 feet.

ROCHESTER BELMONT (Rochester)—Leases all expired and work resumed by company. Crosscut tunnel will be driven to cut vein at depth of 600 ft. on Little Sunflower No. 2 claim.

TAYLOR (Winnemucca)—Shipment of carload gold-silver ore assaying $80 per ton made from this property in Sunshine district, 30 miles from Winnemucca. Considerable tonnage milling-grade ore placed on dumps for future treatment.

ROCHESTER MINES (Rochester)—New mill with estimated capacity of 100 tons is treating 120 tons daily and will treat 150 tons in short time. Extraction now 89%, expected this will be improved. Work on new 1100 crosscut tunnel started.

Lander County

SURVEYS BEING MADE of copper properties under bond to W. P. Hammond interests. Development work will start soon.

COPPER SYNDICATE (Battle Mountain)—Company will prospect claims in Copper Basin with churn drill; Keystone drill, 1200 ft. capacity, purchased from Glasgow & Western.

KIMBERLY CONSOLIDATED (Hilltop)—Milling plant began operations recently; plant running full capacity. Good-grade gold ore being treated.

CAMERON & HART (Austin)—This leasing firm has moved its cyanide plant to tailing dump at foot of grade and is now ready for operations. Tailing will be dug by scrapers and will be hauled on bridge-work over tank. Dump contains 3000 tons assaying 7 oz. silver and 60c. gold.

AUSTIN-NEVADA (Austin)—Hiawatha tunnel cut 4-ft. oreshoot at 150 ft. from portal; drifting west in milling-grade ore now under way. Tunnel will be driven further to cut three other veins showing silver chloride and sulphides on surface. Main tunnel now in 600 ft., oreshoot 60 ft. long showing ruby silver opened.

Lincoln County

PROVIDENCE MINES & COMMERCIAL CO. (Pioche)—Petition in bankruptcy set for hearing in Federal Court at Carson City.

PRINCE CONSOLIDATED (Pioche)—Shipments of manganese ore being maintained at an average rate in excess of 10,000 tons per month. About 100 men on pay-roll.

PIOCHE AMALGAMATED (Pioche)—Short crosscut into foot-wall on 1200 level opened new vein, 2 to 6 ft. wide. Leases let on slag dumps of Pioche Consolidated and Bristol Wells.

AMALGAMATED PIOCHE (Pioche)—Force at work has been somewhat curtailed during the past week owing to the refusal of the smelters to accept zinc shipments. About 80 men still on the pay-roll.

Lyon County

PRESCOTT MINING (Ludwig)—Operating North Douglas property; tunnel now in 600 ft., being driven.

SUTRO TUNNEL CO. (Sutro)—Transfer of 1250 acres land made to Celestino Carrara recently; consideration, $30,000.

DONOVAN MILL (Silver City)—Addition of five stamps with electric motor drive made, making total of 15 stamps.

EMPIRE-NEVADA (Yerington)—Leasers Oberg & Taylor are shipping good-grade coper ore. Leasers in Vardy shaft are also breaking shipping-grade ore.

HOTALLING MILL (Dayton)—Operations will start soon; ore from Hayward mine, Silver City, will be treated. Two shifts working at mine. Pumps will be installed in shaft.

NEVADA-DOUGLAS (Ludwig)—Satisfactory progress being made on construction of new leaching plant. Concrete foundations all finished and work on superstructures under way. Digester installed, absorption towers nearly completed and condenser enclosed and ready for pipe connections. Bluestone mine, Mason, is being examined.

Mineral County

OLD KENTUCKY (Sweetwater)—Mine bonded by Eastern men and work started May 1. Mine a famous producer in early days.

LUCKY BOY CONSOLIDATED (Hawthorne)—Main tunnel now in 5800 ft., driving west will be continued. Raise being lifted to connect with Hubbard shaft. Fifty-foot crosscut driven to King vein; five oreshoots opened. Leaser on Oregon claim opened shoot showing free gold.

Nye County

TONOPAH ORE PRODUCTION for week ended May 1 was 10,665 tons, estimated at $217,930, compared to 10,109 tons the week previous. The producers were: Tonopah Belmont, 3648; Tonopah Mining, 3000; Tonopah Extension, 1680; West End, 825; Jim Butler, 1100; Tonopah Merger, 154; North Star, 50; and Halifax 208 tons.

TONOPAH CASH BOY (Tonopah)—Lowering water in Victor shaft will drain Cash Boy, permitting work at greater depth.

MIDWAY (Tonopah)—Seven leases let in ground opened by old shaft between 200 and 500 levels; more will be let. Company operating ground opened by new shaft.

NORTH STAR (Tonopah)—Drifting on 2-ft. oreshoot of good grade, assaying almost entirely in gold, under way on 1250 level. New crosscut started to cut western extension of vein

LLEWELLYN PLACER (Round Mountain)—Two monitors working; water supply secured from Jefferson, Slaughterhouse and Shoshone cañons. Record nugget for this ground, valued at $240, found last season.

Storey County

UTAH (Virginia City)—Hoisting plant being demolished. This one of principal hoisting plants on Comstock Lode in early days.

MEXICAN (Virginia City)—Good-grade ore being broken in north stope on 2300 level. Winze station in Patton crosscut on 2500 level being repaired preparatory to work on deeper levels, soon to be made accessible by work of Comstock Pumping Association. Similar preparatory work under way in Ophir, Consolidated Virginia and Union Consolidated

OPHIR (Virginia City)—Work in Central tunnel continues to open good tonnage low-grade ore. Ventilation greatly improved by repairs to raise on Andes line. Stoping on East ledge under way. Mill shut down three days recently for repairs. Work on 2500 level under way jointly with Consolidated Virginia. Winze to 2700-ft. level will be repaired preliminary to work on that level.

White Pine County

COCOMONGO MINING (Cocomongo)—Ten-stamp mill overhauled and operations resumed on custom ore supplied by leasers in district. Camp is six miles southwest of Cherry Creek

NEVADA CONSOLIDATED (Ely)—Production now normal. Steam shovels operating on hill between Eureka and [illegible] pits with purpose of joining them, pit will then be [illegible] mile wide. Preparations for underground mining [illegible] mine under way

ELY AMALGAMATED (Ely)—This property [illegible] mining district will build concentrating plant so[illegible] ments made with Nevada Consolidated for [illegible]ly. Large tonnage good-grade concentrating o[illegible] mine. Stated Ely Gibraltar may also build [illegible]

OREGON

Baker County

GOLDEN GATE MINE—The 10-stamp mill at this mine has been started after having been closed for several weeks.

J. F. ELSTEP, representing a California syndicate which has secured options on the Emil Melzer holdings on Clark's Creek, has started drilling operations with view of erecting dredger.

POWDER RIVER GOLD DREDGING (Sumpter)—Work of clearing brush getting ready for digging pit for new dredge is under way. The dredge will be a duplicate of the one now in operation by this company near Sumpter, except it will have 7-ft. instead of 9-ft. buckets as on dredge now in use.

Coos County

TWO TONS OF GOLD-BEARING BLACK SANDS have been taken from the South Inlet district near Marshfield, by J. C. Moulton, representing San Francisco company. Samples were taken from prospects recently opened up by John R. Smith. Company will drill district thoroughly with view to mining same for gold and platinum. These deposits are an old beach and gold-bearing sands are covered with few feet of earth and rubbish.

Curry County

MANY PLACER CLAIMS are being staked in vicinity of Rock Creek which is back from Ocean Beach at Port Orford. Considerable amount of nuggets has been found.

Josephine County

OSCAR CREEK PLACER—Bernard P. Miller has taken a lease on this property on the Applegate River which has been a good producer of large show nuggets.

KERBY QUEEN MINE (Waldo)—Ore from this mine being transported 40 miles by wagon to railroad at Grants Pass for shipment to smeltery at Kennett, Calif.

GREENBACK MINE—Miller and Gale, who have recently optioned this property are now making test run at mill, ten stamps being in use. This mine has yielded well to previous owners but has been idle for two years.

COPPER QUEEN (Leland)—Plant has recently been rearranged and new equipment added by P. B. Wickham who recently purchased property. Operations at cyanide plant have commenced; plant has capacity of 20 tons per day and will be increased to 40 tons per day within next month.

UNITED COPPER & GOLD—Copper properties of this company sold to Charles O. Wheeler and associates of Scranton, Penna., for $250,000 to be paid in installments during the next three years. Mine is 33 miles west of Grants Pass on Illinois River. Operations at the mine are to begin in June.

Lincoln County

B. F. JONES (Roseburg)—Formally receiver of Land Office has purchased Sweet Bros. concentrator and will go into black-sand mining on beach at Otter Rock post office.

UTAH

Beaver County

PALOMA (Milford)—Two feet of zinc ore of good grade found in old shaft on this property in Star district.

ROB ROY (Beaver City)—Work has been resumed at this property five miles north of the Sheep Rock. B. T. Farnsworth of Salt Lake is interested.

LEONORA (Milford)—Lying between Moscow and Cedar Talisman, will install compressor and hoist. Crosscutting will be started from drift off main shaft, for Thompson fissure. There are three other fissures which will be prospected at contact of limestone with monzonite intrusion.

Juab County

TINTIC ORE SHIPMENTS for week ended Apr. 30 amounted to 132 cars compared with 116 cars week previous.

GODIVA (Tintic)—Has opened up 4½ to 5 ft. of ore in raise from 200 level assaying 35% zinc with but little lead.

MAMMOTH (Tintic)—Resumed shipments with six carloads ore from 600 level after a nonproductive period of four months.

Salt Lake County

UTAH METAL & TUNNEL (Bingham)—This company has opened body of silver-lead ore in raise above main tunnel. Material runs well in lead and silver and carries copper and gold.

UTAH COPPER (Bingham)—Arthur and Magna mill now working at full capacity, treating daily from 18,000 to 20,000 tons of ore. Additional flotation equipment to treat feed from the secondary classifiers is being considered.

Summit County

PARK CITY ORE SHIPMENTS for week ended May 1 amounted to 1987 tons compared with 1960 tons week previous.

Tooele County

INTERNATIONAL SMELTERY (Tooele)—Is running five furnaces on lead ores and three reverberatories on copper. Approximately 1000 tons of lead ore and 600 to 700 tons of copper ore are being treated daily.

MINES IN DRY CAÑON section of Ophir district are shipping about 1000 tons per month. Those producing are: Hidden Treasure, Mono, Stephens, Brooklyn, and Utah Queen; also numerous leasers. Post office for this section is Gisborn, Utah.

DRY CAÑON CONSOLIDATED (Stockton)—Is driving tunnel for purpose of picking up continuation of Queen of the Hills oreshoot, lost through faulting. Tunnel is in 4000 ft., and for the last 200 ft. has passed through highly mineralized ground. Queen of the Hills ore ran well in lead and silver.

WASHINGTON

Stevens County

NORMAN LEAD (Northport)—Owing to inability to agree upon development plan with owners, has concluded not to proceed with installation of new machinery at present time.

UNITED COPPER (Chewelah)—Will increase working force from 75 to 100 men. Output will gain accordingly, in preparation for operation of 50 stamps now being added to the milling capacity. Conrad Wolfle, of Spokane, is manager.

AMERICAN REDUCTION (Spokane)—New organization, with $250,000 capital, by F. R. Clark, mining engineer, has acquired North Washington Power & Reduction Co., at Republic. Consists of concentrator, power plant, and mining equipment. Will begin active operations.

WISCONSIN

Grant County

WISCONSIN ZINC (Platteville)—Company is prospecting on old Broadway leases in the City of Platteville.

Iowa County

ROSS (Linden) This old producer will add another milling plant.

LUCKY SIX (Mifflin)—Company is erecting 200-ton mill at Dodger mine.

Lafayette County

STATE LINE (New Diggings)—Company has made valuable discovery of zinc ore by churn drilling at New Diggings.

CANADA

Ontario

CANADIAN MINING & EXPLORATION CO. has underwritten 20,000 shares of new issue of Alaska Juneau.

DOME MINE (Porcupine)—Coming annual meeting is expected to make decision relative to building larger mill.

VIPOND (Porcupine)—Is diamond drilling on 300 level. Capacity of mill is to be increased to 120 tons per day.

ST. PAUL CLAIMS (Bartlett Township)—Shaft is being sunk on this property situated some distance south of Porcupine.

McINTYPRE (Porcupine)—Contact vein has been cut on 400 level from No. 5 workings. It is similar in width and grade to 500 level vein.

RIGHT-OF-WAY (Cobalt)—Now that power is available it is intention of company to start active exploration from No. 3 shaft on south end of property.

NORTH THOMPSON (Porcupine)—One of Hamilton, Erlich & Co. subsidiaries, has resumed operations and contract has been given for sinking of a 300-ft. shaft.

TEMISKAMING AND BEAVER MINES (Cobalt) — The manager, Moffat, and president, Culver, are getting bids on big power plant to be used by both properties.

CASEY COBALT (Cobalt)—Development on 365 level from new shaft, has opened up three new veins from 1 in. to 2 in. of high-grade ore in an entirely new part of property.

MINING CORPORATION OF CANADA—(Cobalt)—Started new cyanide annex Apr. 26. Will treat 170 tons of slime products from Townsite, City of Cobalt and Cobalt Lake mines.

BEAVER (Cobalt)—Estimated that there are 45,000 tons of ore on dump and broken in the mine which will produce 1,200,000 oz. of silver and that this ore can be raised from mine and milled for $100,000.

PORCUPINE PET (Porcupine)—Company has made voluntary assignment to creditors. A 5-stamp mill has been in operation for about a year but ore was spotty and development was very costly.

CASEY MOUNTAIN (Cobalt)—On this property adjoining Casey Cobalt operations have been begun by R. G. Williamson, of Calgary. Diamond drilling will be undertaken immediately and machinery installed.

YORK ONTARIO (Cobalt)—Work will at once be recommenced at King Edward mine on which this company holds lease. A contract has been let for sinking of shaft from its present depth of 500 ft. to 1000-ft. level.

TIMISCAMING & HUDSON BAY (Cobalt)—This company has secured option on Wright claims known as Salvador property. Little of value has so far been found on this location, but developments on adjoining properties have been encouraging

NIPISSING (Cobalt)—Thomas Syskoe, a German-Pole, tried for attempting to blow up powder magazine of Nipissing company, found guilty. Maximum penalty of fourteen years' imprisonment was imposed. John Syskoe and Walter Henshal charged with conspiracy were acquitted.

DOME LAKE (Porcupine)—Has been closed down fo short time to enable necessary repairs to be made in mill Crew has been discharged but will be hired back again a lower wages to conform to average wage scale of camp. Thi done to escape provisions of Lemieux Act which requires 30 day notice before wages can be cut. It is expected tha under new arrangement property can make profit of $4000 month. At this rate will take two years to repay Hudso Bay the money loaned.

HOLLINGER (Timmins)—Regular four-weekly statemen for period ended Mar. 25 is less favorable than usual on a count of curtailment owing to power shortage. Gross profi were $151,004 from 22,066 tons of ore, average value $11.53 p ton. Working costs $4.09 per ton. On distribution of dividen on Apr. 22, $3,000,000 has been paid in dividends or $60,00 more than paid up capital.

BURMA

BAWDWIN MINES—Cable advices report continuation 430 level crosscut shows an additional 17 ft. of silver-lead o average assay 50 oz. silver, 52% lead and 13% zinc, in add tion to the 40 ft. previously reported, averaging 24 oz. silve 23% lead and 37% zinc. This 17-ft. band of high-grade s ver-lead ore was 5 ft wide in cross-cut 130 ft. above. Simil band was disclosed on 300 level in crosscut from winze 365 north of internal shaft

The Market Report

METAL MARKETS

NEW YORK—May 12

Copper was rather dull during the last week, and lead showed signs of being not quite so strong as it was. On the other hand, the spelter market went higher than ever, advancing on relatively small business.

Inasmuch as transactions in spelter are based solely on St. Louis, except at those rare intervals when foreign spelter is imported into this country, when New York becomes the basing market, we have discontinued the column of New York prices. Anybody who needs to know the New York equivalent place, for averages or other purposes, may add 17c. per 100 lb. to the St. Louis price.

Copper, Tin, Lead and Zinc

Copper—Business in copper during the last week was relatively light and the market was characterized as flat. The largest sellers maintained their previous asking price of 18⅞@19c., regular terms, but no business at that price was reported except for non-competitive markets. Such business as offered itself was taken by other sellers who were willing to accept 18¾c., regular terms and did so, the transactions amounting to fairly large volume in the aggregate. At the close of the week there were still sellers at 18¾c., regular terms.

The sinking of the "Lusitania" apparently created no alarm respecting the shipping situation.

The port of Archangel is now reported to be open and one ship is said to have entered there.

Some extraordinarily large orders for copper were under negotiation during the last week, but up to the time of our going to press had not been concluded. Questions of capacity enter largely into the considerations. Some of these pending contracts provide for deliveries as far ahead as 1917. This does not mean necessarily that it is regarded that the war will last so long, but simply that in arranging for copper supplies it is deemed best to contract for the maximum that may be required, it being certain that the copper will be wanted after the war anyhow.

Exports of copper for the week ended May 1 are reported by the Department of Commerce at 15,351,637 lb.; also 4400 tons of matte valued at $6390. The chief metal exports were 8,029,030 lb. Great Britain; 3,472,633 lb. to Sweden; 2,042,432 lb. to Canada; 896,715 lb. to Italy; 700,460 lb. to France. Imports for the week were: Metal, 3,436,164 lb.; in ore and matte, 1,519,084 lb.; total, 4,955,248 lb. The larger imports were from Canada, Chile, Peru, Spain and Japan.

Copper Sheets base price is now 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 19½@20c. per lb. carload lots at mill.

Brass Prices, base, to date from Apr. 28 are: Sheets, 21¾c. net per lb. for high brass; 22⅞c. for low brass. Wire, high brass, 21½c.; low brass, 22⅞c. Rods, high brass, 21½c.; low brass, 23⅝c. Tubes, 25⅜c. for both brazed and open seam. Angles and channels, 25⅜c. Scrap allowances are 16¼c. net per lb. for high brass; 16⅞c. for low brass.

Tin—The sinking of the "Lusitania" created some excitement in this market, and a rather heavy business was done on May 8 at an advance in price, but otherwise, the market was quiet during the week.

A company has been formed at Santiago, Chile, to build a plant to smelt tin ores from Bolivia. It is proposed to build the plant at Arica or Mejillones.

Imports of Tin from Great Britain, as already announced are now permitted only on invoices to the British Consul-General at New York. Deliveries to the purchasers here have to be made on application to the consulate specifying packages, quantities, etc., and giving the following guarantee: "In consideration of your consenting to the delivery to them of the said tin, chloride of tin, tin ore (a), I undertake that I will not, directly or indirectly, at any time so long as the present war continues, export any tin, chloride of tin, or tin ore from the United States, except to the British Dominions, and that I will not sell any tin, chloride of tin, or tin ore for exportation without satisfying myself that it is not intended for exportation from the United States, except to the British Dominions."

This must be accompanied by guarantees from the purchaser that the tin is intended for industrial use in the United States and that he will not export it or sell it to others to be exported to any country except the British Dominions. A similar undertaking must be given whether the importer takes the tin for his own use or for sale to a second party, the respective forms differing only in slight detail.

Lead—Inquiries for military purposes are again exciting some interest, but the supply of lead appears to be ample, and in the latter part of the week the market exhibited a rather softer tone.

Spelter—At the close of our last previous week of record, this market was distinctly softer in tone, but during the last week there was an advance again on moderate business—a few thousand tons—and the situation appears to be tied up tighter than ever. The sales of last week were chiefly for

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
May	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
6	4.7956	50	18.50 @18.60	39	4.20 @4.30	4.12½ @4.17½	11¾ @13½
7	4.7956	50	18.50 @18.60	39	4.20 @4.30	4.12½ @4.17½	12 @13½
8	4.8000	50	18.50 @18.60	41	4.20 @4.30	4.12½ @4.17½	12 @13½
10	4.7975	50⅛	18.50 @18.60	41	4.20 @4.25	4.12½ @4.15	12½ @13½
11	4.7913	50⅛	18.50 @18.60	40	4.20 @4.25	4.12½ @4.15	12½ @13½
12	4.7956	50⅛	18.50 @18.60	40	4.20 @4.25	4.12½ @4.15	12½ @13½

The quotations herein are our appraisal of the average markets for copper, lead spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
May	Silver	£ per Ton	Cts per Lb	3 Mos	Best Sel'td	Spot	3 Mos	£ per Ton	Cts per Lb.	£ per Ton	Cts per Lb
6	23 9/16	78¾	17.00	79¼		161½	162	20½ @20¾	4.37 @4.51	64½	14.01
7	23½	79½	17.27	80¼		164½	164	20¾ @20¾	4.37 @4.51	64	13.90
8	23 9/16										
10	23⅝	79½	17.27	80¼		165½	165	20 @20⅝	4.35 @4.48	62	13.47
11	23⅝	77¾	16.86	78¾		164	164	19¾ @20½	4.32 @4.45	62	13.47
12	23⅝	80	17.38	80¼		164	164	19¾ @20½	4.32 @4.45	64½	[illegible]

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: [illegible] 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.8[illegible] [illegible], £1 = 0.21⅜c.

domestic account. Apparently some large consumers were short of covering their requirements for May and June spelter and were obliged to deal with sellers who could supply liberally for those months but included in their terms the taking of considerable quantities of spelter for later deliveries. Sellers who could supply only the later deliveries were out of competition for this business, and found it difficult to sell on any terms satisfactory to themselves.

On May 10 tenders for delivery of 400 tons of intermediate spelter to the Washington Navy Yard were opened. The business was taken at 17.24c. delivered there.

Zinc sheets have been a little lower and the base price is now $16.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The makers are not anxious to sell just at present.

The first cargo, 6000 tons, of Broken Hill ore is now being delivered at Bartlesville, Okla. The steamer came through the Panama Canal and discharged at Galveston, where she took aboard a cargo for Liverpool, whence she will go back to Australia.

Our Kansas correspondent reports the following furnaces now in operation in Kansas and Oklahoma, not including the two small plants at Pittsburg, Kan.

Works	Number of Furnaces	Daily Output tons
Granby	6	50
Altoona	5	31
Kirk, Iola	1	4½
Prime Western, Iola	4½	23½
Prime Western, Gas	4½	23½
American, Dearing	5	39
American Caney	4	42
Bartlesville, Collinsville	12	92½
Bartlesville, Bartlesville	9	54
Tulsa	9	54
Sand Springs	3	20½
National	7	49
Lanyon-Starr	5	30½
Cherryvale	8	67
Totals	83	581

The present production is at the rate of 210,000 tons per annum. The output of Kansas and Oklahoma in 1914 was 139,343 tons. A new furnace is being built at Sand Springs. There are no stocks of spelter at the Kansas-Oklahoma works. In their bins there were about 53,000 tons of Western ore and 5000 tons of Joplin ore on May 1. This group of smelters uses relatively little of the Joplin production of ore, the bulk of which goes to smelters in Illinois.

Other Metals

NEW YORK—May 12

Aluminum is more active and demand seems to be increasing. Prices are rather firmer, 19½@19¾c. per lb. being quoted for No. 1 ingots, New York.—**Antimony** is strong and rather excited, and purchasers find it difficult to get supplies. Ordinary brands are 35@37c. per lb. Cookson's is entirely nominal, but 42@43c. per lb. has been paid. No bids for futures are accepted.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is still uncertain but rather quieter than it has been. In New York large lots are held at $74 per flask of 75 lb., but there are reports that sales have been made lower. Small lots are quoted at $75@80 per flask. London price is £11 15s., with second hands quoting £11 12s. 6d. per flask.

Minor Metals—Current sales of **Bismuth** have been at $2.75 @3 per lb., New York.—**Selenium**—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.—Cadmium is quoted in London at 6s.—$1.44—per lb.—**Tellurium** is reported sold at 80s.—$19.20—per lb. in London.

Gold, Silver and Platinum

NEW YORK—May 12

Gold in the United States May 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,060,343,169; in Treasury current balances, $224,755,256; in banks and circulation, $604,044,040; total, $1,889,142,465. This is an increase of $12,815,926 during April.

Silver—The market has been steady, but with small fluctuations. Recent purchases have been chiefly by the Indian Bazaars, which have awaited the action of the English Government on the wheat export situation. This action the Bazaars considered favorable for silver, hence the purchases.

Coined Silver in the United States May 1 is estimated by the Treasury Department as follows: Standard dollars, $568,172,478; subsidiary coin, $185,067,966; total, $753,240,444, a decrease of $90,043 during April. Of the dollars $493,305,000 are held in the Treasury against silver certificates outstanding.

Silver shipments from London to the East Jan. 1 to Apr. 22, as reported by Messrs. Pixley & Abell

	1914	1915	Changes
India.	£2,306,500	£1,684,000	D. £622,500
China	40,000		D. 40,000
Total..	£2,346,500	£1,684,000	D. £662,500

Imports of silver into Great Britain, three months ended Mar. 31, were valued at £2,804,204; exports, £2,279,203; excess of imports, £525,001, which compares with an excess of exports of £1,009,023 last year.

Silver imports into Great Britain for the three months ended Mar. 31 are reported by Messrs. Samuel Montague & Co. as below, in ounces:

From	1914	1915	Changes
United States	16,665,449	21,259,555	I. 4,594,106
Canada	4,449,947	4,133,619	D. 316,328
Other countries	1,333,650	711,990	D. 621,660
Total	22,449,046	26,105,164	I. 3,656,118

The increase in imports from the United States was 1,376,564 oz. in January and 3,242,418 oz. in February; but there was a decrease of 44,876 oz. in March.

Platinum—The market remains quiet, with only a small business reported. Prices are still quoted at $38@39 per oz. for refined platinum while hard metal is $42@46 per oz., according to percentage of iridium.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 8

The competitive base price paid this week for 60% zinc ore was $60@64 per ton. The base price paid this week for 80% lead ore was $51 per ton.

SHIPMENTS WEEK ENDED MAY 8

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,496,480	526,800	340,260
Year	65,665,630	2,255,990	7,464,790

Shipped during week to separating plants, 3,257,000 lb. zinc ore.

JOPLIN, MO.—May 8

Blende, high price $78; assay base 60% zinc, premium ore $75; medium grades $73@65; lower grades down to $58 per ton. Calamine, base 40% zinc, $45@42 per ton; average, all grades of zinc, $63.22 per ton. Lead, high price $54.50, base $51@52 per ton of 80% metal content; average, all grades of lead, $50.34 per ton.

SHIPMENTS WEEK ENDED MAY 8

	Blende	Calamine	Lead	Values
Totals this week	13,861,800	1,933,720	1,880,550	$546,660
Totals this year	199,457,040	18,314,110	29,882,020	7,104,310

Blende value, the week, $469,180; 19 weeks, $6,058,020.

Calamine value, the week, $30,150; 19 weeks, $329,900.

Lead value, the week, $47,330; 19 weeks, $716,390.

Another record shipment is made and these are cutting down the reserve stock to a minimum, lower than since early in the year. The Collinsville, Ill., zinc smeltery has been taken over by the Picher Lead Co., of Joplin. The North Pittsburg smeltery was taken over principally by the owners of the Oronogo Circle mine and the S. Y. Ramage mine of Webb City. Ore is being shipped from the Ramage mine and some calamine is being purchased.

Iron Trade Review

NEW YORK—May 12

The iron trade has been supported this week mainly by foreign orders. The domestic business has not been large, though it promises better for the future.

Structural steel is looking up and there is much more business in sight. Some large car orders are under negotiation and the railroads have taken a lot of bridge material. The mill continue to operate at 70 to 75% of capacity, and seem confident of being able to maintain that rate.

The pig-iron market has been more active and sales have been quite large. Some speculative buying is again apparent, especially in Southern iron.

The Chesapeake & Ohio and the Southern R.R. have reduced rates on pig iron from Virginia furnaces to Norfolk or Newport News from $1.52½ to $1 per ton when the iron is for export. The Norfolk & Western has made a similar reduction.

Imports at Baltimore for the week included 970 tons ferromanganese from Liverpool, England.

Pig Iron Production in April again showed an increase. The reports of the furnaces, as collected and published by the "Iron Age," show that on May 1 there were 195 coke and anthracite stacks in blast, having a total daily capacity of 71,400 tons; an increase of 1400 tons over Apr. 1. Making allowance for the charcoal furnaces the total production of pig iron in the United States in April was 2,143,500 long tons; for the four months ended Apr. 30 it was 7,560,400 tons. Of this total 5,488,500 tons, or 71.2%, were made by the furnaces owned or operated by the steel companies.

Exports and Imports of Iron and Steel, and of manufactures thereof, two months ended Feb. 28, are valued as below by the Department of Commerce:

	1914	1915	Changes
Exports	$33,226,658	$31,524,172	I. $1,297,514
Imports	4,532,582	3,080,115	D. 1,452,467
Excess, exports	$28,694,076	$31,444,057	I. $2,749,981

The larger increases in exports this year were in bars, billets and wire.

PITTSBURGH—May 11

While all business men are deeply moved by the "Lusitania" event, trade is not likely to be affected seriously if at all. Consumption is not decreased thereby. The horrors of war as they are seen are increased but the recent trade revival occurrd in full viw of the war and while expectations were entertained that it would last years rather than months.

The Steel Corporation showed a decrease of 93,505 tons in unfilled obligations during April, to a total of 4,162,244 tons at the close of the month. The decrease was 4000 tons greater than that of March but shipments probably increased 50,000 tons or so, indicating that bookings were somewhat heavier in April than in March. The bookings would have been larger if the mills had been willing to accept contracts more freely for forward delivery.

To the large car inquiries of the Pennsylvania R.R. system already reported there have been added inquiries, chiefly from western roads, for fully 15,000 cars, perhaps 20,000, making a total of 30,000 to 35,000 freight cars now in the market, not far from double the number actually purchased since the war began, and a large proportion of these cars is expected to be placed very shortly. There has been an increase in structural business coming to the mills, and the National Tube Co. has booked two pipe line orders aggregating nearly 35,000 tons. Steel bar business continues good, sheet demand is increasing a trifle, and wire demand is dropping off less than it usually does at this season. Altogether the steel trade prospects are distinctly better than a fortnight ago, and the actual production is probably a trifle heavier, easily averaging more than 70% of steel ingot capacity. The Pittsburgh and Valley mills are operating at an average of between 75 and 80%, while the Carnegie Steel Co. alone is operating at 80%.

Pig Iron—Two sales of basic iron, 15,000 and 4000 tons respectively, have been made by a Shenango Valley furnace interest, at $12.65 at furnace, 15c. above the regularly quoted market. This appears to be due to the fact that the delivery was to a near-by point which takes higher freight rates from other Valley furnaces. Buying of foundry iron continues good as to small lots. We continue to quote: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Imports of ferromanganese during the last quarter of 1914 are just reported, and amounted to 19,884 gross tons, considerably more than had been estimated, as the British embargo was supposed to have become effective early in the quarter. The year's imports were therefore 82,217 tons, and the stocks of ore and alloy at the beginning of this year must have been fairly large. Scarcely any business has been done in new contracts at the recently announced price of $88, Baltimore, consumers being interested simply in deliveries on old contracts, which seem likely to come forward as absolutely needed. Demand for spot lots is very limited, the market being $90@95 per ton.

Steel—The Central Steel Co., Massillon, O., has made its initial sale of steel, 6000 tons, to the Cleveland Steel Co. The American Iron & Steel Co. at Lebanon, Penn., has bought 4000 tons of billets, presumably from an Eastern mill. Billets are about $18.50@19 and sheet bars about $19@19.50, at maker's mill, Youngstown, and about 50c. higher at maker's mill, Pittsburgh. The Carnegie Steel Co. is out of the market on openhearth sheet bars. Rods are $25, Pittsburgh, with the export demand holding up very well.

FOREIGN IRON

British Foreign Trade in Iron and Steel three months ended Mar. 31 is valued by the Board of Trade returns as below:

	Exports	Imports		Excess
Iron and steel	£7,732,850	£1,531,755	Exp.	£6,201,095
Machinery, hardware, etc.	6,952,184	2,956,463	Exp.	3,995,721
Totals	£14,685,034	£4,488,218	Exp.	£10,196,816
Totals, 1914	28,014,275	7,942,340	Exp.	20,071,935

The quantities of iron and steel exported were 1,206,135 tons in 1914, and 654,548 in 1915, decrease, 551,887 tons. Quantities imported, 577,490 tons in 1914, and 183,057 in 1915; decrease, 394,439 tons.

German Pig Iron Production in March is reported by the German Iron & Steel Union at 938,438 metric tons, which is 134,815 tons more than in February, but 664,458 tons less than in March, 1914. For the three months ended Mar. 31 the total make was 4,615,261 tons in 1914, and 2,616,194 tons in 1915, a decrease of 1,999,067 tons, or 43.3%, this year.

IRON ORE

Shipments of iron ore from the Lake Superior region in April were larger than expected. The total [illegible] ports are reported by the "Iron Trade Review" as below, in long tons:

Port	1914	1915	Changes	
Escanaba	110,729	49,307	D.	61,422
Marquette	....	4,438	I.	4,438
Ashland	40,838	43,949	I.	3,111
Superior	62,338	87,175	I.	24,837
Duluth		174,989	I.	174,989
Two Harbors	55,781	143,974	I.	88,193
Total	269,686	503,832	I.	234,146

The greatest activity was at Duluth and Two Harbors. It is expected that May shipments will be light, as ore will be held back to get the benefit of the rate reduction.

LAKE ORE AND COAL RATES

Lake freight rates for three years past, as compiled by the "Marine Review" of Cleveland, are as follows, in cents:

	1912	1913	1914
Iron ore, Escanaba to L. Erie ports	38.72	40.00	35.00
Iron ore, Marquette to L. Erie ports	48.72	50.00	45.00
Iron ore, Duluth to L. Erie ports	53.72	55.00	50.00
Anthracite, Buffalo to Chicago	30.00	35.00	30.00
Anthracite, Buffalo to Duluth	30.00	30.00	30.00
Bituminous coal, L. Erie to Chicago	30.00	35.00	30.00
Bituminous coal, L. Erie to Duluth	30.00	30.00	30.00

Charge to vessels for unloading iron ore, 10c. per ton

In former years there was often a considerable difference between contract rates and the wild or outside rates. So much of the business is now done by contract boats that the wild rate has practically disappeared.

COKE

The British government has prohibited the exportation of coal and coke from Great Britain, to date from May 13, except to colonies of the country or allied nations.

Connellsville—A Valley furnace interest has removed its contract for high-grade Connellsville furnace coke, involving about 10,000 tons a month over the second half, the price not being stated. Other second half inquiry hangs fire and the furnace coke market shows little life. Foundry coke is looking up, there being heavier sales of prompt while a few contracts are being entered for the twelvemonth beginning July 1. We quote: Furnace coke, prompt, $1.50@1.55; contract to July 1, $1.60@1.65; to Dec. 31, $1.75; foundry coke, prompt, $2.@2.35; contract, $2.20@2.35, per net ton at ovens.

The "Courier" reports production in the Connellsville and Lower Connellsville region in the week ended May 1 at 292,891 tons, a decrease of 6602 tons, and shipments at 303,377 tons, an increase of 9711 tons.

Anthracite Shipments in April were 6,486,201 long tons, being 1,500,803 tons more than in March and 414,037 tons more than in April, 1914. For the four months ended Apr. 30 the total shipments were 20,534,050 tons in 1914, and 20,481,241 tons in 1915; a decrease of 52,809 tons, or 0.26% this year.

Fuel Exports from Great Britain three months ended Mar. 31, in long tons:

	1914	1915	Changes	
Coal	17,430,369	11,219,726	D.	6,210,643
Coke	301,749	235,174	D.	66,575
Briquettes	502,181	243,348	D.	258,833
Steamer coal	5,035,448	3,978,631	D.	1,056,817
Total	23,269,747	15,676,879	D.	7,592,868

The imports of fuel are insignificant, amounting only to 5707 tons in 1914 and 803 tons this year.

Chemicals

NEW YORK—May 12

The general market remains rather quiet, but is still disturbed by the situation abroad.

Arsenic—Business is moderate and supplies seem to be equal to the demand. Prices are unchanged at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business has been fair and [illegible] as usual. The advance in copper metal has made prices [illegible] firm. Quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is reported [illegible] are firm and unchanged. Quotations are [illegible] for spot and for all positions this year.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	May 1	June 1	$0.005
Andes Silver, Nev	May 4	May 25	0.03
Argenta, Ida.	May 10	June 10	0.001
Belcher, Nev.	May 15	June 8	0.15
Best & Belcher, Nev.	May 12	June 1	0.05
Caledonia, Nev	May 11	June 1	0.05
Cash Boy, Nev.	May 17	June 17	0.01
Cedar Creek, Ida	May	June 5	0.005
Consolidated Imperial, Nev.	Apr. 27	May 18	0.01
Con. Virginia, Nev	May 4	May 25	0.10
Contact Copper, Mich	May 15		0.50
Crown Point, Nev	May 17	June 8	0.15
Diam'field Black Butte, Nev.	Apr. 30	June 3	0.01
Emerald, Utah (three instal.)		June 9	0.01
Enterprise, Ida. (post.)	...	May 20	0.002
Exchequer, Nev	May 11	June 1	0.03
Gold Mt., Utah	May 10	May 27	0.0025
Hancock Cons., Mich	Sept. 1		1.00
Houghton, Mich.	May 25		1.00
Idaho-Nevada, Ida	May 10	June 5	0.002
Jack Waite, Ida. (post.)	...	May 22	0.01
Laclede, Ida.	May 24	June 14	0.003
Majestic Ild., Nev	Dec. 15	Jul. 20	0.005
Mullan, Ida.	Apr. 24	May 24	0.002
Mountain Rose, Ida	Apr. 19	May 19	0.001
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Hope, Ida	May 5	June 2	0.002
Ophir, Nev	June 4	June 25	0.05
Overman, Nev.	May 19	June 8	0.05
Raven, Ida	May 15	June 14	0.0006
Royal, Ida.	June 1	July 6	0.0015
Samson, Ida. (post.)		June 3	0.002
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Cliff, Ida. (post.)	.....	May 29	0.0025
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida	May 15	June 15	0.002
Silver Pick, Nev	June 5	July 12	0.01
Smuggler	Apr. 17	May 17	0.0025
Tarbox, Ida.	Apr. 26	May 28	0.0025
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Virginia, Ida	May 10	May 29	0.02
Wisconsin, Ida.	May 15	June 15	0.003
Yellow Jacket, Nev	May 14	June 8	0.15

Stock Quotations

Among sales at auction we note: $15,000 Gates Coal & Coke Co. 1st mort., August, 1912, coupons on, $70 lot; $1,065,000 Dering Coal Co. 1st mort., April, 1909, coupons on, 20.

COLO. SPRINGS May 11

Name of Comp.	Bid
Acacia	04
Cripple Cr'k Con	01
C. K. & N.	04½
Doctor Jack Pot	09½
Elkton Con.	43
El Paso	1.05
Findlay	.03½
Gold Dollar	04
Gold Sovereign.	04½
Golden Cycle	1.79½
Isabella	18½
Jack Pot	06½
Jennie Sample	‡ 02
Jerry Johnson	04
Lexington	‡ 008
Mary McKinney	33
Pharmacist.	01¾
Portland	1.19
Raven B. H.	03½
Vindicator	1.69

SALT LAKE May 11

Name of Comp.	Bid
Beck Tunnel	05
Black Jack	08
Colorado Mining.	11
Crown Point	01½
Daly-Judge	5.25
Gold Chain	15
Grand Central	53
Iron Blossom	66
Little Bell.	12
Lower Mammoth	04¾
Mason Valley	3.00
May Day	15½
Opohongo	01
Prince Con	42½
Seven Troughs	01½
Silver King Coal'n	3.05
Silver King Con.	1.82½
Sioux Con.	02
Uncle Sam	03
Yankee	01

TORONTO May 11

Bailey	02	Dome Exten	09
Coniagas	04	Foley O'Brien.	31
Peterson Lake	23	Hollinger	26.50
Right of Way	04	Imperial	06½
Seneca Superior	1.12½	Jupiter	11
Silver Queen	01	McIntyre	48
T. & Hudson Bay	18.00	Pearl Lake	01
Timiskaming	38	Porcu. Gold	‡ 25
Wettlaufer-Lor	03	Preston E. D.	02
Big Dome	12.75	Rea	10

SAN FRANCISCO May 11

Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡ 04	Belmont	1.12½
Andes	05	Jim Butler	76
Belcher	15	Lone Star	.07
Best & Belcher	.05	MacNamara	.03
Caledonia	.30	Midway	16
Challenge Con.	‡ 06	Mont.-Tonopah.	.35
Confidence	09	North Star	16
Con. Virginia	12	Rescue Eula	12
Gould & Curry	02	West End Con	72
Hale & Norcross	03	Atlanta	2
Julia	‡ 01	Booth.	37
Mexican	29	C. O. D. Con	04
Occidental.	79	Comb. Frac.	08
Ophir	09	Jumbo Extension	62
Overman.	02	Pitts.-Silver Peak	12
Potosi	‡ 01	Round Mountain	41
Savage	02	Sandstorm Kendall	07
Sierra Nevada	.10	Silver Pick.	07
Union Con	.17	Central Eureka	17
Yellow Jacket	.19	So. Eureka	‡2.25

N. Y. EXCH. May 11

Name of Comp.	Clg.
Amalgamated	67⅞
Am.Sm.&Ref.,com	67¼
Am. Sm. & Ref., pf	105½
Am. Sm. Sec., pf. B	80
Anaconda	32⅜
Batopilas Min	⅝
Bethlehem Steel	136¼
Bethlehem Steel, pf.	110
Chino	44⅜
Colo. Fuel & Iron.	27
Federal M. & S., pf.	25
Great Nor., ore., ctf.	33
Guggen. Exp.	57⅝
Homestake.	117¼
Inspiration Con.	29⅜
Mex. Petroleum	75⅜
Miami Copper.	24¾
Nat'l Lead, com.	60¼
National Lead, pf.	108
Nev. Consol.	14⅜
Ontario Min.	3¼
Quicksilver, pf.	1¼
Ray Con.	22¾
Republic I&S, com.	26½
Republic I&S, pf.	83½
SlossSheff'd, com	33
Tennessee Copper.	31½
Utah Copper	64¾
U. S. Steel, com.	53⅞
U. S. Steel, pf.	106½

N. Y. CURB May 11

Name of Comp.	Clg.
Alaska Juneau, w i.	14⅜
Alta Con	.85
Beaver Con	38
Big Four	07
Blue Bell	05
Braden Copper.	7⅛
Buffalo Mines	9/16
Can. Cop. Corpn.	1⅞
Can. G. & S.	03
Caribou.	‡.50
Cashboy	.06
Chambers Ferland.	17
Con. Ariz. Sm.	.75
Con. Coppermines.	1⅞
Davis-Daly.	15/16
Diam'field-Daisy	07
Dia. Black B.	03
Florence	49
Goldfield Con.	1 7/16
Goldfield Merger.	23
Greene Cananea.	28½
Kerr Lake	4⅝
La Rose	50
McKinley-Dar-Sa	28
Mines of Am	2⅛
Nevada Hills	22
New Utah Bingham	1¼
Nipissing Mines	5⅝
Ohio Copper.	25
Oro	08½
Pacific Smelt	‡ 09⅜
South Utah	‡⅜
Stand'd Oil of N. J.	402
Standard S. L.	1.43¾
Stewart	1 11/16
Tonopah	6 15/16
Tonopah Ex.	3¼
Tonopah Merger	35
Tularosa	3/16
West End Ex	05
Yukon Gold	2⅛

LONDON Apr. 26

Alaska Tre'dwell	£7 6s 3d
Cam & Motor	0 15 0
Camp Bird	0 9 6
El Oro.	0 7 10½
Esperanza	0 8 6
Mexico Mines	3 16 3
Oroville	0 12 3
Santa Gert'dis	0 7 6
Tomboy	1 4 3
Tough Oakes	0 14 3

BOSTON EXCH May 11

Name of Comp.	Clg.
Adventure	2¼
Ahmeek	280
Alaska Gold M	34¼
Algomah	2½
Allouez	‡53½
Am. Zinc	38½
Ariz. Com., ctfs.	7¼
Bonanza	35
Butte-Ballaklava	3
Butte & Superior.	62½
Calumet & Ariz.	64½
Calumet & Hecla	585
Centennial	19
Cliff	1½
Copper Range.	53
Daly West	3
East Butte	11½
Franklin	11
Granby	84
Hancock	21
Hedley	26¾
Helvetia	70
Indiana	7½
Island Cr'k, com	43½
Island Cr'k, pfd	89
Isle Royale	27
Keweenaw.	2¼
Lake.	12¾
La Salle	6
Mass	14¾
Mayflower	5¼
Michigan	2
Mohawk	71
New Arcadian	10
North Butte	32
North Lake	2¼
Ojibway	2¼
Old Colony	4¾
Old Dominion	52
Osceola	78½
Quincy	86
Santa Fe.	3
Shannon	9
Shattuck-Ariz.	26½
Superior	31
Superior & Bost.	3⅞
Tamarack	33
Trinity.	5
Tuolumne	‡ 40
U. S. Smelting	36¼
U. S. Smelt'g, pf.	44½
Utah Apex	2⅞
Utah Con	12
Victoria.	3
Winona	4¼
Wolverine.	57
Wyandot	1⅛

BOSTON CURB May 11

Name of Comp.	Bid
Alvarado	.50
Bingham Mines	6
Boston Ely.	27
Butte & Lon'n Dev	.21
Calaveras	1⅛
Calumet-Corbin	10
Chief Con	.80
Corbin	.90
Cortez	.30
Crown Reserve	.85
Eagle & Blue Bell	1⅛
First Nat. Cop.	2¼
Houghton Copper.	3
Iron Cap Cop. pf.	5
Majestic	42
Mexican Metals	.17
Nevada-Douglas.	70
New Baltic	3½
Oneco	1¾
Raven Copper	.07
Smokey Dev.	.30
So. Lake	6¾
Tonopah Victor.	‡ 17
Trethewey.	14
United Verde Ext	3 11/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996		63.182		67.786	
June	13.603		61.336		66.274	
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year						

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360		150.702	
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900		3.808		18.503	
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074		4.924		21.393	
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90		13.90		14.27	
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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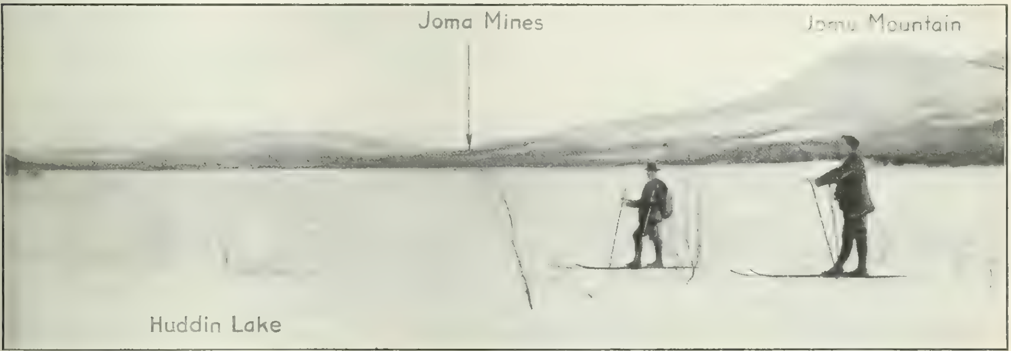
The Grong Copper and Pyrites Mines of Norway

By Andreas Dahl Udhany*

SYNOPSIS—Explorations in northern Norway have shown the existence of important pyrites properties in the parish of Grong, a few degrees south of the Arctic Circle. Some of the ore is copper-bearing, while other lenses are free from copper and average as high as 50% sulphur. The mines are about 80 km. from the coast and there are as yet no railroads to transport the ore.

The Grong district now gives promise of becoming one of the most important mining districts of Norway, although in 1909 Prof. Amund Helland wrote that "no deposits of ore or useful minerals are known to exist in the large parish of Grong."



In Grong Parish, Northern Norway, Looking Toward the Joma Mines

The Grong mines are situated in the northern and narrow part of Norway to the north of Trondhjem and a few degrees south of the Polar Circle. The distance from the sea or the nearest port is not great, only about 80 km., but owing to the lack of railroads the transport of the ore will not be easy at first and, in fact, will be altogether impracticable without a considerable expenditure of capital.

The credit for having brought these large mineral deposits to public knowledge is due to the well-known engineer and financier, Samuel Eyde, who is one of the inventors of the Birkeland-Eyde process and the creator and leading spirit of the Norwegian nitrate industry.

In his capacity as director for the promoting company, the Norwegian Co. for Electrochemical Industry, he caused the deposits to be examined in 1911-12. These examinations gave such favorable results that the company, after having secured the mining rights, took up the matter with French financiers and formed a new company in December, 1912, under the name of the Aktieselskabet Grong Gruber, with a capital of $1,725,000.

The Grong district embraces three main deposits, of which two, Gjersvik and Joma, belong to the above-mentioned company, while the third, Skorovas, is owned by the Norwegian Co. for Electrochemical Industry. From a short description of these three deposits it will be seen of what great importance they may become, and if Norway is not now the largest producer of pyrites in Europe it certainly has some prospect of becoming so when the Grong mines are put in full operation. Most of the data here given are taken from the report of Prof. J. H. L. Vogt, who examined the deposits on behalf of the Norwegian Geological Survey.

The Gjersvik Deposits

The Gjersvik deposits are situated on the western embankment of the large lake, Limingen, which stretches in a southeasterly direction toward the Swedish frontier. The presence of ore has been known for a long time, as there are a number of outcroppings of iron ore on the surface formed by the oxidation of the pyrite. No mining work had been done before 1911, when the deposits were systematically examined by a number of trenches and shafts. During the winter of 1911-12 the surveying work was continued by the aid of diamond drilling, and it was possible in the spring to form a good judgment of the magnitude of the deposits. As regards the quality of the ore, this had been determined by about 200 analyses of ore from the drill holes and elsewhere.

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*Frognerveien 6 II, Christiania, Norway.

The ore is in the form of an oblong-shaped vessel or folding, widest at the bottom and with a gradient of 19°. The mines will supply chiefly lump ore, although there are some fines, for the treatment of which it is intended to build a washing plant. The quality of the ore is similar to that in a number of other pyrites mines in Norway. It carries from 2 to 2.2% of copper and about 43% of sulphur. There have also been discovered chalcopyrite lodes estimated to contain about 200,000 tons of ore, for the treatment of which it is intended to erect a smelting works on the spot.

The Gjersvik mines are the smallest of the three deposits, but, on the other hand, the ore is more valuable on account of the high content of copper. The quantity of cupreous pyrites present is estimated at about one million tons, besides the above-mentioned 200,000 tons of chalcopyrite ore, and when the mines are put into operation the annual output will be brought up to 60,000 tons.

The Joma Deposits

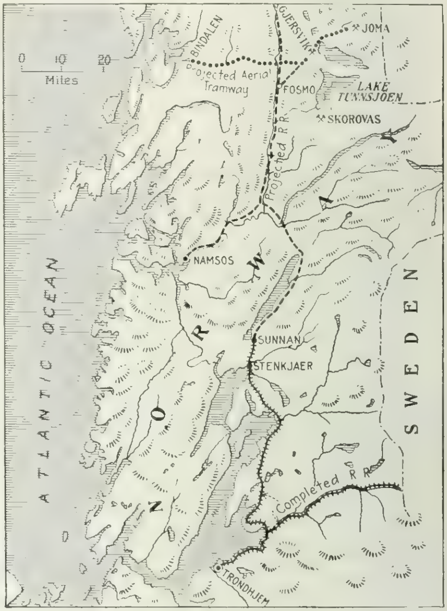
The Joma deposits are situated about 21 km. east of the Gjersvik mines and about 4 km. from the Swedish frontier. The claims were taken up in 1911, when a pyrite lode, 50 m. long and 10 m. wide, was discovered in a river bed. The deposits were subjected to a provisional examination during the summer of 1912, and afterward a number of diamond-drill borings were made. At the end of 1913 it was possible to pass a reliable judgment on the deposits in regard to their extent and value. They consist of a number of separate orebodies, in the form of lenses, as at Gjersvik. The gradient of the axes, however, is steeper, about 45°. The horizontal mineral area measures about 20,000 m. square, and there can be extracted about three tons of export ore from every cubic meter of the crude mass. The greatest width of the orebodies measured is nearly 50 m. These figures are sufficient to show that the Joma deposits are the largest known pyrites deposits in Norway.

As regards the quantity of ore present, Professor Vogt has based his calculations on the quantity of ore which is lying above the projected ground-level in a height of 90 m. The minimum quantity to be extracted here he has estimated at 3,500,000 tons, but under normal conditions there should be at least 4,200,000 tons, and he says that it is quite possible that this figure may be too low. The tonnages cited in the foregoing do not represent the quantity of ore present but the marketable quantity, deductions having been made for loss in mining.

Below the above-mentioned level Professor Vogt has estimated that there can be extracted at least 30,000 tons per m. of depth; but it is more probable that this quantity may be brought up to 40,000 or 15,000 tons. Borings have been made to a depth of 170 m. vertically, and there is no reason to presume that the ore should not continue to a considerably greater depth.

The Joma deposits should be able to produce 6,000,000 tons at least, although 8,000,000 would possibly come nearer the total, and there is, of course, a possibility of the quantity being brought up to 10,000,000 tons, as a depth of 170 m. is not prohibitive to economical exploitation. The mining expenses will be low at Joma on account of the magnitude of the orebodies. An additional advantage is that the ore as a rule occurs nearly pure.

About one-sixth of the deposits contains a cupreous pyrites, with 2% of copper and 43 to 44% of sulphur. The ore in the remaining parts of the field consists of nearly pure pyrites with little copper, the tenor of sulphur varying between 40 and 50% and averaging about 44%. The cupriferous deposits can be worked independently to a certain degree, and during the first years the total output of ore will comprise a rather large percentage of cupreous pyrites. But the noncupreous mineral is, of course, the chief thing, and with this in view the work will have to be carried out on a large scale so as to make it possible to reduce the cost of mining and transport to a minimum. Nearly all the Joma ore will be lump ore, the amount of fines being so smal that the erection of a special plant for them is not con sidered.



Sketch Map Showing Situation of Pyrites Deposits in Northern Norway

The Skorovas Deposits

The Skorovas mines are situated at the southwester end of Lake Tunnsjöen, and are perhaps the most inter esting of these three deposits, although as yet they hav not been so thoroughly examined as the two other de posits. The most interesting point is the purity of th ore, which is nearly free of copper; but, on the othe hand, it is exceptionally rich in sulphur, averaging a high as 50%. A similar ore may be found in the Jom mines, but in Skorovas this grade represents the averag and it is easy to conceive that a high-grade ore of this kind will have no difficulty in finding a ready market at a good price.

From a geological point of view the Skorovas deposits are of interest because of their great "iron hat," which exceeds anything known in this country. The "iron hat" is regarded as proof of the existence of a large amount of ore below, but there is also a drawback combined with it. Covering nearly the whole of the deposits with a thick layer, it is making all kinds of surface examination difficult.

View of the Gjersvik Pyrites Properties of the Aktieselkabet Grong Gruber

The two illustrations form a continuous panorama

The work of surveying the field was started in the autumn of 1913, but the subsequent diamond drilling was not in full operation before June of last year. Unfortunately, the work was brought to a standstill when the war broke out. But from what has been done has become possible to make a provisional estimate of 000,000 tons of ore that may be regarded as proved. certain orebodies this calculation has included only e quantity of ore that lies above the bottom of a small lley in the vicinity, and for other orebodies the cal lation has included the ore to a depth of about 20 m. he above-mentioned figure is thus in a certain sense isleading, because it refers only to the part of the de sits that has been examined. It would consequently more just to say that the quantity of ore present ounts to 1,000,000 tons, plus much more, which words y easily express an additional quantity of several mil n tons. The width of the largest orebodies runs up 10 m. The cost of mining will be low, especially in the beginning, as several hundred thousand tons, possibly even as much as half a million tons, can be extracted by means of quarrying.

If a calculation is made of the total quantity o in the Gjersvik, Joma and Skorovas deposits, the same may safely be estimated at 8,000,000 tons of ore, but [illegible] probably at 10,000,000 tons. These figures do not clude the ore which may be extracted from greater depths at Joma and from prospective orebodies in the int of the mountain at Skorovas.

Transport

The lack of railroads and roads has made it difficult to carry out any work on these deposits. First of all, the Grong Mines Co. is obliged to build a private road 26 km. in length for immediate requirements. As regards the transport of the ore from Gjersvik and Joma, it was first intended to build an aërial tramway to the nearest seaport, Bindalen, and the idea has not yet been entirely abandoned. The distance between Joma and Bindalen is 78 km., and this aërial tramway would thus be the longest in the world.

It has, however, long been under discussion to co tinue the present railway from Trondhjem to Sunn as far as the town of Bodö, north of the Arctic Ci In case this project can be realized immediately, t company has agreed to abandon the above-men plan and instead to let the railway transport to the port of Namsos, to which town a side have to be built. In this case there are two under consideration for the transport of the ore to Fosmo on the main line. In the one it is proposed to build an aërial tramway from Fosmo to Gjersvik and further to Joma, the total distance being 43 km. Another line will then have to be built to Skorovas, a distance of 22 km. In the second project it is proposed to connect the main line with the mines by means of a private railway which will go from a station south of Fosmo to Skorovas (23 km.) and then further to Gjersvik (30 km.), from which place it will proceed to Joma (23 km.). The main line would reach Namsos in a distance of 86 km., and the total distance by rail between this place and the three mines would thus be 109, 145 and 170 km. respectively.

In regard to tonnages, the Grong company has guaranteed as a minimum 200,000 tons per year, which represents the estimated annual output from the Gjersvik and Joma mines in the beginning. When in operation, the two mines will require about 1000 men. At Gjersvik the water system and the electric plant have already been completed and the erection of small towns for the accommodation of workmen and their families has been begun.

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Mining under Public Waters in Minnesota

By A. L. H. Street*

By a law which took effect Apr. 6, 1915, in Minnesota, it is made unlawful for any person, firm or corporation "to mine any mineral below the low-water mark of any public lake or river without first having obtained authority from the state"; or "to drain any meandered public lake for the purpose of mining of minerals without first having received the consent of a board hereby created for such purpose, consisting of the governor, attorney general, secretary of state, state treasurer and state auditor, or other officers which may be empowered by law to grant such permission." Violation of the law is punishable by a fine of not more than $10,000, or by imprisonment in the state prison for five years, or both such fine and imprisonment.

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Waste-Heat Boilers at Chrome, N. J.

By Clarence L. Brower*

In 1901 and 1902 when the copper refinery of the United States Metals Refining Co., at Chrome, N. J., was built, two 250-hp. vertical Cahall boilers were installed on two 75-ton reverberatory refining furnaces, as shown in Fig. 1, p. 893. The results of a test on them are presented i Table I. The installation was a failure; the boilers did no produce enough steam to pay for their maintenance. Th furnace operation was also unsatisfactory on account draft conditions caused by the boilers.

View of Furnace Building at U. S. Metals Refining Co.'s Plant, Chrome, N. J.

Note absence of large stacks for individual furnaces

TABLE I—EVAPORATION TEST ON CAHALL 250-HI WASTE-HEAT BOILER

(For Arrangement of Boiler see Fig. 1)

Date of trial	Apr. 17 and 18, 190
Duration, hours	25.2
Kind of coal	(soft coal) P. P. &
Average steam pressure (gage)	1
Average temperature of feed water entering boiler, deg. F.	1
Total wet coal fired, pounds	25,8
Moisture in coal, per cent	2.25
Total dry coal fired, pounds	25,2
Weight of ash, pounds	4,0
Total water evaporated, pounds	67,5
Factor of evaporation	1.11
Actual water per pound wet coal	2.61
Equivalent evaporation per pound of wet coal	2.91
Equivalent evaporation per pound of dry coal	2.9
Boiler horsepower developed	86.60
Percentage of builder's rating	34.64
Ash in coal (by analysis)	8.05
Carbon in ash (by analysis)	49.9

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*Attorney, St. Paul, Minn.

*Chief engineer, United States Metals Refining Co., Chrom N. J.

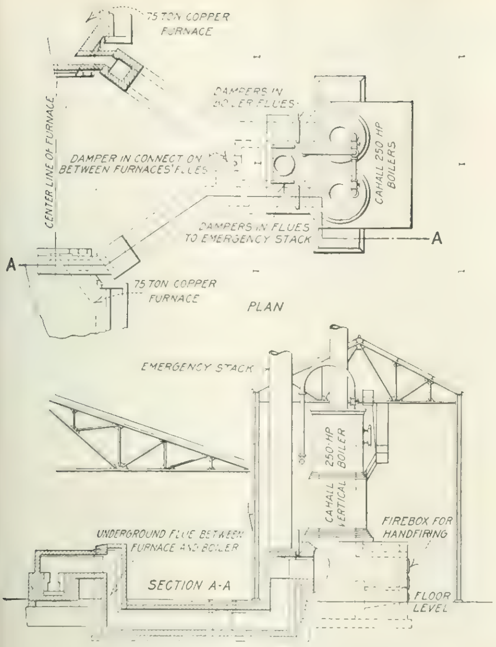

FIG. 1. FIRST WASTE-HEAT BOILERS AT CHROME, N. J. (1901)

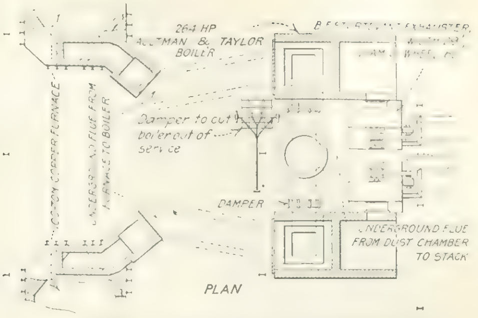
264 HP AULTMAN & TAYLOR BOILER
75-TON COPPER FURNACE
UNDERGROUND FLUE FROM FURNACE TO BOILER
Damper to cut boiler out of service
DAMPER
UNDERGROUND FLUE FROM DUST CHAMBER TO STACK
PLAN

FIG. 2 AULTMAN & TAYLOR BOILERS (1903)

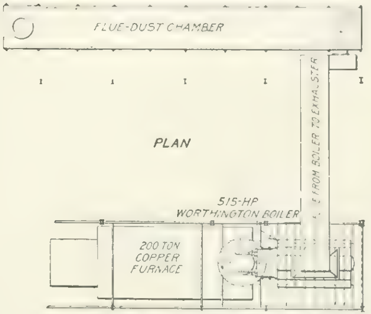

FIG 3 1906 ARRANGEMENT WITH WORTHINGTON BOILER

UNPROFITABLE WASTE-HEAT INSTALLATIONS

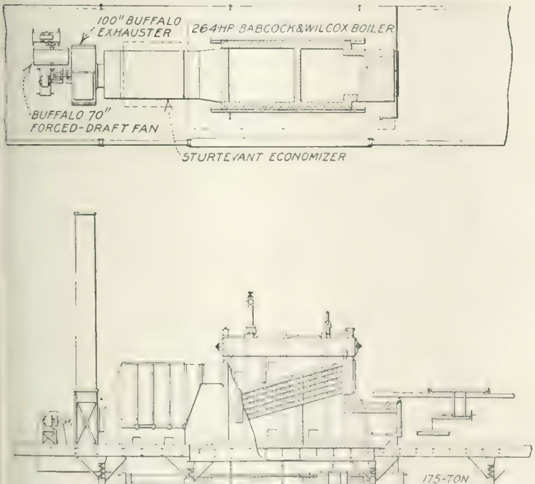

FIG. 4. 1912 ARRANGEMENT OF BABCOCK & WILCOX BOILER

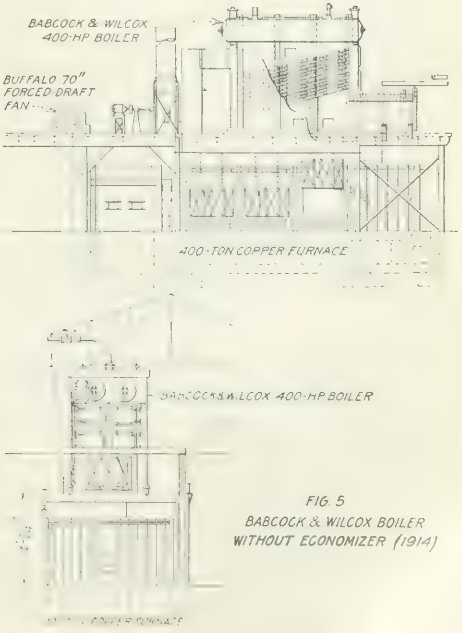
BABCOCK & WILCOX 400-HP BOILER
BUFFALO 70" FORCED DRAFT FAN
400-TON COPPER FURNACE
BABCOCK & WILCOX 400-HP BOILER
COPPER FURNACE

FIG. 5 BABCOCK & WILCOX BOILER WITHOUT ECONOMIZER (1914)

SUCCESSFUL WASTE-HEAT BOILERS AT CHROME, N. J.

These boilers absorb more heat units than do the refining furnaces to which they are attached

Two more copper furnaces were added in 1903, with two 264-hp. Aultman & Taylor horizontal water-tube boilers, shown in plan in Fig. 2. The results of this installation (Table II) were practically the same as in the case of the first installation.

TABLE II—EVAPORATION TEST ON AULTMAN & TAYLOR 264-HP. WASTE-HEAT BOILER
(For Arrangement of Boiler see Fig. 2)

Date of trial	Apr. 12 and 13, 1905
Duration, hours	25.7
Kind of coal	(Soft coal) P. P. & K.
Average steam pressure (gage)	149.0
Average temperature of feed water, deg. F.	123.0
Average temperature of flue gases leaving boiler, deg. F.	540.0
Draft at outlet of boiler, inches of water	0.83
Total wet coal fired, pounds	23,200
Moisture in coal, per cent	1.50
Total dry coal fired, pounds	22,900
Weight of ash, pounds	4,561
Total water evaporated, pounds	58,000
Factor of evaporation	1.1376
Actual water per pound of coal	2.5000
Equivalent evaporation per pound of wet coal	2.8441
Equivalent evaporation per pound of dry coal	2.8815
Boiler horsepower developed	74.42
Percentage of builder's rating	28.2
Ash in coal (by analysis)	13.95
Carbon in ash (by analysis)	29.90

In 1906 two 300-ton refining furnaces were added to the Chrome plant. A 525-hp. Worthington water-tube boiler was installed on one of these furnaces, as shown in plan in Fig. 3. The results from the installation are presented in Table III and were not much superior to those of the first two installations, the boiler producing merely enough steam to pay for its maintenance.

TABLE III—EVAPORATION TEST ON WORTHINGTON 515-HP. WASTE-HEAT BOILER
(For Arrangement of Boiler see Fig. 3)

Date of trial	Nov. 18 and 19, 1907
Duration, hours	24
Kind of coal	Soft coal
Average steam pressure (gage)	148
Average temperature of feed water, deg. F.	73.6
Average temperature of flue gases entering boiler, deg. F.	1303.7
Average temperature of flue gases leaving boiler, deg. F.	517.3
Average draft at inlet to boiler, inches of water	1.2
Total wet coal fired, pounds	37,500
Total water evaporated, pounds	113,772
Factor of evaporation	1.1883
Actual water per pound of coal	3.0339
Equivalent evaporation per pound of coal	3.6051
Boiler horsepower developed	163.27
Percentage of builder's rating	31.70
Average percentage of CO_2 in flue gases	4.2

These three installations are of interest in this connection to show what not to do in waste-heat-boiler installations on copper-refining furnaces.

In 1912 it was decided to install charging cranes the full length of the furnace building, which made it necessary to move the waste-heat boilers shown in Fig. 2, and the question arose whether we should throw these boilers out and consider waste-heat boilers a failure or to rearrange them.

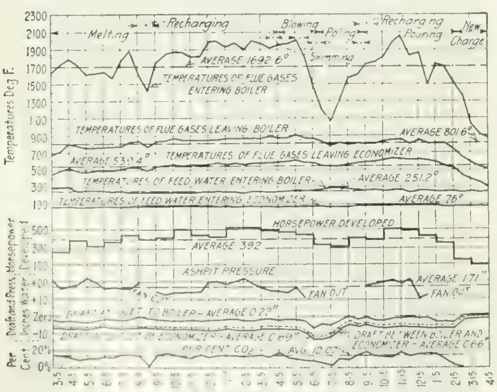

Diagram of Test on No. 4 Waste-Heat Boiler Equipped with Economizer

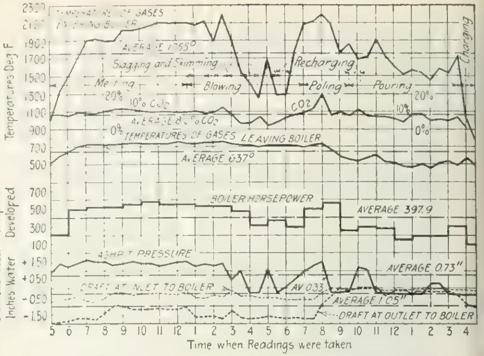

Diagram of Test on No. 5 Waste-Heat Boiler

After careful consideration of what had been done and the results, I became convinced that waste-heat boilers could be made to pay on reverberatory copper-refining furnaces with a proper installation, the important factor being to get the boiler as close to the furnace as possible, eliminating all long and crooked flues, also to discard the emergency stack, thus doing away with dampers that we
practically impossible to keep tight. The design show
in Fig. 4 was adopted and the boilers shown in Fig.
were moved to this new arrangement with the result giv
in Table IV. One remakable thing about this install
tion is that the boiler absorbs more heat units than t
furnace does.

TABLE IV—EVAPORATION TEST ON WASTE-HEAT BOILER EQUIPPED WITH ECONOMIZER

This test started at 3:15 p.m. July 30, 1914, just after charging of furnace was finished, and continued for a period of 25 hr., until the furnace was charged again. The gas samples were taken in the flue between the boiler and the economizer. The boiler had been in service eight days since last cleaned. Average ashpit pressures were taken during the periods the fan was running. Readings were taken every half-hour.

Date of trial		July 30 and 31, 1914
Duration, hours		2
Kind of coal		Soft coal
Average steam pressure (gage)		150.7
Average temperature of feed water entering economizer, deg. F.		76.0
Average temperature of feed water entering boiler, deg. F.		251.2
Average temperature of flue gases entering boiler, deg. F.		1692.6
Average temperature of flue gases entering economizer, deg. F.		801.6
Average temperature of flue gases leaving economizer, deg. F.		539.4
Average ashpit pressure, inches of water		1.71
Average draft at inlet to boiler, inches of water		0.22
Average draft between boiler and economizer, inches of water		0.66
Average draft at outlet of economizer, inches of water		0.69
Total wet coal fired, pounds		50,9
Moisture in coal, per cent		2.94
Weight of dry coal fired, pounds		49,4
Weight of ash, pounds		4,8
Total water evaporated, pounds		285,0
Factor of evaporation		1.18
Actual water per pound of coal		5.60
Equivalent evaporation per pound wet coal		6.64
Equivalent evaporation per pound of dry coal		6.84
Boiler horsepower developed		392.0
Percentage of builder's rating		148.48
Analysis of coal	Volatile matter, per cent	24.94
	Fixed carbon, per cent	67.99
	Ash, per cent	7.07
Analysis of ash	Volatile matter, per cent	0.46
	Fixed carbon, per cent	12.51
	Ash, per cent	87.03
Analysis of flue gas	Carbon dioxide, per cent	12.07
	Carbon monoxide, per cent	Trac
	Oxygen, per cent	7.49

The results of this test were so good that all furnaces have since been equipped with waste-heat boilers shown in Fig. 5; the results of operation being shown in Table V and in an accompanying diagram. An individual B. F. Sturtevant economizer has been installed on one of these boilers with excellent results, and it is the intention at this time to install individual economizers on all the waste-heat boilers.

TABLE V—EVAPORATION TEST ON NO. 5 WASTE-HEAT BOILER

This test started at 5 p.m. May 27, 1914, just after charging the furnace, and continued for a period of 23½ hr., until the furnace was charged again. The gas samples were taken in the induced-draft flue. The boiler had been in service 233 hr. when the test was started.

Date of trial		May 27 and 28, 1914
Duration, hours		23.5
Kind of coal		Soft coal
Steam pressure		145.6
Temperature of feed water, deg. F.		76.0
Temperature of gases entering boiler, deg. F.		1755.0
Temperature of gases leaving boiler, deg. F.		637.0
Draft at inlet to boiler, inches of water		0.318
Draft at outlet to boiler, inches of water		1.051
Ashpit pressure, inches of water		0.73
Total wet coal fired, pounds		52,000
Moisture in coal, per cent		1.79
Weight of dry coal fired, pounds		51,069
Weight of ash, pounds		5,943
Total water evaporated, pounds		272,133
Factor of evaporation		1.1855
Actual water per pound of wet coal		5.2334
Equivalent evaporation per pound of wet coal		6.2046
Equivalent evaporation per pound of dry coal		5.3177
Boiler horsepower developed		397.9
Percentage of builder's rating		99.47
Percentage of CO_2 in flue gases		8.84
Analysis of coal	Volatile matter and fixed carbon, per cent	92.85
	Ash, per cent	7.15
Analysis of ash	Volatile matter and fixed carbon, per cent	12.75
	Ash, per cent	87.25

The appearance of the outside of the furnace building is interesting from the entire absence of large stacks, as shown in the view on p. 892.

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New Weights and Measures in China

United States Minister Paul S. Reinsch writes from Peking:

The recently promulgated weights and measures law of China establishes a double system, one being the standard metric unit, the other based on the Ying Tsao chih (builder's foot) for length and the Kuping tael (or liang) for weight. The law contains provisions for the inspection of weights and measures used, imposes fines for the use of untested or fraudulent measures, and sanctions the establishment of a special plant for the manufacture of instruments of weight and measure in order to secure absolute uniformity. Those who wish to make the manufacture or the sale and repair of weight and measure instruments their profession must apply to the Ministry of Agriculture and Commerce for special permission.

The units for length, area, capacity and weight, with their metric and American equivalents, are: Length: Chih = 0.32 m. = 1.049867 ft. Surface: Mou (6000 square chih) = 0.06144 hectare = 0.15182 acre. Capacity: Sheng = 10.354688 liters = 10.9416 liquid quarts or 2.7354 gal. Weight: Liang = 37.301 gm. = 1.31561 avoirdupois ounces. The term "li" is used to express (a) 0.001 chih (also 1800 chih), (b) 0.01 mou, and (c) 0.001 liang.

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The Phosphate Rock marketed by the United States in 1914 was 2,734,043 long tons, of which Florida marketed 2,138,891; Tennessee, 483,203; South Carolina, 106,919; and the Western States, 5030, according to the U. S. Geological Survey. The Survey calls the quantity marketed "the production," as distinguished from the quantity mined, 2,649,174 tons. The logic is obvious.

New Mining Activities in the Southern Appalachians

Special Correspondence

A number of new mining undertakings are under way in the region comprising southwestern Virginia, eastern Tennessee and western North Carolina. One of the most interesting projects is controlled by F. R. Walter and associates, of Philadelphia. Under the name of the Minerals Refining Co., title has been acquired to the mineral rights of more than 12,000 acres, mostly in western North Carolina, on which are deposits of mica, asbestos, barite, chromite, excellent clay, feldspar and other minerals. The properties have been examined by John H. Banks, of New York, and are now being developed. It is proposed to install a plant at Johnson City to produce a variety of products, including ground mica, potash from feldspar, various barite preparation and washed clays.

The John T. Williams barite plant at Bristol is being overhauled and is expected to operate again soon. It is reported that a new use for barite as a plant spray will create a demand for the barite found in the vicinity of Bristol, in Tennessee, and western North Carolina. The demand for other barite products for paint has been increased by the curtailment of imports. A plant to make peroxide of hydrogen has been established at Charleston, W. Va., which will also require barite.

Active Exploration for Zinc Going On

Exploration of the widely scattered zinc deposits of the southwestern Virginia district has been started at Ivanhoe on the Carolina branch of the Norfolk & Western from Pulaski. S. L. Boggs is developing the John Jackson tract adjoining the Austinville property of the New Jersey Zinc Co. A Pittsburgh syndicate has an option on the Wissler tract, also at Ivanhoe, and the property was recently examined by Dr. Richard R. Hice, state geologist of Pennsylvania, and by Kirby Thomas, of New York. Local interests are prospecting the extensive deposits of zinc-iron sulphide at Allisonia between Ivanhoe and Pulaski. George Carter of Pittsburgh, owner of the Ivanhoe furnace and iron mines, has developed two deposits of zinc on the property and has been shipping carbonates for several months. He is building a 100-ton concentrator to treat the sulphides opened in the old iron mine near Ivanhoe. Resumption of explorations on the Lobdell mine in Rye Valley about 20 miles west of Ivanhoe is also being considered. This was drilled and explored by the American Zinc, Lead & Smelting Co. last year, but the option was not exercised. This is the company which has successfully developed the Mascot zinc mine near Knoxville, Tenn.

In Rye Valley, Philadelphia people are operating the old Umbager mine for manganese. About a thousand tons of manganiferous iron ore have been shipped to the Pulaski furnaces and several carloads of manganese ore to Pittsburgh. H. H. Greene, who formerly developed the Columbia lead mine near Sugar Grove in the same valley, is in charge. A small plant is being installed to wash the ore, and it is expected to ship a large amount during the coming season. The narrow-gage road has been extended from Sugar Grove to the mine. A plan is being considered to extend the broad-gage road from Speedwell to Rye Valley, thus giving the iron, manganese and zinc mines an outlet in that direction instead of by the switchback road to Marion.

In East Tennessee E. R. Eaton is in charge of several explorations for local interests. The old Haysville iron mine, about 12 miles southwest of Greeneville, is being reopened for zinc, indications of which are found on the old dumps. A new manganese deposit near the dam on the Nolichucy River is being opened, and several cars of high-grade ore are ready for shipment. The Fall Creek zinc mine northeast of Greeneville is under negotiation. This has been closed for several years by litigation. It is equipped with a mill. The Embreeville zinc mines have installed electric power, and it is reported that they have more than five years' supply of ore from the old iron pits. The ore is mostly carbonate, and is washed and sorted. Explorations are being made to find the sulphides. The Johnson City iron furnaces are taking all of the ore from the Cranberry mines and are seeking other supplies, as these mines are not yielding as formerly as to grade or cost conditions. This furnace makes a low-phosphorus iron which is in good demand.

Recent Improvements in the Metallurgy of Zinc

George F. Brooks, of the New Jersey Zinc Co., has patented (U. S. pat. 1,137,835, May 4, 1915) a briquette for charging zinc retorts, consisting of four parts by weight of zinc ore crushed to the usual degree of fineness; one part of more finely powdered ore, or in lieu thereof one part of commercial zinc oxide; one and a half parts of coal of the usual degree of fineness; and a sufficient quantity of common salt dissolved in water to form a thick plastic mixture of the several ingredients, the amount of salt solution being approximately 1½% in weight of the amount of ore in the mixture. [We fancy that this refers to the percentage of salt, not the percentage of salt solution.—EDITOR.] This mixture is formed into briquettes approximately 7½ in. in diameter and 7 in. in length by a pressure of approximately 90 lb. per sq.in. The molded briquette then is dried for about 24 hr. at about 220° F. The result of the drying is to bring the salt out to the surface of the briquette, where it forms a hard, inclosing crust. This crust strengthens the briquette mechanically and, furthermore, forms a filter of material high in salt, through which the fumes distilled from the ore are compelled to pass, which results in an increased production of spelter from a given quantity of ore and a correspondingly reduced production of blue powder. A further advantage is the ability to charge 15 to 20% more ore into a retort than in the ordinary way. Allowing for this and the smaller quantity of blue powder to be recharged for redistillation, the capacity of a given furnace is increased approximately 50%.

The inventor in his specification states that he is aware of the previous practice of adding a small percentage of salt to the charge for zinc distillation. His claim for novelty rests upon the special way described herein.

Dr. Max Engels, of Westend, near Berlin, Germany, has patented (U. S. pat. 1,136,519, Apr. 20, 1915) the use of zirconia in the batch for making zinc retorts. He states that good results have been obtained with retorts, consisting of about 33 parts in weight of clay, 62 parts fireclay and 5 parts of zirconia. Such retorts are remarkably more durable than the usual ones, consisting of about 33 parts of clay and 67 parts of fireclay. The increase in durability is obtained only when the proportion of zirconia is relatively small, not to exceed 10%. With the use of a larger proportion, the increase in durability ceases and deterioration sets in. However, it is not necessary to adhere strictly to a proportion of 5% zirconia Good results are obtained with a smaller proportion, and it has been found that even 1% of zirconia gives a preceptible improvement of the retort.

Reduction of Rand Costs

A noteworthy feature of the annual reports of Witwatersrand gold mining companies which have made their appearance during the last few weeks is that in nearly all cases a reduction in working costs has been recorded, says the *London Financial Times,* of Apr. 26, 1915. This has not been the outcome of a general large increase in the quantity of ore milled; as a matter of fact, in some instances the expense ratio has been brought down notwithstanding a decline in the tonnage treated. The reduction in working costs is all the more satisfactory in view of the fact that the native-labor requirements of the mines were not fully met during the last year, a fact which encourages the hope of further reductions, given more regular and adequate labor supplies, such as most of the gold mines have been enjoying during the last few months, partly, if not largely, in consequence of the suspension of production at the diamond mines.

In the appended table are given the official figures for the last two years of 25 Rand companies whose reports have recently been issued:

COST DATA OF RAND COMPANIES

Mine	1913		1914		Reduction	
	s.	d.	s.	d.	s.	d.
Aurora West	20	0	19	11	0	1
Bantjes Consolidated	22	8	22	1	0	7
Brakpan	18	9	18	6	0	3
City Deep	25	7	22	5	3	2
Consolidated Langlaagte	17.6		14.7		2.9	
Crown Mines	16	5	15	7	0	10
Durban Roodepoort Dp	24	5	23	5	1	0
Geldenhuis Deep	24	4	22	10	1	6
Ginsberg	19.6		17.9		1.7	
Glencairn	13	0	11.7		1.3	
Knight Central	20	3	19	2	1	1
Meyer and Charlton	18	3	17	6	0	9
Modderfontein B	16	4	15	7	0	9
New Goch	16	3	14	5	1	10
New Primrose	13.6		12.7		0.9	
New Rietfontein	19.9		18	0	1.9	
New Unified	17.6		13.8		3.8	
Robinson	14	1	14	3	2d inc.	
Roodepoort United	18	0	16	11	1	1
Rose Deep	16	7	16	7	..	..
Van Ryn Deep	19.9		16.5		3.4	
Village Deep	20	7	17	8	2	11
West Rand Consolidated	22	9	19	11	2	10
Witwatersrand Deep	17	3	16	5	0	10
Witwatersrand (Knights)	14.7		13.4		1.3	

It will be seen that expenses have been reduced in all but two cases, those of the Rose Deep having averaged the same amount in both years, while those of the Robinson were a couple of pence per ton higher last year than in the preceding period. The declines range from 1d. per ton in the case of the Aurora West up to as much as 3.8s. per ton in the case of the New Unified. In a few of the technical reports references have been made to the labor efficiency on the Rand having been improved. This factor no doubt accounts in some measur for the satisfactory showing made by the above cite figures as a whole.

* * *

Gaseous Alloys are in general stable only at low temperatures and pressures. This is shown, according to H. vo Wartenberg (Journ. Soc. Chem. Ind., Nov. 16, 1914), by consideration of Nernst's heat theorem and Trouton's rul A determination of its heat of formation showed that MgZ exists at 600° C., and vapor density determinations that it dissociated at 1300° C. The vapor tensions of sodium an of Na_3Hg were measured at 111° C., and the stability of Na_3H at 380° and 144° C. demonstrated by distillation.

Apex Litigation at Tonopah

SYNOPSIS—Court decides that a vein dipping north on one side and south on the other side can have extra lateral rights in both directions and that they hold despite a broken end-line.

In the JOURNAL of Apr. 10 were published the contentions of the two parties to the apex suit of the Jim Butler vs. the West End, together with a map and sketches. On Apr. 30 the court handed down a decision in favor of the West End, and inasmuch as some novel points were involved in the suit, the decision is briefly quoted from herewith.

Early in the opinion the court makes this interesting comment:

> During the taking of evidence and in the argument a tendency was occasionally vocally manifested by experts and counsel to view the situation from the standpoint of the miner. Nothing in the law or elsewhere demands of a skilled geologist or lawyer that he view anything as a prospector might or he who wields a shovel, but this tendency had at least the value of preventing these learned gentlemen from wandering too deeply into the often uncertain realms of speculative geology.

One important contention of the plaintiff was that the vein in question was in the form of an anticline and that an anticline did not give extralateral right under the apex law. The defendant contended that the vein was not an anticline, but two separate veins coming together at a point like a wedge, and the point being on their ground gave them extralateral right in the direction of the dip of each vein. The court says:

> The . . . contention of fact is whether the body of quartz, ore, etc., . . . in controversy constitutes one vein or two. The evidence easily preponderates that it, or they, form but one vein. . . . But, though thus found to be one vein, this conclusion is not at all what might be called an absolute one, but is qualified, as will further appear in this discussion.
>
> . . . .
>
> The plaintiff company rests its case to a great extent upon its claim that the vein is an anticline. That the vein is an anticline, using the word broadly and generally, is true; but strictly speaking, it is not true either geometrically or geologically. The difference, however, is merely one of wording of definitions, and is not important. The word "anticline" will serve as a name for the vein-form if properly limited and if no conclusion is drawn from the use of the word that is not justified by its application here. The word "anticline," geometrically speaking, implies the existence of one or two "synclines" or "troughs" lying laterally with it and having the same direction. Nothing of this kind is shown by the evidence in this case; no synclines accompany the anticline.
>
> . . . .
>
> Whether the word "anticline" is applicable here or not, the word "anticlinal" has a broader meaning and is more applicable. It is defined: "Inclining or dipping in opposite directions." "Anticlinal axis" is defined: "A line from which strata dip in opposite directions, as from the ridge of a roof." The MacNamara-West End vein is anticlinal, using the word liberally; and, if so, it has presumably an anticlinal axis. As a proposition of law the plaintiff company holds that if this is true, there can be no extralateral rights, because there is no true apex, as the existence of an apex involves the existence of a terminal edge; that there can be no terminal edge if the vein goes up one slope, turns over and goes down the other. This feature of the case is so momentous that it must be decided as a question of fact first to what extent an anticlinal axis actually exists.
>
> . . . .
>
> The defendant company claims two apices along the anticlinal axis, one for the north-dipping vein and one for the south-dipping vein. The latter vein, according to this theory, apexes along the line where it abuts against the north-dipping vein, while the latter apexes along an irregular line above the other vein as indicated by the quartz exposures in the "A Raises." The finding has already been made that there is but one vein, which, having disposed of the two-vein theory, now requires a consideration of what the "A Raises" do show. The plaintiff's witnesses admit the presence of bodies of quartz in these raises, some of the bodies of good size and considerable length; but they include them in the "Stringer Zone" of the vein, or its "Halo." Some of these are large, from [illegible] 5 ft. in thickness, which, were it not for inescapable comparison with the immense quartz bodies in the MacNamara-West End vein itself, would never be termed "stringers." The larger ones are probably not stringers, geologically or otherwise; they are not part of the "Stringer Zone," but are part of the "Halo," the distinction being readily grasped; that is to say, they constitute an upward extension of the main vein toward the surface.
>
> They follow to some extent, though not very closely, a gouge hanging wall, which the West End people assert is the hanging wall of the north-dipping vein, but which the Butler people ascribe to the Siebert fault.
>
> . . . .
>
> If the halo is to be included in the vein, and geologically it should be, this vein reaches now and did reach all the surfaces to which the apical facts are referable. It has, therefore, along its crest and extending above the anticlinal axis of the united main quartz bodies, a condition of things that may well serve as a terminal edge under the many peculiar circumstances and facts of the case.
>
> It was very strongly urged on behalf of the plaintiff company that this vein has a rolling habit. . . . The vein is irregular in size and much distorted and broken, but it is almost free of rolls, having only two worthy of notice, one easily accounted for as a phenomenon of junction with the Fraction vein and the other as a result of a number of small faults lying close together.
>
> Much time and attention were given to the question of strike. As a matter of common sense rather than technical mathematics the strike of the vein as a whole is easterly and westerly, and the strike of its two slopes, assumed for the purpose to be separate veins, is as claimed by the West End.
>
> . . . .
>
> Now the questions of law. Can a vein have extralateral rights in two opposite directions? Or to express it more carefully, can extralateral rights extend downward from an anticlinal axis or common apex of a vein in a given claim beyond both side-lines of the claim? The answer depends upon the peculiar facts of the case; and in this instance, because of those peculiar facts, the vein, though one, being practically more two than one, they can; or, treating it as one vein for both theoretical and practical purposes, a condition exists along its crest or axis which gives to the vein, considered broadly and as a whole, a terminal edge at the summit or highest point or line of highest points where the vein reaches most closely to the surface, making that line of highest points a true apex for the whole vein, from which apex the vein can be followed downward both northerly and southerly.
>
> Can a secondary vein have a southerly extending extralateral right, if the primary vein, or discovery vein, has its extralateral right extending northerly? Counsel for the Butler company holds that, under the two-vein theory of this case, no extralateral right to the south can be exercised, because the extralateral right predicated on the discovery vein flows to the north. This contention is fully and conclusively answered by counsel for the West End.
>
> Is the West End claim entitled to any extralateral rights, its west end-line being a broken line? The rule probably is that for extralateral rights to flow from a mining claim it must have unbroken and parallel end-lines, if the vein crosses the end-lines; or it must have unbroken and parallel side-lines if the vein crosses its side-lines. In this case the vein passes through the east end-line, which is unbroken, and passes out through the north side-line, having its length in the claim along and gradually approaching the side-line, which eliminates the side-line as a bounding line from which a limiting vertical plane might be dropped. The end-line being unquestionably the line [illegible] which the easterly limiting plane should be dropped, and being unbroken, and the opposite limiting plane being necessarily parallel to it and fixed by the [illegible] point on the side-line, it seems as though [illegible] the west end-line has nothing to do with any extralateral right that may flow from the claim. However, the [illegible] contract with the Government includes four co[illegible], the

> part of the locator, that he make a discovery of mineral in place, that he give notice of his claim, that he define his boundaries, and that his boundary lines conform to the requirements of the law, that is, they must be parallel and unbroken. If he observes these, the Government not only gives him the land inclosed in his lines, but the extralateral right. A strict application of this idea would bar the West End claim from any extralateral right; but the law as applied by the courts is not so strict. Treating a part of the westerly end-line as converging, it has no application to the present facts of the case, as it passes west of all orebodies in dispute.
>
> If the conclusion reached herein seems revolutionary, that from the apex or apices of one vein extralateral rights flow downward across both of its side-lines, attention should be given to the words of former Chief Justice Beatty, of Nevada:
>
>> We are willing to admit that cases may arise to which it will be difficult to apply the law; but this only proves that such cases escaped the foresight of Congress, or that, although they foresaw the possibility of such cases occurring, they considered the possibility so remote as not to afford a reason for departing from the simplicity of the plan they chose to adopt.
>
> It is easy to realize that the condition described in this opinion is one that escaped the foresight of Congress and is also exceedingly remote from the simplicity of the plan they chose to adopt; yet the law must be applied to it, the law in which Congress used the expression "exclusive right of possession and enjoyment . . . of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines extended downward vertically, although such veins, lodes or ledges may so far depart from the perpendicular in their course downward as to extend outside the vertical side-lines. . . ." Note the plural of the word "side-lines."
>
> This branch of the case is decided in favor of the defendant corporation. That is to say, the West End Consolidated Mining Co. is the owner of the orebodies in dispute.

The court also said:

> The testimony in the case is voluminous, occupying 1130 pages of transcript, yet it is plain to be seen that it could have been much more extensive. All this is mentioned here as cautionary and as indicating how helpless we are in facing great geological problems.

After reviewing an abstract of the decision, President Clyde A. Heller of the Jim Butler company gave out the following official statement:

> The contention of the Jim Butler company was that there was but one vein, having an anticlinal roll and known in the camp for years past as the West End-MacNamara vein. The West End company endeavored to prove that there were two veins, one dipping north and the other south, and that each vein apexed in their claim, giving them extralateral rights both north and south.
>
> Our local counsel at Tonopah telegraphs that Judge Averill in his decision upholds our contention as to fact and holds that there is only one vein. He awards extralateral rights both on the north slope and on the south slope of said vein. Our counsel regards this as a reversible error of law. The Federal Court's decision in the Leadville cases holds that an anticlinal roll in one vein does not constitute an apex and, therefore, there can be no extralateral rights in any direction.
>
> Judge Averill also holds that the broken end-line of the West End claim does not defeat extralateral rights. Our counsel informs us that the Supreme Court of the United States has decided that there can be no extralateral rights where both end-lines are not parallel. I think there is no doubt that the case will be appealed and it will be reversed by the Supreme Court.

Bolivia to Build Railroads

The government of Bolivia has announced its intention of beginning at once the construction of a railway line from Tupiza, in the southern part of Bolivia, to La Quiaca, in the northern part of Argentina. La Quiaca lies practically on the boundary line between Bolivia and Argentina and is the northern terminus of one of the great Argentine lines. Tupiza lies on the Bolivian railway system and is connected with the Pacific Coast by three lines touching the coast in southern Peru and northern Chile, and the connection of these two lines, now proposed by the Bolivian government, will give another transcontinental railway line to South America. The Bolivian railway system consists chiefly of a north-and-south trunk line through the great elevated region in the vicinity of Lake Titicaca, which line is connected with the Pacific Coast by three distinct lines running to Antofagasta and Arica, Chile, and Mollendo, Peru.

Steam-Electric-Driven Dredge for the Philippines

The Mambuloa Placer Co. has ordered from the New York Engineering Co. an 8-cu.ft. gold dredge embodying a number of interesting features. The dredge will operate in salt water in the bay of Mambuloa, on the north shore of the Province of Ambos Camarines, Island of Luzon. The hull will be built more on the lines of a ship than the usual dredge hull. The dredge is provided with a clay chute placed directly over the screen, so that barren material overlying the gold-bearing gravel may be bypassed instead of going over the gold-saving tables.

Electric Power Generated on Dredge

The most noteworthy feature of this dredge, perhaps, is the fact that the machinery will be electrically driven, the electric power being generated on the dredge by a steam turbo-generator. This arrangement permits more elastic and economical driving of the dredge machinery and eliminates the uneconomical individual engines usually employed on steam-driven dredges. While the application of electric power generated from a steam plant on the dredge is an innovation on gold dredges, it is simply a new adaptation of a practice already established in an allied field, as there are a number of harbor dredges operating this sort of equipment with entire satisfaction.

The Mambuloa Placer Co. is a close corporation organized by Joaquin Casanovas, who is the principal stockholder and an old-time resident of the Philippines. The property controlled by the Mambuloa company consists of about 800 acres near the town of Mambuloa, which is but a short distance from the Paracale district, where the Gumaos, Philippine Dredges, Maximelo and Malaguit companies are operating. A portion of the property owned by the Mambuloa company has been drilled by William Kane, who tested the Gumaos company's ground. Most of the gold is found in a layer of gravel from 6 to 8 ft. thick at the bottom. This is overlain by 40 to 45 ft. of barren sand and clay.

The dredge is designed to dig 55 ft. below water line and to stack 35 ft. above the water line. The dredge hull is 136 ft. long, 10 ft. deep and has a beam of 47 ft., with an overhang of 3 ft. on each side. The dredge will have a wooden hull, as it is to operate in salt water. A steel hull would require frequent docking and painting, which is impractical in this instance, and the first cost is higher. The wood hull will be protected by a special ship-sheathing felt to prevent injury by boring mollusca. The sheathing consists of a specially prepared hair felt, which is dipped in preserving materials and then rolled or pressed into sheets of about ¼-in. thickness. This material is applied outside the regular 4-in. planking of the hull, and then a plank covering, 1½ in. thick, is put on for general protection.

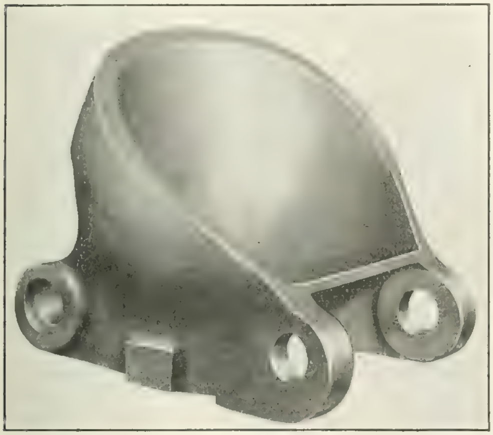
Ventilation of Hull

The ventilation of the hull, essential in the tropics, is accomplished through the ventilating apparatus of the turbo-generator. The air for ventilating the armature will be taken from the hull, and it is calculated to cause a change of air in the hull every 10 minutes.

As the dredge operates in the open sea, all of the hull fittings are galvanized to avoid corrosion from the salt water, and a special arrangement has been provided on the spuds for taking care of inequalities due to the tide, which amount to about 6 ft. in this latitude. This involves paying out the spud lines automatically as the tide rises and taking care of the slack when the tide is falling.

The digging ladder is of the solid plate-girder type, 110 ft. long by 9 ft. at its deepest part. The ladder has a separate set of blocks and ropes for each side. The forward suspension bars will be 5½ in. in diameter and the rear suspension bars will be flat, 7 in. wide by 2 in. thick, all of forged steel, without welds.

A new feature on this dredge is the equalizing sheave placed on top of the main gantry. The ladder-hoist ropes on each side of the ladder have been joined, or rather a single continuous rope has been used for this purpose and passes over the equalizing sheave, thereby equalizing any stretching or inequalities of either side. A similar equalizing arrangement is applied to the hanging of the stacker, which instead of being supported at two points has three suspensions, the rope being reeved through equalizing blocks at the three points.



One-Piece Bucket for Mambuloa Dredge

This 8-cu.ft. bucket is made entirely of manganese steel and is provided with a thickened lip which is expected to last as long as the rest of the bucket.

One-Piece Manganese-Steel Buckets

The buckets for the Mambuloa dredge are of one piece of manganese steel, the lip being cast integral with the rest of the bucket and designed to wear as long as the back and hood. This is considered feasible in the sort of ground this dredge will dig.

The main winch is equipped with nine drums, as in the case of the Gumaos dredge built by the same manufacturers for use in the Philippines. This gives spare drums for any extra requirements around the dredge.

The main dump hopper has a manganese-steel bottom placed on an angle. This is capable of being removed, leaving the regular gravel cushion, if desired. The manganese-steel bottom was adopted to reduce the amount of spill into the well.

The revolving screen is 10 ft. long and 78 in. in diameter, with tires of 12-in. face. The screen is supported by a cast-steel trunnion ring at each end; driving is accomplished by a center-roll drive placed directly below the lower trunnion ring, the screen being maintained in position by small side idlers.

Clay Chute for Barren Overburden

The clay chute to bypass barren material is placed directly over the screen, running aft to the stern, where it divides into two branches, each extending over the stern about 30 ft. The clay chute is semicircular in section, to secure the largest carrying capacity with the least amount of water. The upper part of the chute where the buckets dump will be of manganese steel, and this part will be so hinged that it can be readily raised when auriferous gravel is being dug, permitting the buckets to dump in the hopper in the usual manner and the material to pass through the screen.

The high-pressure pump will furnish water at the head of the clay chute for washing, the water being introduced across the entire width of the sluice and in the same direction in which the sand and clay are traveling. The 12-in. high-pressure pump will be driven by a 125-hp. motor direct-connected, and the 14-in. low-pressure pump will be operated by a direct-connected 75-hp. motor. Besides these, there will be fire pumps and the usual accessory pumps for the power plant.

A traveling crane, separate stacker hoist and other modern equipment will be provided. Cast steel is used in nearly all the dredge parts, even for some of the bearings. All gears throughout the dredge have machine-cut teeth, insuring smooth running and minimum breakage of teeth.

The boiler is of the water-tube type, especially arranged for using wood fuel. It will have straight tubes accessible at each end for cleaning. The boiler will furnish steam at 150-lb. pressure to a horizontal 625-kv.-a Curtis turbo-generator which will run condensing. The condenser will be of the vertical type with 1-in. brass tubes. Wash water on its way to the screen will be passed through the condenser for cooling purposes.

It is interesting to note that in alternate bids for a steam-electric-driven and for a steam-driven dredge the boiler equipment in the first instance was a 330-hp. boiler, whereas in the regular steam-driven dredge equipped with individual engines for driving the different machinery a 500-hp. boiler was specified. The former bid was accepted. Wood costs about $5 per cord delivered on the dredge, so that the daily saving in fuel will be important. The total cost of the dredge when erected will be about $250,000. While the steam-electric-driven dredge is expensive in first cost of the machinery required, as compared with the ordinary electric-driven dredge, it should be noted that for the latter the purchase of power from an outside company obviates the investment for a power plant.

The operating cost of the Mambuloa dredge is expected to be lower than that of the ordinary steam-driven dredge, inasmuch as the driving units are more economical. The oil and supplies required for each engine on the steam-driven dredge and the wear and tear on these engines are greater than that of the steam-electric-driven dredge;

also, the reciprocating engines of the steam-driven dredge have a tendency to cause more racking of the hull than in the case of the turbo-generator and motor-driven units.

When a second dredge is installed by the Mambuloa company, the power plant will be taken off this dredge and put on shore, as it is considered that it will then be more economical to operate the dredges by electricity from a single power plant. This is the reason for the installation at this time of a 625-kv.-a. turbo-generator.

Besides the dredge itself, the contractors will supply a gasoline-driven tender 40 ft. long, having a 10-ft. beam. This will be used for the purpose of conveying passengers and workmen from the town to the dredge, and also for towing and handling scows laden with fuel. These scows, of which three will be built, will be 40 ft. long, 15 ft. wide and 5 ft. deep. A small machine-shop equipment is also being furnished, as well as material for two houses for administration and residential purposes.

Business in Mexico

Business continues to be carried on in Mexico. Among the lower classes of natives particularly there has been less disturbance than one might imagine. To those unacquainted with that country it is marvelous that local business survives the shocks and strains of depreciated currency, suspension of export, removal of banks, absence of salaries, abandonment of large properties, loss of farms and animals, cessation of freight traffic, and withdrawal of liquid capital by natives and foreigners. In commenting upon this state of affairs in the *Daily Consular and Trade Reports,* Apr. 30, 1915, Consul Wilbert L. Bonney, of San Luis Potosi, calls attention to these facts and shows the reasons for their existence.

The explanation lies partly in the fact that a large proportion of the Mexican people have always been and are now outside of all these conditions. Their communities are largely isolated, requiring little and being nearly sufficient unto themselves. Exporting, importing and financing have been carried on over their heads, and the complete failure of the structure would scarcely affect the average Mexican. Those thrown out of employment in the mines and industries have found employment in the army. The exporting business has, in the past, furnished employment, but aside from that has not affected the business with communities. Government expenditures have made money plentiful among the lower classes, and the depreciation of the money has forced its quick circulation. Lack of production of staples has been somewhat compensated for by bringing to market the stores from country warehouses, which are commonly held for high prices. However, this source of supply may soon be exhausted. Paper money is fairly plentiful, but wholesale and importing lines are crippled. Large producers will not resume operations until conditions become sound. The class of people who buy imported goods has always been limited. Retail business in native goods is fairly active, and the paper money is accepted and rapidly passed from hand to hand. There are no banks operating in this district.

The loss of import trade, so far as it affects the vast majority of the people, may be compared with the loss of the Pullman service on the National Railways of Mexico. As nine-tenths of the people never enter a sleeping car, the loss of this service is entirely unheeded by them. The same is true with respect to the paper money. The quality of money is tested only when one desires to purchase a foreign draft. The greater number of Mexicans never have occasion to inquire the price of foreign drafts, and the value of the money does not affect them seriously.

Credits have been completely upset, but again this does not directly affect the vast majority who never enter a bank and who have never had any credit. Central Mexico has undoubtedly been living upon its capital for a long time, and an end must come to this condition. As to the land, if the old system of cultivation is changed and the large properties are broken up, the jobbers and importers of machinery, tools and supplies will be quick to see that the land when divided will require many more industrial outfits for its operation. The old system under which one owner sometimes bought 500 American plows may not survive, but a number of smaller farms may supply a great demand for imported machinery and accessories. The first demand will be for supplies for plants resuming operations after a long suspension. New organizations will undoubtedly be instituted to take care of labor conditions. If employees are to receive higher wages they must be selected with greater care, and it is probable that the piecework system, with maximum use of machinery, will be depended upon wherever possible, in order to make wages accord with the energy and efficiency of the employee.

A state decree in September prohibited the shipment of foodstuffs out of the state, and the sugar producers were prevented from shipping to the United States just at a time when the market was most favorable. On Sept. 16, 1914, a minimum wage decree was promulgated, placing the minimum wage at 75c. on the farms and $1.25 in mines, and limiting the working day to 9 hr.; also canceling debts of laborers to their employers and requiring wage payment in cash. The result has been an attempt to introduce piecework wherever possible. The same decree reduced the landlord's share of produce to one-fourth, and if followed out will retire from the market a large amount of country property.

Duty to Provide Safe Place of Work

By A. L. H. Street*

The rule of law that an employer is under no legal obligation to provide his employees with a safe place to work, when the perils to the working place result from the progress of the work in which they are engaged, has no application to miners engaged in drilling holes preparatory to blasting, and injured through explosion of a missed shot in a hole partly drilled by the preceding shift, according to the holding of the United States Circuit Court of Appeals in the late case of Reardon vs. Balaklala Consolidated Copper Co., 220 *Federal Reporter* 584. This decision proceeds upon the theory that there will be no peril of this kind if proper inspection to discover missed shots be maintained by the operator, especially where the operator undertakes to make such inspection.

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California Has 276 Oil-Producing companies; 72,535 acres of oil-producing land; 6183 wells yielding 657,051,458 barrels, an average of 9050 barrels per acre, according to the annual report of the State Mineralogist for 1913 just issued.

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*Attorney, St. Paul, Minn.

Geology of Juneau District

SYNOPSIS—A review of the general geologic structure of the Juneau gold belt, together with a discussion of some of the local factors affecting ore deposition.

It is a privilege to live in a mining district of the proved magnitude of the "Juneau Gold Belt" in that stage of its development when interesting problems involving every branch of engineering are being encountered. The solution of the problems of economic geology at this stage is of the greatest importance to the district. The studies of Dawson, Kinzie, Becker, Wright, Spencer and Knopf have given considerable knowledge of the general structure of the region, the character of the ore deposits and the nature of the processes by which they were formed. They have shown that the region has a banded structure parallel to the coast which is observable in all the important geologic features.

General Structure of Region

The great diorite batholith, 40 to 70 miles wide, forming the core of the Coast Range, lies in general a few miles inland. Between it and the coast and on the islands of Alexander Archipelago are parallel belts of schists, slates and volcanic rocks, which within 15 miles or so of the diorite dip steeply inland. These are believed to form a close-folded synclinorium of which the tops of the anticlines have been completely eroded.

Of these beds the schists are merely those which, by their proximity to the intrusive diorite batholith, were subjected to the greater metamorphism, and may in any particular case be either of sedimentary, clastic or igneous origin. The slates, graywackes and limestones are, of course, of sedimentary origin. The volcanic greenstones are probably in part intrusive, but largely extrusive, lavas, tuffs and breccias.

The Coast Range diorite was intruded after these strata were laid down and folded in much their present position, as the stratification has determined largely the outline of the diorite. This batholith is quite likely composed of several successive intrusions, and isolated massive intrusions of the same rock occur erratically in the other belts. Some of these, as the Jualin mass, have been shown to be intruded later than the batholith.

Occurring erratically in all the belts of stratified rocks are dikes of perhaps three distinct types—diorite, metagabbro and basalt. Of these the basalt dikes are youngest and apparently have had no influence on the ore deposits.

The Treadwell series of dikes, various dikes near Gastineau Channel and the albite-mica schist of the mainland are examples of mineralization of dikes originating from a dioritic magma. These vary in texture from granular to porphyritic, and even felsitic.

The metagabbro, called also in the less carbonated form amphibolite, or green diorite, when on or near the contact of the main slate and greenstone belts, is usually ore bearing. Wide zones in the adjacent slates are of still greater importance, their width and persistence both laterally and with depth having been sufficiently proved.

The mineral deposits of the region are believed to have been formed under conditions of high temperature and pressure by hot solutions containing soda, potash, phosphoric acid, metallic sulphides and gold. The solutions were probably emitted during the congelation of the diorite batholith. The characteristic ore minerals of these deposits are pyrrhotite and biotite, both characteristic of deep-seated origin. Albitization is characteristic of the region and is found where the rock originally contained no albite, as well as in those in which it was a large primary constituent. Several thousand feet of the rocks have therefore been removed by erosion above the outcrops of the present time.

Glacial Action the Chief Erosion Factor

One of the greatest factors in this erosion has been glaciation. There are indications that in recent geological times an immense ice sheet, with its apex or origin in British Columbia, covered southeastern Alaska to a thickness of from 2500 to 3500 ft. above sea level, having a total thickness of perhaps 5000 ft. The canals of today were the principal streams in this sheet. These and most of the other topographic features were originally determined along large lines by two factors, the schistosity of the region and the large faults. Gastineau Channel is an example of the dominant influence of the first: Lynn Channel and Chatham Strait, two parts of the same waterway which extends for 250 miles from the open ocean in a straight channel 3 to 6 miles wide and from 1000 to 2500 ft. deep, have been determined by a great fault, the displacement along which has been slightly rotary, being greater at the south end than at the north, where it splits into two or three branches. It runs about N 10° W, cutting the schistosity at an angle of about 30°. As an example nearer Juneau may be mentioned Icy Gulch and Gold Creek, which from their junction to Gastineau Channel are determined by the Silver Bow fault, the largest in the vicinity.

The deeply incised drainage system was submerged in the Quaternary. Evidence has been found near Controller Bay of a submergence of 1000 ft. in the late Quarternary, which supports this theory. Subsequent elevation of 200 ft. has also been observed in this region

Ore Occurs Chiefly in Metamorphosed Sedimentaries

The ore deposits appear to be of the same age as the Mother Lode of California with which they are closely related, the metasomatic processes apparently being closely parallel, although not identical. The Mother Lode, however, was probably mineralized at less depth, temperature and pressure. . . .

With a few exceptions occurring in the more recent isolated intrusions of diorite, no ore deposits have been found in that rock. In its immediate vicinity, however, in the Ketchikan district, contact metamorphic deposits are found carrying gold and copper.

Most of the ore deposits occur in metamorphosed sedimentaries at a considerable distance from the diorite—in fact, beyond the marginal zone of schists. In general it may be said that black slate beds in contact with more compact graywacke beds, or with igneous rocks as greenstones, particularly in close association with metagabbro

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Note—Excerpts from a paper read Apr. 17, 1915, by Frederick B. Hyder, geologist, Alaska-Gastineau Mining Co., Juneau, Alaska, before the Mining and Engineering Society of Alaska dikes and dikes containing albite as an important constituent, are the favorable associations. Which of these combinations is most favorable and which has influenced or had the dominating influence in determining ore deposition in localities where all are present is one of the open questions.

In this vicinity there appears to be only one fault of importance—the Silver Bow fault outcropping in Quartz and Snowslide Gulches. This fault appears to have a strike of N 76° E and a dip of about 72° E. Considerable difference of opinion appears to exist as to the extent and nature of the displacement along this fault—in fact, as to whether most of the apparent offset is not in the nature of a sharp fold culminating in a fault displacement of possibly less extent.

Numerous transverse faults of less displacement are found throughout the ore zone. These, with possibly one exception, are certainly later than the completion of the ore deposition. Their strikes and the displacements along them, it is believed, connect them with the Silver Bow fault, indicating all to be due to the same forces. The Silver Bow fault and others as yet little known may contain the key to knowledge of great economic importance.

The ore deposits of the island and mainland are closely related. Knowledge of one will aid in the study of the other. Each may have its distinctive features—the rocks may differ, even the genetic processes may vary, but the parallelism is perhaps closer than present knowledge is able to prove. The recent determination of albite as the characteristic mineral in an ore-bearing rock on the mainland and the persistent association of the gold with that rock over a wide area emphasize that probability.

Pig-Iron Production in Great Britain

The British Iron Trade Association reports that the production of pig iron in Great Britain, which was 4,507,984 long tons in the first half of 1914, was nearly the same—4,497,914 tons—in the second half. This makes the total for the year 9,005,898 tons, which was 1,476,019 tons, or 14.1% less than in 1913. Production began to fall off early in 1914 on account of the industrial depression then existing, which was felt in Europe as well as in this country. It was not seriously affected by the breaking out of the war, as is shown by the close correspondence between the two periods of the year.

The production divided by classes of iron made has been as follows for three years, in long tons:

	1912 Tons	1913 Tons	1914 Tons
Forge and foundry...	3,431,727	3,943,139	3,430,448
Bessemer and hematite	3,408,386	4,057,700	3,235,403
Basic	1,771,771	2,125,689	2,003,693
Spiegel, ferro, etc..	277,240	355,389	336,354
Total	8,889,124	10,481,917	9,005,898

By districts, Scotland, the Northeast Coast, Cumberland and South Wales made all the low-phosphorus iron—bessemer and hematite. The Northeast Coast (Middlesboro) and Lancashire were the larger makers of basic pig. Middlesboro, Cumberland and North Wales made the ferromanganese and spiegeleisen.

The production of pig iron for 10 years past has been as follows (in long tons):

1905	[illegible]	1910	10,217,022
1906	[illegible]	1911	9,718,638
1907	9,923,856	1912	8,889,124
1908	9,289,840	1913	10,481,917
1909	9,661,287	1914	9,005,898

The make of pig iron in 1914 was the smallest of any year in the ten except 1912. It follows the year of largest production. The average for the ten years was 9,693,265 tons; six of the years reported over that tonnage and four fell below it. The figures do not indicate any large prospective increase.

Antimony in Mexico

United States Consul W. L. Bonney writes from San Luis Potosi, Mexico, that "an antimony smelter is in course of erection in the city of San Luis Potosi and will be ready to start operation when mining and transportation conditions permit the ore supply to be shipped and the product exported. The machinery, which is American, is now ready for installation. It is expected that the plant will employ 150 men and the capacity is to be 3000 tons per annum of refined antimony. The product will be shipped to the United States. This will be the first and only smelter in Mexico producing refined antimony for the market. It is owned by American capital and will draw ores from its own properties in San Luis Potosi and Queretaro.

"The only antimony smelter heretofore operating in Mexico is located at Wadley, a small station on the National Ry., 102 miles north of San Luis Potosi. The Wadley smelter is not equipped for finishing the product, and has exported its product to England for further refining. The Wadley plant was erected about 14 years ago, and has drawn a large part of its ore from the Catorce district.

"Antimony has been found in many places in Mexico, especially in Durango, Sonora, and Oaxaca, and relatively small amounts of ore have been shipped to the United States for smelting; however, the Catorce deposits have been the best producers for the last 20 years."

Utah Copper Co.

The report of the Utah Copper Co. for the first quarter of 1915 shows a production of 26,415,995 lb.—8,009,646 in January, 8,202,467 in February and 10,203,882 in March. The total amount of ore treated was 1,396,341 tons, averaging 1.4393% copper. Average extraction was 65.72%. After making allowances for smeltery deductions, but without crediting miscellaneous income, the average cost of net copper was 8.188c. per lb. If all miscellaneous earnings were credited, including those from the Bingham & Garfield Ry., the net cost would be reduced to 7.289c. per lb. Increase in cost was due to winter-weather conditions.

The total net profit, including income from Bingham & Garfield Ry. and from Nevada Consolidated dividends, amounted to $2,167,415. Dividends of $1,218,367 were paid, leaving a net surplus of $949,048 for the quarter. Earnings are based on a price of 14.93c. per lb. for copper. All copper unsold and in transit is carried at 13.5c. per lb.

Only the Magna plant was operated at full capacity until the end of January, after which business conditions improved and a partial operation of the Arthur plant was resumed. Thereafter both plants operated at about two-thirds normal capacity until the third week in March, when an increase was made reaching 75% capacity, and on Mar. 27 full capacity work was resumed.

The business of the Bingham & Garfield Ry. was satisfactory, an average of 10,978 tons of ore and 2131 tons of other freight being handled per day.

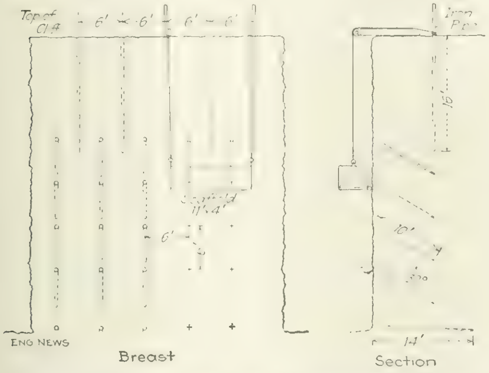
Details of Practical Mining

Quarrying with Air Hammer Drills on Scaffolds

New methods of ledge and cliff excavation have been developed since the advent of self-rotating hammer hand drills which would have been impractical with previous types of drills, according to Charles C. Phelps* in *Engineering News.*

Formerly the familiar bench method was usual, the rock being removed in steps whose depth and width depended upon the size of mounted drills employed. Frequently deep holes were cut from the top of the cliff by churn drills and drill wagons.

In the new method, a support for the workmen is lowered over the edge of the cliff. There being no drill mounting to adjust, the time consumed in setting up and in changing steels is practically eliminated.



Sketch of Breast Drilling at Campbell & Deane Quarry, Straw Plains, Tenn.

In the figure is shown the scheme now employed at the Campbell & Deane Co. quarry, Straw Plains, Tenn. The rock is a hard blue limestone. Formerly, mounted piston drills (3½x6-in. cylinders) were employed to remove the rock in benches. These were capable of drilling holes up to about 2¾ in. starting diameter, and a maximum depth of about 16 ft.

Under present procedure a row of vertical holes, 16 ft. deep, and spaced 6 ft. apart, is put in parallel with the face of the cliff by the tripod drills. Two lengths of gaspipe are inserted in the proper holes and ropes are fastened to them so that a scaffold can be lowered over the face of the cliff. It is fitted with winding drums so that the drillers can raise or lower it after it has been slung over the cliff. The hand-drill holes are spaced 6 ft. apart, vertically and horizontally, and are 10 ft. deep. At this depth, the steels cut to about 1⅜-in. bottom diameter. The holes are inclined downward at an angle of about 30° from the horizontal. Under present conditions one man with a hand drill [illegible] about 80 to 100 ft. of hole per 10-hr. shift.

After the 10-ft. holes have been drilled from the top of the cliff to near the bottom, tripod drills are again put into use for drilling a line of horizontal holes on the very bottom of the cliff, these holes being 14 ft. in depth and looking down slightly from the horizontal. The holes in the side of the cliff are loaded each with 12 sticks of 60% dynamite and those at the bottom with 18 sticks. All the holes are shot simultaneously by battery. The cost of powder per cubic yard of broken stone is about 3½c. with this system, whereas last year, when only tripod drills were used, the cost was 5½c.

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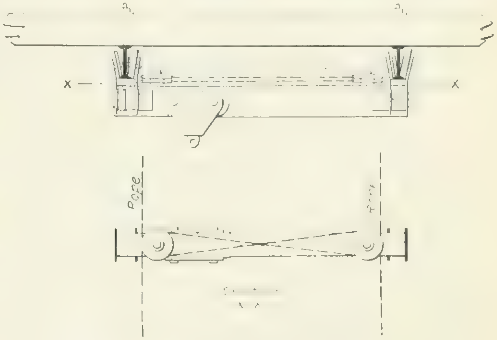
Home-Made Traveling Crane

By M. W. Sherwood*

I notice in the Journal of Apr. 10, 1915, an article by Percy E. Barbour describing a home-made traveling crane. I herewith suggest an improvement, which I believe will add materially to its efficiency. The expense of applying it is very small as compared to the cost of the rest of the construction.

I inclose rough sketches showing the arrangement of compelling the crane to move always parallel, even though in pushing the load the operator may apply the force only at one end. Two portions of light flexible wire rope—about ¼ in. is heavy enough—extend from one end of the crane runway to the other, being made fast at each end. Each cable passes around sheaves on the crane as shown. It is apparent that both ends of the crane must advance at the same rate. A force applied at one end will be transmitted through the cable arrangement [illegible] to be applied also at the opposite end. This is more readily comprehended if one cable shown in [illegible] is considered as absent and the forces in [illegible] only analyzed at a time.



A Home-Made Traveling Crane

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*Ingersoll-Rand Co., 11 Broadway, New York City.

*Franklin, Penn.

Without some such arrangement there will be a tendency for the crane to bind by becoming canted if the force applied to move the crane is not exactly in the center.

Derrick Dangers

Some of the dangerous practices in the use of derricks are treated in a recent number of the *Travelers Standard.*

It is absolutely essential that all the accessory hoisting apparatus be frequently examined. Much has been written regarding the desirability of frequent inspections of slings, wire ropes, chains, pulleys, hooks, and sheaves. This cannot be too strongly impressed on those in charge of derricks, for a great number of accidents are caused by the failure of one or more of these parts. A point not so often mentioned, but none the less equally as important as the others, is the condition of the gears. Gears with stripped teeth, or with teeth that are cracked or otherwise weakened, are apt to drop the load at a critical moment, and the sudden shock due to the quick stoppage of the load when the remaining good teeth become engaged is apt to strain the entire derrick structure beyond the breaking point. The gears, therefore, should be examined daily, and should be replaced by new ones before the work is allowed to proceed, if any excessively worn or weakened teeth are discovered.

When wire rope is used on a derrick, the blocks and sheaves are of considerably smaller diameter than is generally used for a given size of rope under other conditions. A sheave 10 times the diameter of the rope would be cumbersome and obstructive. A smaller sheave of adequate strength serves just as well, but because of the excessive bending stresses in the rope passing over the sheave a shorter useful rope life is to be expected. This is one of the details that must be considered if the safe operation of the derrick is to be maintained.

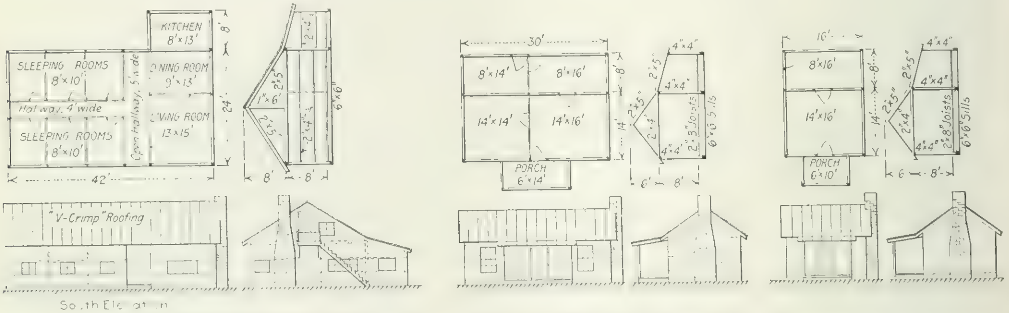
If a sheave is used near the hook, it should have a guard to prevent the workman's fingers being caught on the inrunning side. This guard would also afford a convenient and conspicuous place to state the safe carrying load. The boom should also have marked on it the carrying capacity, and should be provided with a graduated scale showing the safe working load for different positions of the boom.

A thoroughly reliable and competent man is a necessity in derrick operation, and particularly is this the case when a wide range of material, both as to weight and bulk, is being handled. In the handling of a miscellaneous class of material it is very easy for the uninitiated to underestimate the weight of a load, and by so doing greatly increase the chance of an accident. Likewise, experience is required in the proper adjustment of the slings for unwieldy masses and objects of unusual shapes, so that there will be no slipping or an unbalanced stress on one sling.

Miners' Dwellings

By P. E. Barbour

One boarding house, two four-room houses and three two-room houses, in accordance with the accompanying drawings, were built complete at the Montgomery mine, Candor, N. C., for the sum of $1223. The buildings were of plain boards, battened up and down, and the rooms inside were finished overhead only. The sills were 6x6 in. and the corner posts 4x4 in. All roofs were covered with 28-gage, V-crimped roofing and painted. Lumber cost $12 to $15 per M and labor, from $1.25 to $3 per day. The two-room houses were for negro laborers; the other dwellings were for whites. Rent at the rate of 50c. per room per month was charged for all company dwellings, being $1 for the negroes and $2 for the whites per month. These dwellings were good enough for the climate and were considered desirable by the dwellers.



Types of Mine Dwellings at the Montgomery Mine, Candor, N. C.

Boarding house—Sills, 6x6 in., corner posts, 4x4 in.; studding, 2x4 in.; girts, 2x4 in.; floor joists, 2x8 in.; sheathing, 1-in. boards, vertical, with 3-in. battens. Roofing 28-gage V-crimp. Ceiled inside overhead only, walls left rough. Sash made to slide, no weights or cords used.

Four-room house—Sash, 6-light, 10 x12 in. Doors, 2 ft. 6 in. by 6 ft. 6 in. Chimney, 4 ft. Roofing, 28 gage V-crimp. Shiplap or German siding. Interior ceiled overhead only. Inside walls left rough.

Two-room house—Sash, 4 singles. Doors, 2 ft. 6 in. by 6 ft. 6 in. Chimney, 4 ft. Roofing, 28 gage V-crimp. Siding, shiplap or rough boards with battens. Ceiled overhead only.

Surveyor's Duplex Slide Rule

The fact that all astronomical data essential to surveying, such as azimuth, time, latitude, etc., can be ascertained by means of the usual type of transit with vertical circle, but without solar attachment, while generally known, is rather seldom utilized in this country. The main reason for this surprising condition is the difficulty of computing in the field, by spherical trigonometry, the results of the observations.

To render these data more easy of calculation the Keuffel & Esser Co., New York, has introduced a surveyor's slide rule, of accuracy commensurate with the ordinary transit reading to 1 min. of arc, which enables the quick and accurate solution of the following problems: (1) Determining the sun's bearing or azimuth, having the latitude, the declination of the sun and the sun's altitude; (2) stadia reductions—obtaining the horizontal and vertical distances, having the rod reading and the vertical angle; (3) computing the latitudes and departures of the courses, having the length of the course and the bearing; (4) finding the meridian by elongation of Polaris or some other circumpolar star, having the declination of the Polaris (or the other star) and the latitude; (5) determining the hour angle (time) by measuring the sun's altitude, having the latitude, the declination of the sun and the sun's altitude; (6) all general numerical calculating.

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Water-Tank Controlling Device

The device illustrated herewith (*Power*, May 18, 1915) to stop a pump when the tank is filled and to start it when the level of the water has fallen to a predetermined point.

The apparatus (Fig. 1) consists of a brass pipe, its length being the distance between high level and low level of the water in the tank. The upper end of this pipe is supplied with a strainer, and a valve and copper float are attached to the lower end. Near the lower end a fitting is provided to which an air reservoir is attached. From the top of this reservoir a pipe is carried to the top of the tank and thence by a flexible copper tube to a damper regulator located near the supply pump. The damper regulator is used to actuate a balanced valve or other device for starting and stopping the supply pump.

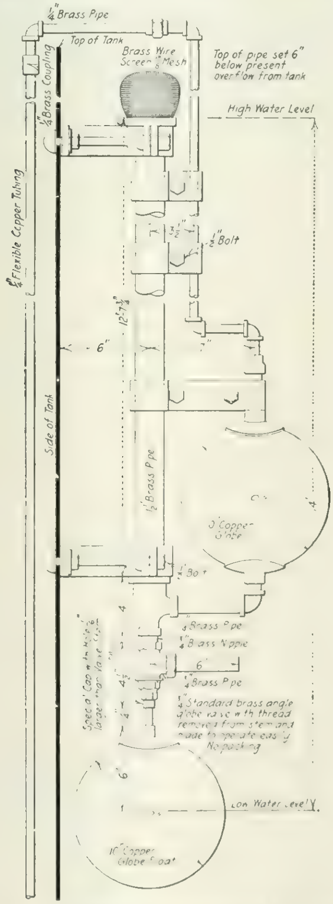
¼" Brass Pipe
Top of Tank
Brass Wire Screen ⅛" Mesh
Top of pipe set 6" below present overflow from tank
High Water Level
¼" Brass Coupling
¼" Flexible Copper Tubing
Side of Tank
½" Bolt
12'-7½"
6"
½" Brass Pipe
9" Copper Globe
4"
½" Bolt
¼" Brass Pipe
¼" Brass Nipple
6"
¼" Brass Pipe
¼" Standard brass angle globe valve with thread removed from stem and made to operate easily No packing
Special Cap with hole ⅛" larger than Valve Disk
4½"
6
Low Water Level
10" Copper Globe Float

FIG. 1. CONTROLLING APPARATUS IN DETAIL

The mechanism operates as follows: The water rising in the tank to the top of the pipe overflows into it and compresses the air in the air reservoir. The pressure due to the height of the water in the pipe is transferred through the flexible copper tube to the damper regulator, and it actuates the pump-controlling mechanism and stops the pump. This pressure is held constant until the water in the tank falls to the bottom of the pipe, when the float valve opens and allows the water to escape, relieving the air pressure; and the damper regulator starts the pump. The apparatus was designed and installed by the Samuel M. Green Co., Springfield, Mass.

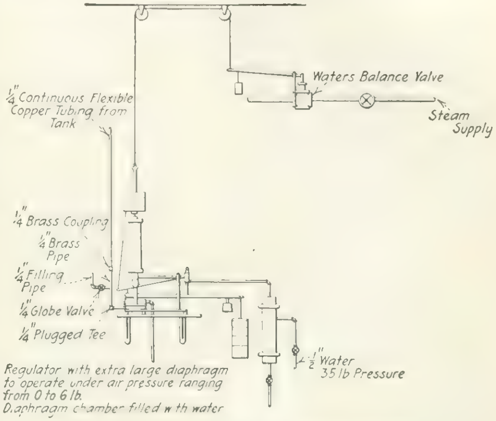
Waters Balance Valve
Steam Supply
¼" Continuous Flexible Copper Tubing from Tank
¼" Brass Coupling
¼" Brass Pipe
¼" Filling Pipe
¼" Globe Valve
¼" Plugged Tee
½" Water 35 lb Pressure
Regulator with extra large diaphragm to operate under air pressure ranging from 0 to 6 lb.
Diaphragm chamber filled with water

FIG. 2. REGULATOR CONNECTIONS

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Tamping and Stemming

Some confusion exists as to the meaning of the words tamping and stemming as used in mining literature, especially that of the U. S. Bureau of Mines and of some sources in England.

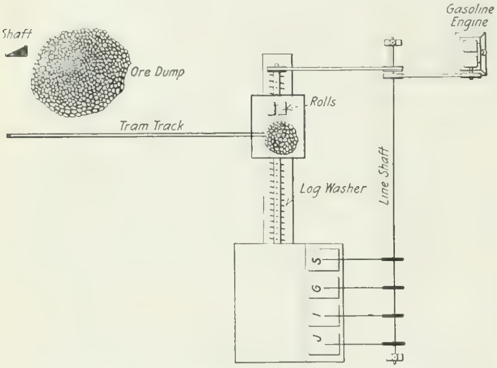
Originally tamping meant the compressing of a charge of black powder in the bottom of a borehole. The term "tamping" was later expanded to include the inert material which confines the explosive in the hole so that it would not be blown out. When dynamite came into common use it was quickly recognized that tamping it into the bottom of a hole with the force used on black powder would be extremely dangerous. Confining the charge, however, with inert material placed in the upper portion of the borehole is, with few exceptions, considered advisable, if not necessary. In common mining parlance, tamping is now, and for a long time has been, used to designate both this inert material and the operation of compressing it into place. In the literature above mentioned, however, the word stemming designates the inert material, either in the case of dynamite or any other kind of blasting powder, while tamping is reserved to indicate only the process of compressing the stemming in p

Details of Milling and Smelting

Cleaning Carbonate Ores at Highland, Wis.

By W. F. Boericke*

Much of the carbonate ore in the Highland, Wis., zinc district is mined by leasers. These are often men of limited capital and not prepared to make any considerable investment in milling equipment even if the "diggings" warrant it. In many cases, however, the material to be cleaned up consists of only a few hundred tons of ore, and anything but the cheapest and most easily constructed equipment would never return its cost. Except in a crude way, therefore, not much attention is paid in the construction of these little plants to economy of operation. The main idea is to erect them with the least possible cash outlay and at the same time to effect the largest practical saving of the mineral content. Under these circumstances the logwashing outfits and hand jigs found in the district are probably the machines for the job, and do the work with a greater ultimate economy than a more elaborate and costly plant.



Plant for Cleaning Carbonate Ores

The usual procedure for the leasers is to mine and hoist out the ore in the cold winter months, piling it conveniently near the shaft and making no attempt to clean up until spring and summer, when it is possible to work in the open and obtain water for milling purposes without freezing troubles. The mines make little water, which must be carefully conserved for milling uses. Fortunately the log washers and hand jigs get along with the minimum quantity; and as no attempt is made to clean a large tonnage a small gasoline pump from the mine will suffice.

The ordinary cleaning plant used at Highland consists of a set of rolls, a log washer and two or three jigs, the number depending on the amount of ore to be cleaned daily and the richness of the feed. The accompanying sketch shows the layout of a successful little plant that was treating about 6 tons of hand-picked ore daily and making 3 or 4 tons of 40% "mixed" ore per 8-hr. shift.

Four men, all leasers, were needed to operate the plant. One man loaded the sorted ore into a car at the dump and trammed it to the rolls. Another man fed the rolls, breaking up the large pieces to 3-in. size with a spalling hammer. The ore being friable, no other preliminary crushing was necessary. The other two men looked after the washer and jigs.

The ore had been sorted and contained little waste. It consisted of "bone" and "jack," in about equal proportions. It was fed to the 12x14-in. rolls in 3-in. pieces. The rolls were set close and made 10 r.p.m. The amount of dirt put through was only 6 tons in 8 hr., from which 3 tons of concentrates was made. As the average mill feed in a big mill is only 6 or 7% concentrates, it can be seen how comparatively rich this feed was.

The crushed ore from the rolls dropped directly down upon the log washer and the concentrates produced were moved toward the jigs. The washer consisted of a 10-in. timber, trimmed octagonally, with a shaft through the center resting in trunnions at each end. Blades of 1/4-in. iron, 7 1/2x3 in., were set spirally on the timber, and as the log revolved these blades disintegrated the ore and at the same time acted as a screw conveyor, forcing the heavier particles toward the head of the washer, while the lighter gangue was washed toward the rear end. It was turned by a gear making 8 r.p.m. The feed came near the rear end of the washer, falling on the ascending blades. The concentrates were gradually worked up toward the fore end and discharged on the jig floor, while the tailings were carried down by the constant stream of water that entered at the fore end. The device makes a surprisingly good separation, needs little water and less power and a minimum of attention. In this case all the water needed for it came from the overflow pipe of the gasoline engine used to furnish power. The total length of the washer was 14 ft., and the fore end was raised 5 in. above the rear end to provide the necessary grade.

The crude concentrates, after passing through the log washer, were shoveled on to the jig beds. Four jigs, 4x2 ft. 6 in., were operated by pulleys from the lineshaft. which consisted of pieces of 2 1/2-in. pipe resting in pillow blocks of 4x5-in. timber. The jigs made 160 strokes per minute, with a 3-in. throw to the eccentric. The sieves were filled to within an inch of the top with crude concentrates and cleaned by hand every three minutes, the tailings being shoveled off the top and thrown to one side. The tray for holding the concentrates measured 3 ft. 3 in. by 1 ft. 6 in., with a depth of 10 1/2 in. The jig beds were 3 in. deep and consisted of galena. Jig grates were $\frac{3}{16}$ in. mesh. After the jig tank is filled with water no more is needed for cleaning the ore. Power is furnished by a 12-hp. gasoline engine, which is ample. The drive goes to a countershaft and from there is belted to the various machines.

It would be hard to find an outfit that could be erected with less expense than this one. A few hundred dollars would cover the entire bill. In considering its efficiency it must be remembered that an additional saving would entail a very much larger cost, not to be considered for the small amount of ore to be cleaned up. With no more elaborate plants than this one, hundreds of tons of carbonate ores were cleaned and sold in the Highland district last year. The entire plant can be easily moved around when the diggings are worked out, and thus always commands a good salvage. Skilled millmen or mechanics are not needed, although a good deal of experience is necessary to handle the hand jigs to the best advantage.

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*Galena, Ill.

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Maximum Use of Shoes and Dies

In the accompanying photograph is shown a noteworthy accomplishment in securing the utmost possible efficiency from shoes and dies in stamp battery work. The new shoes and dies are shown in contrast to those used as long as possible to give satisfactory production. The results were achieved by careful watching of the batteries and by regular and systematic feeding. They were obtained at the New Reliance mill, at Trojan, S. D.

WELL-WORN SHOES AND DIES

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Waihi Grand Junction Mill

A description of the cyaniding process employed at the mill of the Waihi Grand Junction, on North Island, New Zealand, is described by Noel Carless in an extensive article.[1] The precise capacity of the mill is not stated, although it may be placed at about 400 tons per day, since there are 40 stamps, and it is said that the stamp duty has reached as much as 10.5 tons per stamp per day. The general system of treatment is crushing, stamping in 1100-lb. stamps, separation, tube milling, concentration and then separate treatment. The concentrates formed are returned to the tube mills for regrinding, being in a closed cycle from which they cannot emerge until ground fine enough to go off with the slimes.

The separation of sands and slimes is carefully made, and it is a fact of interest that the sands leached are finely ground. Only 4.5% of them will remain on a 100-mesh screen, while 40.9% pass through 200 mesh. It seems that in the grinding and separating processes gone through most of the value is extracted from the sands, so that when they reach the leaching tanks no serious treatment is given them other than a thorough washing, first with barren solution and then with water, after which they are discharged.

The slimes are treated in pneumatic agitators and filtered through a filter of the Moore type. Costs are given as follows:

COST OF MILLING AT WAIHI GRAND [illegible]

Crushing	[illegible]
Stamping	[illegible]
Tube milling	[illegible]
Concentrating	[illegible]
Treatment	[illegible]
Bullion cleaning	[illegible]
Assaying	[illegible]
General	[illegible]
Total	[illegible]

The ore consists of quartz, manganiferous calcite and mineralized propylite, with about 10% of sulphides, chiefly pyrites, with which are associated galena, sphalerite, chalcopyrite, argentite and traces of arsenic, antimony or selenium. Ruby silver was found in one place.

Ore is crushed in 0.11% solution, and lead salts, about 0.5 lb. litharge and 0.22 lb. lead acetate, are added at the mortar boxes. Consumption of shoes and dies is 0.23 lb. per ton crushed for forged-steel shoes and 0.19 lb. per ton for cast-steel dies. There are 10 tube mills, two 19 ft. 3 in. long and 4 ft. 8 in. in diameter. Each of these requires 42 hp. at 25 r.p.m. Consumption of pebbles is 8 cwt. per week. The remaining eight mills are 16 ft. 3 in. long and 4 ft. 3 in. in diameter, requiring 27.5 hp. to operate at 27 r.p.m. and consuming 6 cwt. of pebbles per week. Consumption of sodium cyanide is 0.95 lb., or, in terms of KCN, 1.23 lb. per ton of ore crushed. Alkalinity is maintained by the addition of 0.9 lb. of caustic soda per ton crushed. Power to run the mill is placed at 710 hp., exclusive of lighting.

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Molybdenum Recovery by Elmore Process*

The increasing demand of molybdenum for use as a hardening agent in the manufacture of steel makes the production of this metal of particular interest at present. The difficulty of commercial utilization of the ores of molybdenum is found in the separation of the mineral from the gangue; the molybdenite being soft and flaky, a large proportion becomes powdered in course of crushing, and is not recoverable by the ordinary method of washing. In a great many instances this difficulty has been overcome by the Elmore process.

The method is used at two mines in Norway, at one of which the plant is about to be enlarged, and large quantities of molybdenite concentrates have been shipped.

Several parcels of ore aggregating over 100 tons have been treated at the Elmore testing plant in London with the following results:

Tons	Percentage MoS_2 in Concentrates	Percentage Extraction
32	85.68	91.5
32	86.30	91.5
37	84.25	89.7
30	83.00	90.9
131	84.80	91.7

The ores in the above-cited tests were crushed to 30 mesh.

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King-Posts in a Stamp Battery are often thrown out of plumb as a result of the settling of bins to which they are connected, says the "Australian Mining Standard," Jan. [illegible], and also by reason of continual vibration. In either case it is preferable to allow them to retain the firm and solid position in which they have placed themselves rather than to attempt to re-plumb them. The guide blocks and camshaft bearings should be slightly altered in order to plumb the stems and level the camshafts.

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[1] "Bull. 127," I. M. M., Apr. 8, 1915.

*From data furnished by the Ore Concentration Co. (1905)-Ltd

The Cost of Doing Things

Hollinger Mining and Milling Costs

The figures printed herewith give the details of mining and milling costs at the Hollinger Gold Mines, Timmins, Ont. The total cost reported by the company in its annual report for mining, milling and other charges, including 79.2c. for depreciation of plant, was $5.213 per ton of ore milled. There were 209,999 tons of ore and 28,850 tons of waste removed from the mine, practically all of which came from above 425 ft. There were 297 men employed in the mine and 140 in the mill, office and general work, which indicates that about 480 tons of ore are handled per year per man. Men engaged in new construction work are not included in this figure. The accompanying table shows the distribution of mining costs as reported.

HOLLINGER MINING COSTS

Account	Per Ton Ore Milled	Per Ton Rock Broken
General mining charges	$0.031	$0.022
Superintendence	.069	.050
Diamond drilling	.053	.038
Crosscutting	.103	.074
Shafts	.050	.036
Drifting	.352	.254
Raising	.026	.019
Winzes	.031	.022
Tramways	.008	.006
Timbering, shafts, winzes, etc	.044	.032
Stoping	.741	.534
Scaling	.016	.011
Timbering drifts and stopes	.140	.101
Track laying	.033	.023
Tramming	.415	.300
Pipefitting underground	.035	.025
Mine drainage	.034	.024
Hoisting	.196	.141
Landing and dumping	.040	.029
Drill repairs	.068	.049
Sharpening steel	.099	.071
Collecting steel	.039	.028
Mine sampling	.026	.019
Assaying	.006	.005
Change house	.009	.007
Surveying	.013	.009
Mine lighting	.023	.017
Total	$2.700	$1.946

MILLING COSTS AND DATA

Tons of ore milled, including 2910 tons at $11.17 for Acme	211,846
Average value per ton	$13.60
Total value sent to mill	$2,889,919
Average tons per day	583.59
Per cent. of possible running time	92.2
Average tons per 24 hr. of running time	632.97
Stamp duty per 24 hr. of running time	13.30
Unrecovered values:	
Concentrates stored for re-treatment	$53,686
Loss in filter tails	116,879
Values recovered	2,719,354
Value per ton in tailings	56c.
Cyanide consumed per ton of ore	0.525 lb
Lime consumed per ton of ore	1.557 lb
Zinc consumed per ton of ore	0.532 lb
Acid consumed per tone of ore	0.216 lb
Lead acetate consumed per ton of ore	0.0031 lb
Tons of solution precipitated per ton of ore	2.315
Zinc added per ton of solution	0.230
Average value of pregnant solution	$5.698

COSTS PER TON OF ORE MILLED

General mill charges	$0.054
Superintendence	.047
Tailings disposal	.018
Lighting	.011
Heating	.039
Shoveling in bins	.012
Crushing	.079
Conveying	.034
Stamping	.160
Classification and tube milling	.188
Concentration	.062
Handling concentrates	.007
Treating concentrates	.032
Handling pulp	.040
Thickening	.011
Continuous decantation	.031
Filtration	.103
Neutralization	.012
Clarifying and precipitation	.063
Refining	.059
Pumping solutions	.021
Cyanide	.083
Cleaning mill	.019
Alterations	.034
Assaying	.015
Total	$1.237

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West Rand Consolidated Mines Costs

The report of the West Rand Consolidated Mines for 1914 shows a production of 364,856 tons of ore, of which 310,750 tons was milled. The accompanying table gives a review of the milling operations:

MILL DATA OF THE WEST RAND CONSOLIDATED

Milling	
Tons milled	310,750
Average number of stamps running	100
Total days run	285.85
Average duty per stamp per 24 hr., tons	10.871
Tube mills working	4
Total fine gold recovered, oz	53,000.813
Recovery per ton milled	$3.51
Cyaniding	
Tons of sands treated	168,584
Average value of sands charges	$2.62
Average value of residues	.28
Tons of slimes treated	123,286
Average value of slimes charges	$1.90
Average value of slimes residues	.24
Tons of concentrates treated	18,300
Average value of concentrate charges	$8.06
Average value of concentrate residues	.95
Total tons treated	310,170
Average value per ton treated	$2.65
Average value of residues	.30
Theoretical extraction, per cent	88.43
Actual extraction, per cent	89.80

The total recovery from milling was 53,000.813 fine ounces, or $3.51 per ton treated; and from cyaniding, 36,006.733 oz., or $2.38 per ton—a total of $5.89 per ton milled. The working costs are shown in the accompanying table:

WORKING COSTS OF THE WEST RAND CONSOLIDATED

	Per Ton Milled
Mining	$2.65
Sorting, crushing and transporting	.18
Milling	.38
Cyaniding	.40
General expenses	.53
Office expenses	.21
Development redemption	.50
	$4.85

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Stoping Costs at Copper Mountain, Utah

The accompanying tables show the working costs in the stopes of the Salt Lake Copper Co. at Copper Moun-

MINING COSTS AT THE SALT LAKE COPPER CO.'S MINES

	Level East "A" Costs per Ton	Level West "A" Costs per Ton	"B" Level Costs per Ton
Breaking	$0.81	$0.81	$0.28
Tramming	.82	.45	.33
Sorting	.18	.19	..
Powder	.10	.11	.04
Fuse	.02	.02	.01
Caps	.01	.01	.004
Candles	.04	.03	.01
Timbering		.06	.01
General expense	.61	.65	.72
Total cost	$2.59	$2.33	$1.404
Tons produced	243.1	243.3	676.2

Item	Stope 102, Costs per Ton	Stope 108, Costs per Ton	Glory Hole, Costs per Ton	Station (a)
Breaking	$0.95	$0.90	$0.51	$252.00
Tramming	.93	.62	.54	253.90
Powder	.10	.16	.05	16.90
Fuse	.02	.03	.01	3.54
Caps	.01	.01	.01	1.48
Candles	.05	.04	.03	11.92
General expense	.74	.68	.69	38.46
Total cost	$2.80	$2.38	$1.84	$578.20
Tons produced	287.6	368.2	182.4	

(a) Station, 50 ft. long by 22 ft. high by 9 ft. 6 in. wide = 386 yd. at $1.49.

tain, working oxidized deposits in limestone by the square-set system. The last column shows the expense per yard of cutting a station underground. The item for general expense includes the cost of running a 3-mile aërial tramway. Miners received $3.50 per shift of 8 hr.; trammers, $3.25. The powder used was 40% Hercules; cost, $17.75 per 100 lb. at the mine; fuse, $32.50 per case of 6000 ft.; xxxxx caps cost 86c. per 100; and candles, 40 set 12 oz., 6's, $3.45 per box.

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Mining Costs at Goldfield

The annual report of the Goldfield Consolidated gives, in a wealth of detail, the mining costs of 1914, during which time more than 30,000 ft. of development work was done and 338,192 tons of ore mined. In Table 1 are given the total operating costs based on the total tonnage given in the foregoing. In Table 2 are given detailed stoping and development costs, which are apportioned to the two different tonnages given in the table. The reason these tonnages differ from the total tonnage production is because the total tonnage was not all produced by stoping; 18,000 tons came from development work, nearly 6000 tons came from contractors and over 5000 tons was of high grade obtained from methods other than stoping. Beyond this the two tables require no explanation. They will earn, as they deserve to do, the commendation of the profession for the policy of the company in publishing such figures.

TABLE 1. TOTAL OPERATING COSTS

	Per Ton Total
Mining	[illegible]
Stoping	$2.[illegible]
Development	[illegible]
Total mining	$[illegible]
Moving dumps	0.0[illegible]
Transportation	0.08
Milling	1.58
Concentrate treatment	0.27
Marketing by-product	0.03
Marketing bullion	0.04
Freight and treatment ore shipped	0.13
Sampling and shipping expense	0.005
General expense including office, legal, corporation, administration and industrial insurance	0.37
Elko Prince examination	0.005
Tailings royalty	0.02
Filter royalty	0.05
Bullion tax	0.09
Income tax	0.05
Property tax	0.05
Flood damage	
Contract ore	0.17
Total operating expenses	$6.02

TABLE 2. DETAILS OF MINING EXPENSES

Item	Stoping Costs per Ton Total Tons 282,936,							Development Costs										
	Breaking	Timbering	Tramming	Hoisting	Pumping	Surface	Total	18,415 ft Drifts and Crosscuts,		11,251 ft Raises		362 ft Winzes,		379 ft Diamond Drilling,	Total 30,028 ft,		Total Tons 300,993,	Per Cent Total Cost
								per ft.	per ton	per ft.	per ton	per ft	per ton	per ft	per ft	per ton	per ton	
Superintendence	$0.010						$0.010	$0.051		$0.045		$0.096				$0.005	$0.014	
Foreman	0.014						0.014	0.061		0.052		0.096				0.006	0.019	
Shift bosses	0.039						0.039	0.221		0.186		0.379				0.021	0.058	
Miners	0.436					$0.001	0.437	1.505		1.326		3.436				0.147	0.556	
Shovelers	0.416						0.416	1.270		0.821		2.595				0.112	0.503	
Trammers			$0.129				0.129	0.124		0.159		0.330				0.014	0.135	
Timbermen		$0.231					0.231	0.425		0.333	.....	0.856				0.039	0.257	
Cagers				$0.038			0.038	0.031		0.039		0.056				0.003	0.039	
Hoistmen				0.060			0.060	0.049		0.064		0.095				0.005	0.062	
Top carmen				0.068			0.068	0.053		0.067		0.143				0.006	0.070	
Shaftmen		0.039					0.039	0.046		0.048		0.078				0.005	0.041	
Pumpmen	....				0.011		0.011	0.052		0.041		0.085				0.005	0.015	...
Nippers	0.032						0.032	0.166		0.143		0.236				0.015	0.045	
Filling labor	0.250						0.250										0.235	
Blacksmiths						0.021	0.021	0.105		0.090		0.163				0.010	0.030	
Blacksmiths' helpers						0.004	0.004	0.010		0.010		0.021				0.001	0.004	
Carpenters						0.013	0.013	0.062		0.051		0.135				0.006	0.018	
Watchmen							0.013	0.074		0.065		0.192				0.007	0.020	
Diamond drill														$2.327		0.003	0.003	
Diam'd-drill helpers														1.774		0.002	0.002	
Miscellaneous	0.040					0.018	0.058	0.293		0.258		0.498				0.028	0.083	
Total labor	$1.237	$0.270	$0.129	$0.166	$0.011	$0.070	$1.883	$4.598	$0.281	$3.798	$0.142	$9.490	$0.12	$4.101 $0.005	$1.409	$0.140	$2.209	64.78
Timber lagging		$0.462					$0.462	$0.298		$0.519		$0.584				$0.038	$0.472	
Explosives	$0.093						0.093	0.682		0.587		0.915				0.065	0.152	
Illuminants	0.018	0.004	$0.002				0.024	0.069		0.059		0.133				0.007	0.029	
Drills—fittings	0.023						0.023	0.142		0.102		0.226				0.013	0.035	
Pipe—fittings	0.004						0.004	0.032		0.030		0.034				0.003	0.007	
Track—fittings			0.003				0.003	0.018		0.014		0.020				0.002	0.004	
Cars, repairs			0.002				0.002	0.013		0.012		0.019				0.001	0.003	
Iron—steel						0.006	0.006	0.040		0.032		0.070				0.004	0.009	
Lubricants				0.004			0.004	0.010		0.006		0.023				0.001	0.005	
Tools	0.008						0.008	0.037		0.032		0.072				0.003	0.011	
Diamond-drill parts														0.918		0.001	0.001	
Sundries						0.041	0.041	0.283		0.214		0.490				0.026	0.066	
Total supplies	$0.146	$0.466	$0.007	$0.004		$0.047	$0.670	$1.624	$0.099	$1.607	$0.061	$2.586	$0.003	$0.918 $0.001	$1.641	$0.164	$0.794	23.27
Engineering	$0.017						$0.017	$0.215		$0.208		$0.386				$0.022	$0.038	
Assaying	0.102						0.102	0.475		0.415		0.889				0.046	0.140	
Mechanical dept						0.035	0.035	0.129		0.127		0.198				0.013	0.046	
Electrical dept						0.011	0.011	0.053		0.056		0.057				0.005	0.016	
Sampling	0.004						0.004	0.012		0.011		0.072				0.001	0.005	
Surface						0.015	0.015	0.063		0.063		0.024				0.006	0.020	
Power	0.072			$0.030	$0.013		0.115	0.347		0.331		0.563				0.034	0.143	
Total dept	$0.195			$0.030	$0.013	$0.061	$0.299	$1.294	$0.080	$1.211	$0.045	$2.189	$0.002		$1.274	$0.127	$0.408	11.95
Grand total	$1.578	$0.736	$0.136	$0.200	$0.024	$0.178	$2.852	$7.516	$0.460	$6.616	$0.248	$14.265	$0.017	$5.019 $0.006	$7.324	$0.731	$3.411	
Per cent total																		100.00

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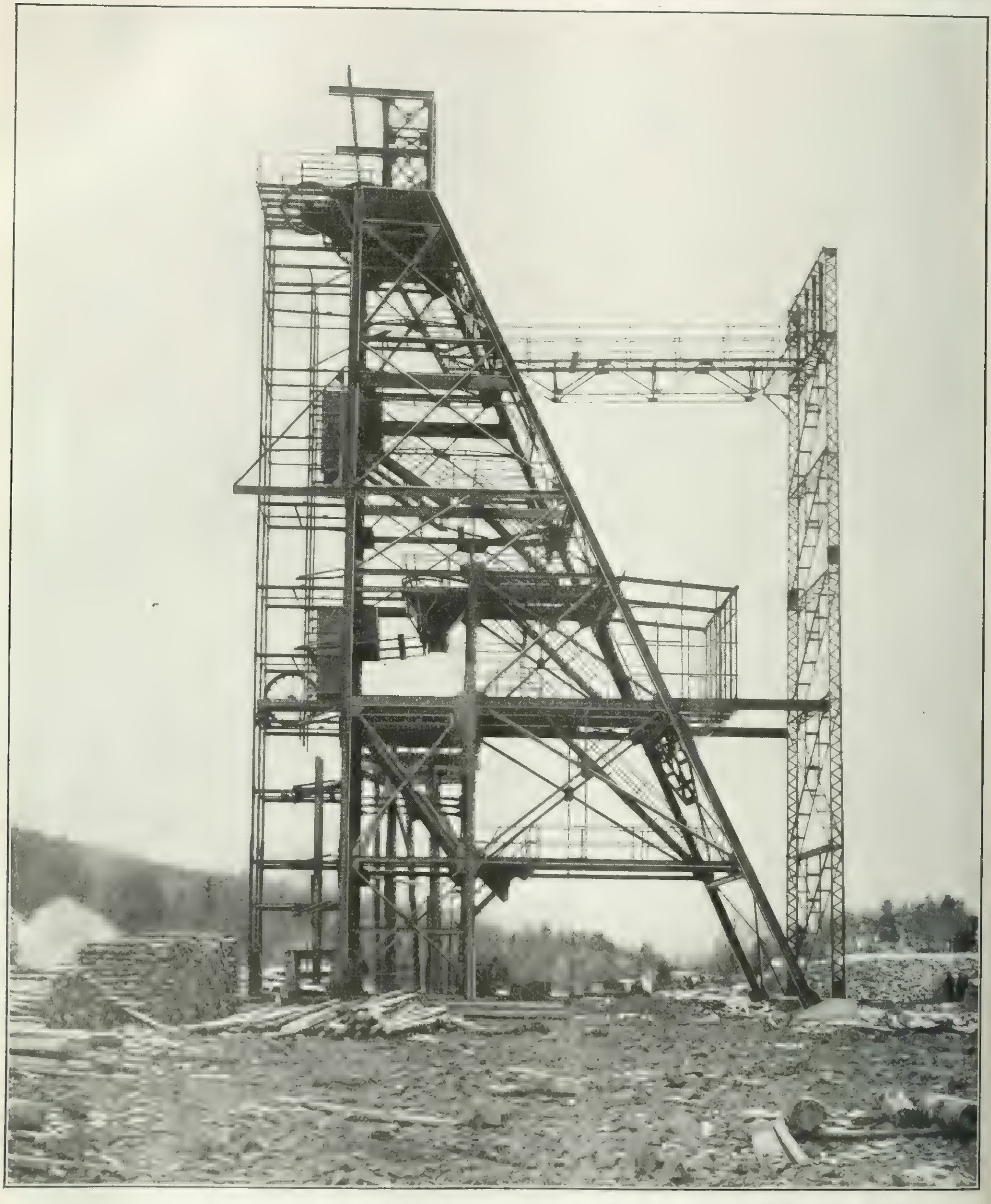
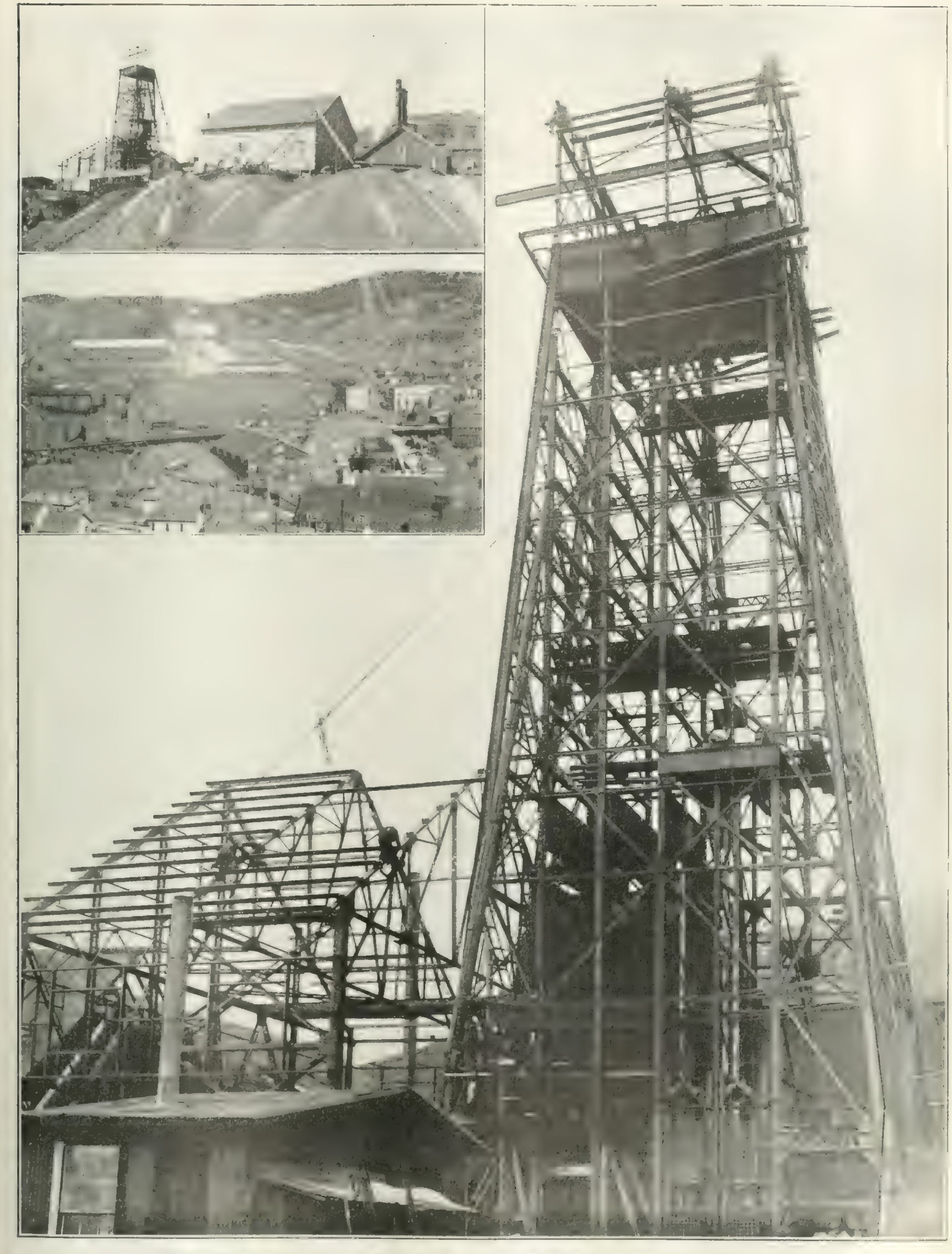
The MacNamara M. & M. Co. of Tonopah rep[illegible] [illegible] milling costs for the seven months from Dec. 1, 1913, to July 1, 1914, were: Mining direct, $4.237; development, $1.094; mining indirect, $0.689; milling direct, $3.517; marketing, $0.202; interest, $0.198; milling indirect, $0.407; total, $10.344 per ton.

Photographs from the Field



STEEL HEADFRAME OF ISABELLA MINE, OF CASCADE MINING CO.

This mine is at Palmer, on the Marquette Range, Mich., and has just entered the producing stage



NEW HEADFRAME AT THE B. & M. SHAFT OF THE HOMESTAKE, LEAD, S. D.

The small photos show different views of the headframe and of the boiler and electric plants now under construction

Correspondence and Discussion

The Patent Mania

I note the letter on the subject of patents from Mr. Croasdale on p. 744 of the JOURNAL of Apr. 24, and am led thereby to offer the following concrete cases from my experience as illustrations:

About 20 years ago I invented a cutoff valve for steam engines, operated by a single eccentric, which worked beautifully on a high-speed engine that I built.

I applied for a patent, and a patent issued in 1833 was cited by the examiner. While this inventor had the same fundamental idea, he had never reduced it to a practicable working device, and no benefit had ever been derived either by himself or anyone else from his patent.

Owing to the action of the Patent Office there was no inducement for me to go ahead and develop the device and market it, for the reason that I was not in the steam-engine business, and if I had attempted to go into it without any protection for the idea, as soon as I began to make any progress my competitors would naturally adopt the idea, and I would be without any compensation for the development work. Therefore in that case the Government, instead of promoting the development of improvements and accelerating progress in the art, held up a dead hand which actually prevented progress in this case.

The question that naturally arises is: What advantage is it to invention and progress to keep records of patents longer than their life, and what advantage is it to prevent invention by quoting a dead reference? If the present practice is carried on for a sufficient number of years it seems obvious that there will eventually be so many records to go through that we will all have to stop work and become patent examiners, in which case we will be in much the same position with anyone who gets so wrapped up in a system as to spend all his time in systematizing instead of doing productive work.

What objection is there to a liberal issue of patents to anyone who is making a bona-fide reduction to practice of any improvement where it cannot be shown definitely that such a patent would interfere with anyone who is actually producing a similar design? In the case of criminals the burden of proof is placed upon the Government, but the honest inventor has not only to prove his case, but he often has to submit to the domination of the personal opinion of some Government official backed up by purely technical theories or ideal dreams that have never got further than the paper they were printed on.

The fad of law-making has become so developed in recent years that it appears to have become a prolific field for the type of inventor whose reasoning faculties never carry him far in the engineering field when he attempts to reduce his ideas to practice.

It seems peculiar that men who do not prove to be the best engineers either in operation or construction have as much influence with legislators as they do; but on second thought it is easy to see why the person who can put up a good front impresses legislators more favorably than one who realizes every problem requires reduction to practice and an experimental period before it can be termed a success.

Why should not our law-making be built up in the same way as our engineering—by experimental reduction to practice and elimination of the failures and waste matter?

J. C. PARKER.

Philadelphia, Penn., Apr. 26, 1915.

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Bill McGinty, Prospector--I

Misther Editor—I'm thinkin' ye might like to hear av some av me adventures down in the land av *frijoles, tortillas* an' *ley de fuga*.

Well, before the Panchos began to levitate the Sherman stuff, I heard av a rich mine in the western part av the State av Durango. I wud like to tell ye the name, but some other felly might buy it before I can graft enough out av me subway contract. Annyhow, 'tis an owld mine indade. 'Tis the first wan diskivered be the Spaniards in the wance rich an' prosp'rous camp av Guarisamey. The owld storekeeper that owned it got full av mescal wan night about the time George Washington quit his job av Prisident, an' swapped his owld mine for a new prospect, called the Candle-Harry or some sich name. So whin I learns some av the facts, I sez, sez I, " 'Twill be a good plan to play up to the Candle-Harry business and thin I can put me hand out an' grab the other mine whin no wan is lookin'."

This Candle-Harry mine has been quarreled over for so manny years that the litigayshun has become quite a pastime an' a post-graduate coorse for lawyers av all kinds, includin' plain lawyers, shysters, imminent counsel, diplomats, Sicreties av State, Mexican licenciados, provishn'l prisidents, invintors av internayshn'l law, criminal lawyers an' other criminals. I gets into the game about the last half av the siventh innin', whin ivery wan was stretchin'. A Mexican lawyer felly was sint to the bat be the visitin' team. This Excelsior Gutierrez was to open up the case out at the town of Sante Ladrone, where the Candle-Harry mine is.

So wan foine January mornin' about six o'clock we pulls our freight. Leavin' the pleasant city av Durango be way av the Alameda, we starts south, crossin' the outcrop av some av the tin dayposits which were actively worked in the time av Santy Anny an' Benito Juarez. The whole western and southern part av the city av Durango is loaded with more or less tin, an' the hill av Remedios is pretty well gambocinoed out here an' there. They cud afford to work low-grade stuff then, because they wanted the tin pretty bad; an' labor an' charcoal was cheap, so they smelted it out on the spot. As Tommy Egleston used to say, their extraction may have been low, but it was as high as they cud get, an' they figured that they never lost what they didn't get, because they never had anny tin to lose except what came out av the furnace. Annyhow,

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Note—We are not so optimistic as Mr. McGinty concerning tin deposits, and in general wish to state that we are not responsible for his opinions, his geography, or his actions—EDITOR some av thim fellys liked to prospect the aisy places close to town.

There's still a lot av tin right there, waitin' for some felly with enough sportin' blood to spind money enough to see if a big concentratin' plant cud make money workin' the whole dayposit like a real mine an' sellin' the tailin's for pavin' more streets or makin' concrete blocks. The foine macadamized streets av the city av Durango are made with crushed tin ore, an' the sidewalks in some places were made av slabs av ore which wore down till the lumps av tin oxide stuck out like plums in a puddin', catching the poor ign'rant *pelados* on the bare toe an' causin' them to turn agin the guv'mint an' yell *"Viva zapatos!"*

Well, after crossin' over to the edge av town an' waitin' for wan av the *mozos* to kiss his swateheart good-by, or get a drink, or somethin', we pulls to the west an' hits out for the high ground. In a few hours we passed through the beautiful suburb of Cieneguita, consistin' av the remains av a ranch chapel an' a few scattered villas and lean-tos av 'dobe an' thatch. After passin' the time av day with the sad-eyed individools who lived there because they had no other place to go, we siparated our mules from a caravan av charcoal burros bound for Durango, an' continued follyin' the advice av Horace Greeley.

Within less than a half hour wan av the mules chants the *"grito de la independencia"* and cuts across the mesa for her dear old home on the Rio Tunal. Excelsior, the lawyer felly, raymimbers his name an' follys the mule as if the Madero rivolution had busted loose two years ahead av schedule. I kapes me eye on the commissary annymal an' flags Juan to do his duty an' hold fast to the all good. 'Tis a good plan to folly whin ye're travelin' through a country like that; an' a still better plan is always to have wan day's grub tied to yer person. For if ye get lost, an' even if yer saddle annymal quits ye, then ye can maybe kape alive till luck strikes ye again. But if ye have nothin' at all, an' maybe break a leg or somethin', ye stand less show than a Belgian in his own home town.

In a little while we rides down into an arroyo called the Neveria. This manes "ice-cream parlor," which it wasn't, and it also manes "ice factory," which it used to be. They had a kin av process to utilize the rapid evaporayshun av *maguey* fiber to make thin sheets av ice.

Whin they got enough sheets they piled thim togither—on the plan av ivery little bit added to what ye got makes just a little bit more. There was a moonshine mescal still an' speak-easy near by, where they still follyed the same plan, but usin' other material.

Bill McGinty.

Brooklyn, N. Y., May 1, 1915.

(*More Installments Threatened*)

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More Mine Taxation in Mexico

The fact that any stable basis for currency in Mexico is disappearing rapidly from the country leads the heads of the political parties to work overtime in devising new schemes for raising an income. The device hit upon by Venustiano Carranza, "First Chief" and "Chargé" of the executive power of the Mexican nation, is outlined in his decree regarding mine taxation. Of course it is not so hard on the companies that are producing gold, or that have been developing small properties and have substantial deposits in United States banks. It amounts to an increase of from 237% to 535%, according to the number of claims held. But for those of us who have neither gold nor bank accounts to fall back upon, and who have to accept the Constitutionalist bills at par and are required to buy United States gold at 14 to 1, the tax is an increase of from 1400% to 2500%, which is not taxation but confiscation. If this tax goes into effect on July 1, as determined, I shall lose the labor of 15 years.

In the Alamos district, Sonora, I have two adjoining claims, Azteca and Aztequita, of 9 and 14 pertenencias each, or 23 altogether. I have owned and held these claims since 1896 at a cost of about 6000 pesos. On them I have expended 7000 pesos in explorations and have not received one cent in return.

In normal times my taxes were 23 times 6 pesos, or 138 pesos per year, or $46 per each four-month term. Under this new decree the taxes will be as follows:

10 pertenencias at	$12	=	120 pesos
10 pertenencias at	15	=	150 pesos
3 pertenencias at	18	=	54 pesos
Total, 23 pertenencias		=	324 pesos in Mexican gold coin

I have never seen Mexican gold in circulation on the West Coast, and there was but a limited circulation in the whole country before the revolution—none since. The silver peso had almost gone out of circulation before the revolution, and since June, 1913, has absolutely disappeared. The silver *toston*—50c. piece—was the general coin in circulation when the Madero revolution began, but it has vanished absolutely. Our only recourse is to buy United States gold at 14 to 1, and as there are no banks or firms doing business in moneys out here, even United States gold cannot be obtained without a special trip to the frontier, an impossibility at the present time.

Even admitting, however, that the gold coin is forthcoming, then my 324 pesos Mexican gold becomes $162 United States gold and $162 × 14 = 2268 pesos in Constitutionalist bills, which I have been forced to accept at par with silver and bank bills since June, 1913. This means a tax which is an advance of 1649%.

I have another property of 32 pertenencias, which I have held since 1898 at an expense of about 5000 pesos in silver coin. I have spent about 36,000 pesos silver on development work here and so far have not received any return from it. Now, this decree raises my taxation from 171 pesos silver per year to 3486 pesos, or 2038%. It is to be remembered that I have no money except the Constitutionalist bills which I have had to accept at par with silver, under penalty, and I have actually exchanged over 12,000 pesos in silver for these bills within the last two years, all at par. The result is that I shall be obliged to drop all my mining holdings, the work of half a lifetime; for claims of even 2 pertenencias, of which I have several, that formerly cost me but 12 pesos per year will now cost 168 pesos per year.

You can readily see the object of this decree. It is to force everybody to pay United States gold, which the Carranza faction—there is no government—needs, and to blackmail the big companies that have large holdings. These are nearly all foreign. Whatever the aim, it means confiscation, and 90% of the present titles will be forfeited next July.

These orders were to be enforced at once. But as many had already paid their taxes, it was decided that the new tax could not be enforced until July 1, 1915.

E. [illegible] H. Tays.

San Blas, Sinaloa, Mexico, Apr. 19, 1915.

Hydro-Electric and Compressor Plants at Chapin Mine

By L. E. Ives

All hoisting engines, rock drills and other machinery at the Chapin mine are operated by compressed air, generated at a hydro-pneumatic plant at Quinnesec Falls, about 3½ miles from the mine. This plant was installed in the early part of the '80s, and has operated economically since then. It consists of three 34x60-in. and one 38x60-in. duplex single-stage air compressors, each of which is geared to a James Leffel 50-in. special Samson double horizontal turbine.

The available head of this water power is 56 ft., and the water is conducted from the dam to the compressor plant in a steel flume 22 ft. wide, 16 ft. deep and 200 ft. long, supported on concrete piers. The water is delivered from the flume to the turbines through four penstocks 8 ft. in diameter. The compressed air is transmitted to the mine through a pipe line 24 in. in diameter and about 17,000 ft. long. Each of these compressors was in operation for over 90% of the entire time during a 12-month period and delivered on an average 15,000 cu.ft. of free air per min., while the average indicated horsepower in the compressor cylinders totaled 1810. The compressors deliver the air at 60-lb. pressure, the loss in transmission to the mine being less than 5 lb. In general, this plant has proved an economical source of power.

The new hydro-electric plant, housed in a steel and concrete building, consists of two 2205-kv.-a. G. E. 2300-volt, 3-phase, 60-cycle, 257-r.p.m. alternators and exciters direct connected to two horizontal, double-runner 2800-b.hp. Allis-Chalmers waterwheels. The waterwheels are equipped with cone-shaped housing for the rear bearing, which is an oil bearing, and is accessible from the operating room through an inspection tube 24 in. in diameter. This machine has no lignum-vitæ bearings. On the second floor are installed two 2000-kv.-a., 3-phase, 60-cycle, 13,200-2300-volt G. E. step-up transformers. On the third floor are placed the solenoid operating switches, installed in concrete compartments, also the electrolytic lightning arresters. The switches are controlled from the main board in the operating room. The switchboard, switches and lightning arresters are furnished by the Westinghouse Electric & Manufacturing Co.

The water is conducted to the waterwheels through two penstocks 12 ft. in diameter, and the current is transmitted to the mine at 13,200 volts by two transmission lines of 00 bare copper wire, carried on self-supporting, galvanized-steel towers manufactured by the American Bridge Co. This plant has been in operation since the middle of last June, and although electric storms have been frequent and severe, there has been no interruption in the transmission of power.

Dinner to Prof. Henry S. Monroe

The Alumni Association of the School of Mines, Engineering and Chemistry of Columbia University is to give a dinner to Prof. Henry S. Monroe, who is about to retire as professor of mining at Columbia, the chair that he has occupied with distinction for a great many years. The dinner will take place at the Chemists' Club, 52 East 41st St., New York City, at 7:30 p.m., May 28. It is expected that about 200 guests will be present. George C. Stone, of the New Jersey Zinc Co., 55 Wall St., New York, is chairman of the dinner committee.

Air Blasts at Quincy Mine

A series of "air blasts" again occurred in the Quincy mine, Houghton, Mich., on Mar. 25, 1914. This is the first serious disturbance of the kind since 1909. Before this a series of "air blasts" occurred in 1906. The first disturbance of the kind in the Lake Superior copper district happened in the summer of 1904, when there was serious caving at the Atlantic mine which had the effects of an earthquake in that section of the country. Windows and china were broken and chimneys dislodged, and the shock was felt on the shores of Lake Michigan, 10 miles away. The Atlantic mine was finally closed in 1906 on account of caving. "Air blasts" have occurred on the Rand in South Africa and have been the subject of much discussion. Some claim that they are the result of altered strains and stresses due to large excavations and intimately connected with faults and other lines of weakness; others have claimed that they are the result of slipping of the rock strata, but this is not generally believed. It has been suggested that these blasts on the Rand are mostly due to the weight at great depths or to stresses set up by the effects of tectonic pressures caused by earth movements in the past. In the Central Rand mine these blasts occurred at 2000 ft. near a large fault with a throw of 100 ft. The disruptions took place near a large symmetrical fold, and it seemed evident that the force that produced the fold was still in operation.

Roof pressure is undoubtedly the cause of "air blasts" in mines where large areas have been worked out without giving sufficient support to the walls. This cause certainly seems to be the most feasible one in the case of the Atlantic and Quincy mines. This theory will not apply to "air blasts" in drifts in virgin ground. In the Brakpan Shaft No. 1 on the Rand a band of quartzite at 3000 ft. was continually breaking off in fragments. These were hurled across the shaft accompanied by a loud report. In this case the cause was certainly due to the weakness of the quartzite—its inability to stand some strain from overlying rocks. The cracking and breaking of veins at the bottom of mines might be accounted for by the enormous weight of a rigid hanging wall bearing upon the face of the vein. The strain on the vein being somewhat similar to the strain on a wedge placed at the heel of a crowbar, this strain would naturally increase as depth was gained.

In the Lake Superior copper district the walls are tough and solid. For years the practice was to mine out the vein without leaving practically any support for the walls. In most mines caving would have resulted long before it did in the Atlantic or the Quincy, had the same method of mining been employed. These "air blasts" which have occurred in series of disturbances at certain periods must be the final giving away of blocks of ground which have been gradually weakening under the load of the unsupported walls. The similar disturbances of a less serious nature must be movements similar, as evidenced by the cracking and splitting of the rocks, to those heard in the stopes of any mine where the walls are settling or giving away. The only difference is that, the walls being tougher than usual, the period of cracking and breaking subsequent to complete caving is much longer and the sounds are more audible than in softer rocks.

Just previous to the cave-in of the Hampton stope in Goldfield, Nev., where the walls were heavy and soft, the movements of the ground and cracking of the timbers could be heard, but there was just sufficient time before the cave to get the men out of the stope and into the drifts leading to the shaft. As it was, three men working in an area some distance above and over from the stope were caught in a cave which followed immediately afterward. The rush of air in the drifts leading from the Hampton stope was so great just after the cave that men in the levels were blown several feet toward the shaft, and one was struck by a car which was sent flying along the tracks by the concussion.

According to the annual report of the Quincy, air blasts have continued with more or less frequency since July, 1914. As a consequence of the blasts, in March various crosscuts and drifts were closed up. No. 6 shaft timbers were crushed between the 51st and 58th levels. No. 2 shaft was crushed and closed between the 40th and 50th levels. Below the 50th level the shaft was not damaged, though crosscuts at the 57th, 64th and 66th levels were entirely closed and levels north badly damaged. The 67th, 68th, 69th, 70th and 71st levels north and south were not injured. The cost of repairing the damage done by air blasts amounted to $57,190, and $21,487 was spent in efforts to prevent them. It was stated in the report that in the earlier days of mining it was the custom to stope out the lode irrespective of shafts, etc. If the lode was rich in copper it was stoped out to the shaft without leaving pillars. There are practically no pillars in the area near No. 2 and No. 6 shafts to protect them; in fact, this area is one open stope.

It is only natural that caves should occur in this area in the Quincy, even though it has taken years to prove that the walls could not stand the strain. Fortunately for the Quincy, only a part of its ore reserve is in the area affected by the caves, and future operations can undoubtedly save other areas from caving until all ore is worked out. Many remedies have been advocated for the prevention of air blasts, or caving, as it should be called, in the Lake Superior district. Filling and packing stopes as near the face as possible would probably answer in some cases; but with an old mine with large worked-out areas open the cost would be great. Of late years at the Quincy the policy has been to leave pillars near the shafts, and caving has never caused any damage to these sections of the shafts. At the bottom of the mine these pillars are being left 200 ft. on each side of the shafts. Filling, or "rib work," as it is called, is also being employed in all new stopes. This was first employed after 1906, and for a number of years these rock packs proved effective; but experience has proved that this work was not carried far enough. The advisability of using sand to fill the voids and strengthen the "rib work" is being seriously considered. Some sort of a retreating system, with proper protection for the shafts, should overcome the danger from these caves. Some have suggested sinking main shafts and running main levels in the footwall. Generally this should be effective; but where the footwall is softer than the vein pillars it is quite possible that some disturbance to openings in the footwall might be caused by these pillars, under enormous weight, being driven into the foot wall, unless the openings were at a considerable distance from the vein or the walls supported so that no movement could take place.

Butte First-Aid Contest

Special Correspondence

The efficiency of the instruction in first-aid work given under the direction of the Bureau of Mines was amply demonstrated on Sunday, May 9, when 2000 spectators watched a first-aid contest in which 16 teams from Butte and Anaconda participated. The event was under the auspices of the American Mines Association and directly under the authority of the officials of the U. S. Mines' Rescue Bureau, J. L. Boardman and his assistant, G. W. Grove, first-aid instructor, who have been in Butte for several weeks imparting instruction to classes of miners. It was the first such contest ever held there.

There were three separate contests, the one-man event, the two-man event and the team event. For the first event the prizes were $30 and $20; for the second, $40 and $25, and for the third, $120, $60 and $30. Aside from these prizes, the team securing the highest general average in all events was entitled to special medals presented by the American Mines Safety Association. The results were:

One-man event—Leonard mine team, first; Poulin mine team, second.

Two-man event—Washoe Reduction Works' team, first; West Colusa mine team, second.

Team event—Anaconda mine team, first; High Ore team, second; Washoe team No. 16, third.

Highest general average for all of the events—Leonard mine team, 99¼%; Washoe team No. 16, 98[illegible]%, and the Anaconda mine team, $92\frac{2}{5}$%.

Much credit is given to the Bureau of Mines instruction system and to C. W. Goodale, head of the Safety-First department of the Butte mines.

Iron Contents of Lake Ores

The Lake Superior Iron Ore Association has completed its analysis of the shipments of iron ore from the Lake region for the past season. The following table gives the shipments and the average iron content, natural state in comparison with the previous season:

	1913		1914	
	Shipments, Tons	Grade Iron, %	Shipments, Tons	Grade Iron, %
Old Range bessemers	4,678,[illegible]	55.3237	3,248,715	56.3773
Mesabi bessemers	13,877,060	53.2641	8,075,955	52.[illegible]
Old Range nonbessemers	8,245,258	52.2179	6,424,034	52.5031
Mesabi nonbessemers	19,584,9[illegible]	49.3445	12,726,990	49.[illegible]88
Totals	46,388,288	51.6311	30,475,694	51.611[illegible]

From these computations manganiferous and low-grade siliceous ores are excluded.

The records run back to 1902 and show a considerable drop in the proportion of bessemer ores shipped. In 1902 such ores were 65% of the total; in 1909 they were [illegible]5%; while in 1914 the proportion was only 37% of the total. The decrease in iron contents in all ores has been gradual but continuous since 1902, the reduction in the 12 years being about 3¾ units in bessemer and [illegible] in nonbessemer ores.

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the first quarter of 1915 shows a total production of 14,463,213 lb. of copper—4,053,147 lb. in January, 4,830,553 lb. in February and 5,579,513 lb. in March. In addition to copper derived from concentrating ores there was a total of 136,742 lb. of copper contained in ore shipped to the smeltery during the quarter. This brings the total gross production for the quarter up to 14,599,955 lb. There was a gradual increase in production during the quarter in response to the increased demand for copper.

The total ore milled for the quarter was 656,652 dry tons, averaging 1.667% copper. The average mill recovery was 66.08%. Milling costs for the quarter were 48.95c. per ton, and the average mining and coarse-crushing cost was 52.202c. per ton, of which 3.017c. was the cost of coarse crushing.

The average cost per pound of net copper produced from milling ores for the quarter, after allowing for smelting losses and applying dividends of the Ray & Gila Valley R.R., but no other miscellaneous income as a credit to costs, was 8.911c. The combined cost per pound of net copper produced for milling and shipping ore for the quarter was 8.874c. These costs include all operating and general charges, as well as 12½c. per ton of ore milled, which is applied to the retirement of mine development cost.

The net operating profit for the quarter was $777,759; miscellaneous income, $4360, giving a total of $782,119. Deducting $40,580, interest on bonds, the net surplus is $741,539. The earnings for the quarter are based on a price of 14.324c. per lb. for copper. All copper remaining unsold at the end of the quarter has since been sold at an average price considerably in excess of that at which the unsold was carried, and the resulting large additional earnings will appear in and as a part of the profits of the second quarter. It is stated that it is the intention of the directors to resume dividend payments on June 30 next.

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Ontario Mineral Production in 1914

The following information on the metal and mineral production of Ontario in 1914 has been officially given out by the Deputy Minister of Mines, the items being arranged in order of descending value: Silver, 25,217,994 oz.; pig iron, 556,112 tons; gold, 268,942 oz.; nickel, 22,760 tons; portland cement, 2,665,650 bbl.; natural gas, 13,262 million cu.ft.; copper, 14,453 tons; iron ore, 240,059 tons; cobalt oxide, 643,891 lb.; salt, 104,774 tons; petroleum, 7,437,356 Imp. gal.; lime, 2,075,228 bu.; iron pyrites, 107,258 tons; gypsum products, 31,117 tons; sand and gravel, 359,100 cu.yd.; calcium carbide, 2381 tons; arsenic (refined), 4,059,868 lb.; graphite (refined), 1363 tons; quartz, 52,917; talc (products and crude), 10,135; corrundum, 548; gypsum (crude), 43,183; feldspar, 18,062 tons; cobalt and nickel oxides, 113,843 lb.; mica, 349 tons; cobalt ore, 97 tons; nickel oxide, 303,752 lb.; phosphate of lime, 450 tons; peat, 600 tons.

The total value of the metallic products was $33,345,291, and of the non-metallic products listed in the foregoing, $7,756,419.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AIR-WASHING AND CONDITIONING APPARATUS. Willis H. Carrier, Buffalo, N. Y., assignor to Buffalo Forge Company, Buffalo, N. Y. (U. S. No. 1,138,081, May 4, 1915.)

ALLOY—Metallic Compound. Herbert B. Coho, Mount Vernon, N. Y. (U. S. No. 1,138,845; May 11, 1915.)

ALUMINATE SOLUTIONS—Process of Treating Aluminate Solutions. Henry Howard, Brookline, Mass. (U. S. No. 1,137,860; May 4, 1915.)

AMMONIA—Method of Producing Ammonia and the Like. John E. Bucher, Coventry, R. I., assignor to Nitrogen Products Co., Providence, R. I. (U. S. No. 1,138,191; May 4, 1915.)

CRUCIBLE AND LIKE FURNACE. Alexander Constantine Ionides, Jr., London, England. (U. S. No. 1,138,482; May 4, 1915.)

CRUSHER—Roll Crusher. Ray C. Newhouse, Milwaukee, Wis., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,137,418; Apr. 27, 1915.)

CRUSHING—Ball Mill. Frank E. Marcy, Salt Lake City, Utah. (U. S. No. 1,137,878; May 4, 1915.)

CRUSHING—Grinding Mill. Edward F. McCool, Victor, Colo. (U. S. No. 1,137,224; Apr. 27, 1915.)

CRUSHING—Grinding Mill. Robert M. Willson, Riverside, Calif. (U. S. No. 1,137,685; Apr. 27, 1915.)

CRUSHING—Means for Securing Tires on Crushing and Grinding Wheels, Rolls, and the Like. Marvin A. Nicol, Willamina, Ore. (U. S. No. 1,138,399; May 4, 1915.)

CRUSHING—Mill for Treating Ores and the Like. Albert Victor Park, South Melbourne, Melbourne, Victoria, Australia. (U. S. No. 1,139,064; May 11, 1915.)

CRUSHING—Ore Grinder. Edward F. McCool, Victor, Colo. (U. S. No. 1,138,966; May 11, 1915.)

DRILL—Rock Drill. Moses Arthur Knapp, Oakland, Calif. (U. S. No. 1,138,612; May 4, 1915.)

DRILLING—Attachment for Rock Drills for Supplying Water Thereto. Charles Hansen, Johannesburg, Transvaal. (U. S. No. 1,138,214; May 4, 1915.)

DRILLS—Reaming-Bits for Prospecting Drills. William Thompson Underwood, Birmingham, Ala. U. S. No. 1,138,332; May 4, 1915.)

GASES—Apparatus for Washing, Cleaning and Cooling Gases. Hans Ed. Theisen, Munich, Germany. (U. S. No. 1,139,385; May 11, 1915.)

GOLD-SEPARATING MECHANISM. Frank W. Stevens, Newton, Mass., assignor of one-half to Alfred Hopewell, Wellesley, Mass. (U. S. 1,139,143; May 11, 1915.)

HOISTING AND CONVEYING MACHINE. Mark R. Colby, Portland, Ore., and James Stewart, Cleveland, Ohio, assignors to The Brown Hoisting Machinery Co., Cleveland, Ohio. (U. S. No. 1,136,939; Apr. 27, 1915.)

INGOT MOLD—Emil Gathmann, Baltimore, Md. (U. S. No. 1,137,264; Apr. 27, 1915.)

LEACHING—Process of Leaching Ores. Jasper A. McCaskell, Salt Lake City, Utah. (U. S. No. 1,137,874; May 4, 1915.)

METALLURGICAL FURNACE. Utley Wedge, Ardmore, Penn. (U. S. No. 1,137,559; Apr. 27, 1915.)

NITROGEN—Process for Fixing Atmospheric Nitrogen. John E. Bucher, Coventry, R. I., assignor to Nitrogen Products Co., Providence, R. I. (U. S. No. 1,138,190; May 4, 1915.)

ORE TREATMENT—Apparatus for Treating Ores. Bernard MacDonald, South Pasadena, Calif. (U. S. No. 1,139,428; May 11, 1915.)

PEAT BRIQUETS—Production of Wet-Carbonized Peat Briquets. Nils Testrup, London, England, and Thomas Rigby, Dumfries, Scotland, assignors, by mesne assignments, to Wetcarbonizing, Ltd., London, England. (U. S. No. 1,139,315; May 11, 1915.)

PERCUSSIVE TOOL. Arthur H. Gibson, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,138,209; May 4, 1915.)

PERCUSSIVE TOOL. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,138,179; May 4, 1915.)

PHOSPHORIC ACID — Process of Rendering Available Phosphoric Acid. Walter S. Landis, Niagara Falls, N. Y., assignor to Frank S. Washburn, Nashville, Tenn. (U. S. No. 1,137,065; Apr. 27, 1915.)

SEPARATOR—Ore Separator. Hugh H. McGovern, Oak Grove, Ore. (U. S. No. 1,139,206; May 11, 1915.)

SLURRY—Apparatus for Mixing Slurry. Aage Schröder, Charlottenlund, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,137,294; Apr. 27, 1915.)

SMELTING—Ore-Smelting Furnace. George P. Gibson, Braddock, Penn. (U. S. No. 1,138,651; May 11, 1915.)

STAMP MILL. Edward H. Moyle, Los Angeles, Calif. (U. S. No. 1,137,272, Apr. 27, 1915.)

STEEL—PROCESS of Refining Steel and Producing High-Phosphoric Slag. Albert V. Gögler, Dortmund, Germany, assignor to the Firm of Deutsch-Luxemburgische Bergwerks- und Hütten-Aktiengesellschaft, Dortmund, Germany. (U. S. No. 1,137,681; Apr. 27, 1915.)

WHITE LEAD—Means for Forming Lead Wire. Adam Tudor Eyton, Nelson, B. C. (U. S. No. 1,137,199; Apr. 27, 1915.)

ZINC Briquet for use in Zinc Furnaces. George S. Brooks, Depue, Ill., assignor to The New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,137,835; May 4, 1915.)

Editorials

Calumet & Hecla Shares Prosperity

The Calumet & Hecla and its affiliated companies are going to distribute about $500,000 among their employees to make good the loss of wages during the time when rates were reduced and operations curtailed, beginning last September. At that time the outlook for the copper industry was gloomy and the managements knew naught else to do than to reef sails. But during the last six months there has been a remarkable change and lately the copper mining companies have been making a great deal of money. The curtailment of last fall was instrumental in bringing about the present satisfactory conditions, and it is just the square thing that the workmen who were obliged innocently to suffer then should be rewarded now. It is characteristic of the Calumet & Hecla management to have thought of doing this before the idea occurred to anybody else.

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Use of Salt in Zinc Smelting

Elsewhere in this issue is summarized an interesting patent recently issued to George S. Brooks, who is associated with a subsidiary of the New Jersey Zinc Co., for an improvement in the art of zinc smelting, consisting in the briquetting of the charge after preliminary saturation with a weak brine. There is nothing new in the use of salt in zinc smelting, nor in the use of a briquetted charge, but the combination is novel, so far as we know. The process described by Mr. Brooks is being employed in the operation of three furnaces at the works of the Mineral Point Zinc Co. at Depue, Ill., and is showing advantages on the lines of those indicated in Mr. Brooks' specifications—that is, ability to charge more ore per retort than previously and reduction of the percentage of blue powder produced, which further increases the capacity of the furnace, inasmuch as the quantity of blue powder to be resmelted is diminished. These results afford an opportunity for an interesting discussion of several important points in the metallurgy of zinc.

The use of a small proportion of salt in admixture with the charge for distillation is no new thing. This was indicated in Dony's patent of Dec. 7, 1809, and had previously been practiced at Döllach in Austria, where the old Carinthian process of smelting was employed and where 1.4% of salt, by weight, was added to the ore. These priorities did not, however, prevent one Bennett from obtaining a patent in 1861 for the use of salt in the charge for distillation.

About 25 years ago the regular use of salt was inaugurated at Auby, France, where about 1% was used; and about 15 years ago the smelters at Overpelt, Belgium, adopted this practice, using 0.5 to 0.8% of salt, especially when they began smelting Broken Hill ore, which made a good deal of blue powder. In recent years the use of salt has become common among zinc smelters in the Western districts of the United States. At Auby and Overpelt, in Europe, it was found that the addition of salt to the charge reduced the production of blue powder. The experience in this country has been similar. Respecting the fact itself there is no doubt whatever, but with regard to the explanation of it there is a good deal of doubt and difference of opinion.

The production of blue powder occurs especially during the first stage of the distillation, when the temperature is relatively low and internal oxidizing agents are active. This results in the condensing pellicles of zinc becoming coated with zinc oxide, like a frosting, or showing merely a few hairs of zinc oxide. This prevents the pellicles of zinc from coalescing and consequently they accumulate in the condenser as a dust. No matter how strongly this dust be heated it cannot be melted.

When a little salt is used in the charge in the retort the formation of this dust is diminished. The same benefit is said to result from putting a little salt in a clay dish in the front of the retort. The explanation that is offered for this by some metallurgists is that volatilized sodium chloride or zinc chloride exercises a solvent action upon the oxide-coating of particles that would otherwise deposit as blue powder, and by removing the oxide permits those particles to coalesce. If the ore distilled be simply calamine, or if the salt be not mixed with the charge, there might be simply sodium chloride volatilized; but if the ore be roasted blende, there will inevitably be enough zinc sulphate present to react with any salt admixed therewith, producing zinc chloride, which is volatile and is a powerful solvent for zinc oxide, taking it up as oxychloride. When salt is used with roasted blende, drops of zinc chloride are found in the condensers. It is known, moreover, that when blue powder is heated under a cover of zinc chloride it is possible to obtain molten zinc.

Critics of this explanation say: "But the percentage of salt is so very small, how can it have any strong chemical effect?" The natural reply is that the percentage of zinc oxide to be removed is also very small and the action of the salt is undoubtedly most energetic in the early stage of the distillation, which is precisely the time when blue powder is especially deposited.

The opponents of this hypothesis point to experiments at Auby, where sodium carbonate was added to the charge instead of sodium chloride, giving equally beneficial results. They are led, therefore, to argue that the use of a sodium salt gives a yellow coloration to the flame at the end of the condenser and causes the latter to become a more satisfactory index for the regulation of the temperature of the distillation and condensation. This rather offhand explanation is met by the claim that the use of salt is found to give beneficial results with furnaces that are under close pyrometric control, for which therefore no flame indicator is necessary for the proper regulation of their temperature. The counter retort is: "But does your pyrometer show even temperature throughout the furnace? It cannot do so absolutely unless you have a point in every retort. Everybody knows that a furnace may show local hot spots or cold spots."

So the argument runs, and the non-partisan metallurgist is likely to come to the conclusion that while the fact of the beneficial influence of salt is well established, no adequate, thoroughly satisfying explanation of it has been offered.

The advantage gained by briquette-charging is quite a different matter, being something that relates to the density of the charge, as to which there are rather wide variations in practice, discussion of which may be deferred until another time.

The Apex Law at Tonopah

We have from time to time remarked on various phases of the apex question which cry aloud for reformation. From the most recent apex decision which has come to our notice we quote the following: "This interesting and evidently conspicuous phenomenon received some rather strong jolts on the rebuttal; but hardly enough to jolt it out of the case." And again, speaking of the veins, the court says: "They are respectable and probably were so before the playful Siebert fault came their way." Speaking of another theory advanced, the learned court says: "One distinguished witness (speaking of the vein) called it eccentric and said it was subject to undulations, and had the effect of shearing the 'halo' on the north side," etc.

Being ever athirst for knowledge, we set apart a time for an investigation of this "halo" theory. We find that a halo is actually "a circle of light appearing to surround a luminous body and resulting from the reflection, refraction or diffraction of its light"; or it "is a morbid discoloration surrounding," etc.; or, figuratively, "is an ideal glow or glory investing an object as viewed through the medium of feeling or sentiment," as the "circle of light surrounding the head of a saint." We incline to the opinion that there is in this new "halo" business nothing luminous or suggesting either reflection or refraction or diffraction of light, but that there is some evidence of morbid discoloration as viewed through a medium which should have been foreign to the case in hand.

We do not hesitate to admit that our "halo" is not yet sufficiently developed to enable us to be patient with a law that leaves large and vital decisions to the tergiversations of an imagination which can conceive a vein of "undulating habits" shearing a "halo" and which presents the subject in such a way that the court, in a state of self-preservation perhaps, drifts into a levity hardly in keeping with the judicial ermine.

Forced Advance in American Chemical Industry

For years the American metallurgist has been lambasted at every opportunity for his backwardness in making byproduct recoveries. That the criticism has been mainly from those who did not understand the economics of the case has not altogether abated its sting.

Apparently the American manufacturer is now to be forced into byproduct recovery. We have chronicled, from time to time, the decisions of the Lackawanna Steel, Republic Iron & Steel, Tennessee Coal & Iron, Woodward Iron, Zenith Furnace and other companies to build toluol and benzol plants, and we are advised that a plant for the production of liquid sulphur dioxide is being considered by another American company.

In the last week an announcement has been made of contracts for 279 Koppers byproduct coke ovens, which will have a capacity of about 3000 tons of coke per day. The last-mentioned report is the most encouraging sign that we have seen, as it is probably in coking that our greatest wastes have been incurred, and it is the byproduct coke oven which furnishes the basis for the organic-chemical industries.

Mechanical Engineering in Mining

Returning from an extended business trip through many mining camps in the West, a member of the American Society of Mechanical Engineers voices surprise at what he considers the universally poor mechanical engineering in the mining field. He states that of the large membership of his society only three are to be found in mining districts, and he draws the perhaps natural conclusion for an observer unacquainted with the mining field that there is a wonderful opening for the mechanical engineer in the mining business.

Excepting of course the larger companies, whose engineering work is of the best in the country, and many plants of medium size which, in their way, are equally careful of such details, we must admit that mining in general presents some wonderful examples of mechanical engineering as it should not be practiced.

Strangely enough, however, this is not to be considered a general reflection upon the mine superintendent or manager, although of course we are not pretending to give them all an absolutely clean bill of health in the matter. The necessity and requirements and provisions of a mining operation are in a class by themselves. Time is a more valuable factor in a mining operation than in any other business. It is much more profitable to purchase a machine wholly unsuited to local conditions, but one which can be delivered promptly, than to hunt for the most efficient machine and wait for a long time for its delivery. The fact of poor mechanical engineering is counterbalanced on the profit and loss sheet by the time element.

We have seen occasions where it was necessary to play a fire hose on an air compressor to keep it from burning up while running, but this proved to be better judgment than to close down the entire operation at that particular moment to make repairs. Another most striking illustration was afforded by the purchase of a compressor for the Hayes-Monnette lease in Goldfield when the lease had but 30 days to run, and the shipping of this compressor in a baggage car attached to a special locomotive and run on passenger-train time from Denver to Goldfield. We know of no other production enterprise which would justify a move like this, and it is corollary to this urgent need that the choice of an efficient machine was wholly subordinated to immediate delivery. Good mechanical engineering is a *desideratum*, but not a *sine qua non*, in mining.

However, there is another cause for poor mechanical engineering around mines which should be the subject of emphatic and unanimous protest by those concerned. This is the result of a most unfortunate point of view of the average stockholder. It is a mental phenomenon that the average resident east of the Mississippi River considers that a beneficent Nature has placed the desired gold, copper, lead, etc., somewhere in the West, and that all that is necessary to recover them are a railroad ticket and some receptacle in which to bring them away. On account of this, no other business promotion lends itself so easily to the sophistries of the charlatan as does mining. The result is that much of the mining equipment purchased and installed for mines is bought by people who are boomers and who know nothing of the problems in hand. When the proposition is turned over to a superintendent or manager who is capable and who has mechanical engineering sensibilities, it is often in a condition which he realizes only too well is almost hopeless from an engineerng standpoint. His job is to do the best he can with what he has given him, and the consideration of outlay for new machinery is as much out of the question as would be the time for tearing out the old and installing the new equipment if it could be had.

If the small stockholder would exhibit as much interest in having an engineer handle the mining end of his investment from the start as he does in putting up a howl later on when results are unsatisfactory, we should have many fewer monuments to poor engineering in the hills and cañons of our mining country.

BY THE WAY

The New Jersey Zinc Co. two weeks ago tendered a banquet to the foremen and shift bosses of its Franklin mine and mills. The banquet was given for having mined and run through the mills 60,000 tons of ore in one month, which is said to be the largest amount of ore ever mined in a similar period of time at the Franklin mines.

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The embargo on coal exports from Great Britain looks as if it ought to help our coal operators to secure a large share of the trade which has gone to Argentina and other South American countries. This trade has been held by England because it imported largely from Argentina, and cheap freights westward could generally be secured. The chief difficulty in securing this trade at present is the high ocean freight rates—indeed the frequent difficulty of securing any bottoms at all for the trade.

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In order to emphasize the ridiculousness of many laws aimed at operators of mines, a West Virginia parody on such legislation is published by *The Mining Congress Journal*. Limitations, which many would like to see enforced against mine operators, are applied to the farmer. While some exaggerations have been resorted to, in order to bring out the travesty, there is a grim lesson behind the burlesque which should not be missed by legislators who have been active in hamstringing industries.

The parody reads as follows:

A bill to regulate prices, to prevent extortion and to prevent injurious practices by farmers and certain others engaged in agriculture and commerce.

Be it enacted by the legislature of West Virginia:

Section 1. Only one price for a given commodity shall be lawful. A farmer desiring to change a price shall file a schedule thereof with the commissioner hereby created, which shall go into effect 30 days thereafter, unless suspended by the commissioner at the instance of any consumer.

The said Commissioner of Agriculture shall carry into effect all of the provisions of this act, and he is hereby invested with all necessary powers to that end.

Sec. 2. No prices shall be increased, however, except upon due proof, the burden of which shall be upon the farmer, that existing prices are confiscatory of his goods and gear. In his discretion the commissioner may refuse to permit any such increase until a valuation by his engineers and accountants shall have been taken. In such valuation the farmer shall have no credit for past profits invested in new fields or improved structures, but shall be allowed only original cost plus borrowed money invested.

Sec. 3. "Commodity," as used herein, includes all grains, vegetables, live stock, dairy articles, excepting sand, gravel and manure, and hair.

Sec. 4. Every hired man shall work eight hours only per day, not including the Sabbath, and shall not recommence work unless he has completed a period of not less than 18 hr. of absolute rest and quiet. He shall not work on the Lord's day nor on legal holidays nor on Jack Love's birthday.

Sec. 5. Every farmer shall hire one more hired man than his work requires.

Sec. 6. The only permissible exceptions to the two foregoing sections shall be periods of stress resulting from earthquake, Halley's comet or European invasions.

Sec. 7. All wagons and all poles and doubletrees shall be provided with couplers, coupling with impact, so that the hired man need not go between the wheels of the wagon and the heels of the horses.

Sec. 8. All wagons shall be supplied with suitable brakes, grabirons, stirrups and platforms of standard dimensions to be fixed by the commissioner.

Sec. 9. All bulls, when moving on the highway or in unfenced areas, shall be equipped with a bell of not less than 50-lb. weight, a steam-whistle and an electric headlight of at least 1100 cp.

Sec. 9-a. All rams shall, when moving on a public highway or when having access thereto, be equipped with electric horns and headlights of such loudness and candlepower as may be fixed from time to time by the Commissioner of Agriculture by his order duly issued; provided, however, that this section shall not be construed to apply to hydraulic rams.

Sec. 10. Sheds shall be built over all fields where hired men have to work in summer.

Sec. 11. All fields, engines and machinery shall be fenced in; all belting shall be incased in metal housings; and all grindstones, churns, hay cutters, bull's-horns and other moving parts shall be strongly incased in sheaths for the protection of the hired man.

Sec. 12. All barns, sheds and other outbuildings shall, in cold weather, be adequately heated, and at all times shall be well lighted and policed.

Sec. 13. The right to mortgage real estate is a franchise reserved to the state. No farmer shall make any mortgage nor incur any indebtedness extending for a period of more than one month without the written approval of the commissioner, obtained upon petition and hearing, and upon paying the state treasurer [illegible] for each $100 of indebtedness. Indebtedness incurred without such consent shall be void.

PERSONALS

Charles F. Rand is expected home from Cuba about May 25.

A. Longwell has changed his address to 410 Crown Office Building, Toronto, Ontario.

Heath Steele has gone to North Carolina and will return to New York early in June.

E. Norris Hobart has been examining copper properties in the Black Rock Mining district in Arizona.

Rush J. White has retired from the staff of the Federal Mining & Smelting Co. and has opened an office at Wallace, Idaho, as consulting mining engineer.

Arthur L. Parsons, of Toronto University, will make an investigation for the Ontario Bureau of Mines of the iron ranges on Hunters Island, west of Port Arthur.

P. K. Horner, manager of the Union Minière du Haut Katanga, was in New York this week. He will visit a number of the important copper mines in this country before returning to the Belgian Congo

William M. Mehlhorn, who has been general superintendent of the steel plant of the Eastern Steel Co., at Pottsville, Penn., has been made a director and vice-president of the company in charge of manufacturing.

Webster P. Cary, graduate of Colorado School of Mines, 1910, has just been promoted from the position of mill superintendent to that of manager of the Atlas Mining Co., operating at Sneffels, Colorado.

O. M. Bilharz announces that he is located in the city of St. Louis in the practice of his profession and will now be able to give attention to the examination of and report upon mining and milling projects.

Alexander Taylor has been promoted from assistant secretary to secretary of the Lake Superior Corporation, the Algoma Steel Corporation and subsidiary companies, succeeding Thomas Gibson, who recently became president.

Prof. M. B. Baker of Queen's University, Kingston, Ont., has been commissioned by the Provincial Bureau of Mines to make a reconnaissance and map showing the geology and economic resources of the area in the vicinity of Kingston.

Frederick Haynes Newell, who has recently been appointed professor of Civil Engineering and head of the Department of Civil Engineering of the University of Illinois, entered upon his duties on May 1 He has been for 26 years in government service, principally as chief engineer and later as director of the U. S. Reclamation Service, and was previously employed in the oil country of Pennsylvania.

C. E. Lesher, associate geologist of the land-classification board of the U. S. Geological Survey, has been assigned by the Director of the Survey to take charge of the work of compiling the statistics of coal production for the annual volume "Mineral Resources." This work has heretofore been directly under Edward W. Parker, who resigned. Mr. Lesher is a graduate of the Colorado School of Mines and after his graduation was engaged in mining in British Columbia until 1910, when he went to the Geological Survey. As a member of the land-classification board, his largest contribution has been in perfecting the scheme for the valuation of the public coal lands

OBITUARY

Joseph Steppler, 89, died of pneumonia in Denver, Apr 24 He began mining at Central City in 1861 He is credited with being the discoverer of gold tellurides in Colorado, he having run across them in 1872 in his Red Cloud mine, Boulder County.

Joseph Tarringan Monell died at his home in St. Louis, May 9, aged 54 years He was born in St. Louis, graduated from Washington University and practised as a mining engineer, chiefly in the Southeastern Missouri lead district until 1906, when he entered the government service. He leaves a daughter and two sons.

James C. W. Chipman, who was chief clerk for the Oliver Iron Mining Co. on the Marquette range for 26 years prior to January last when he was retired on a pension, died in Marquette, Mich., on May 11. He was born in Boston in 1843, went to Ishpeming from that city as chief clerk for the Lake Superior Iron Co., which was absorbed later by the Oliver company

Peter Turnbull died at Leadville, Colo., May 4, aged 65 years. He was born in Canada and brought up in California. He went to Leadville in 1880, and had resided there since, being engaged in mining, as he had previously been in Utah. He located and opened the Ballard mine. At one time he was president of the Leadville Miners' Union; he had also represented Lake County in the Colorado Legislature.

George T. Wickes, a prominent Montana mining man, died at Helena, May 7, at the age of 73 years. Thirty years ago Mr. Weeks came to Helena from the South where he was engaged in operating iron mines. He became manager of the Wickes mines at the town of that name in Jefferson County. He next became engineer for the Helena & Livingston Smelting & Refining Co., operating smelteries in Helena and near Wickes He then turned his attention to the coal resources of the state, opening the Cokedale mines in the Bull Mountain region, and making the preliminary survey of the Rocky Fork coal mines for the Northern Pacific. Three grown children and his wife survive him.

John P. Barnes died in San Francisco May 2, aged 83 years. He was born in Missouri and went to Montana among the pioneers in 1864. He worked at mining and milling in the York, Eldorado and Helena districts for 10 years with varying success. In 1867 and 1868, in company with A. G. Clark and Alexander Kemp, he constructed the Eldorado ditch from Trout Creek to Eldorado bar. In the fall of 1887 Mr. Barnes purchased a one-half interest in three mining claims in the North Moccasin mountains and in 1888, with his son, C. E. Barnes, he bought the other half interest from A. D. Harmon. He developed these and added others to them until they had a group of 15 claims known as the Barnes-King group. This group was later bonded to an Eastern syndicate and has had rather an eventful history.

Richard Webb, editor and owner of the "Amador Ledger" at Jackson, Calif., died at San Francisco on Apr. 18, from rupture of a blood vessel of the heart. Mr. Webb was born in England in 1843. He was educated at Adelaide, Australia, studied for the ministry at the Congregational College in Melbourne, and began preaching at the age of 16, but later learned the printing trade. In 1871 he went to California, and was employed in San Francisco and Sacramento as reporter and editor. He then went to Salt Lake, thence to New York and returned west to Virginia City. He finally settled in Amador County, California, publishing a paper, the "Foothill Ensign" at Sutter Creek, and in 1875 the "Amador Ledger." His knowledge of and close relation to the mining industry made him and his paper popular and useful in the Mother Lode region. Mrs. Webb will continue the publication of the "Ledger."

Professor David Alexander Louis died at his home in London, England, Mar. 25, aged 58 years. Born in London he studied at the Royal School of Mines. For some years he was employed in chemical work and research, but later turned his attention to mining and metallurgical work, gaining practical experience in Colorado, Germany and Italy. From 1891 he practised as a consulting mining engineer and metallurgist in London, making visits abroad for longer or shorter periods every year in the course of his work. In this way he frequently visited and was conversant with most of the centers of mining in Europe and the United States. He also lectured on mining at Leeds and in London. He was associated with Dr. Paul Dvorkovitz in the discovery of petroleum in Egypt. Professor Louis was an active member of many societies and a profuse writer, being the author of many papers on mining and metallurgical topics. He was a man of exceptionally wide knowledge and experience, and his loss is regretted by many friends.

John Birkinbine died at his home, Cyndwyd, near Philadelphia, May 14, aged 71 years. He was born in Philadelphia, the son of H. P. M. Birkinbine, who was noted in his day as a hydraulic engineer. He was educated in Philadelphia, graduating at the Polytechnic College of Pennsylvania. After two years' service in the army he became associated with the late P. L. Weimer as the firm of Weimer & Birkinbine, operating machine works at Lebanon Penn. Later he became manager of the South Mountain Mining & Iron Co. He was connected with other iron mining enterprises in Pennsylvania and Michigan, and gradually acquired a reputation as a consulting engineer. He was in Mexico for a time. Later he became consulting engineer for the Philadelphia & Reading Coal & Iron Co., Thomas A. Edison, the Cambria Steel Co. and the Colorado Fuel & Iron Co. He was for a number of years a special agent of the U. S. Geological Survey and he reported upon iron ores for the Twelfth and Thirteenth Census. He was past president of the American Institute of Mining Engineers, president of the Franklin Institute and a member of the Pennsylvania Forestry Association. He was a member also of the Engineers' and Manufacturers' Clubs of

Philadelphia, and of the Engineers' Club and the American Society of Mechanical Engineers, New York, and the Canadian Mining Institute. He was chief engineer and vice-president of the National Export Exposition, and from its inception in 1905 had been chairman of the Water Supply Commission of Pennsylvania. Mr. Birkinbine was active in the formation of the United States Association of Charcoal Workers, served as its secretary, and for nine years edited its journal. He was the author of numerous papers for technical journals and societies. Mr. Birkinbine leaves a widow, four sons and six daughters.

SOCIETIES

Society of Chemical Industry—A joint meeting with the New York Section of the American Chemical Society and the American Electrochemical Society at Rumford Hall, New York, was held May 21. The subject for the meeting was distillation of petroleum.

American Society for Testing Materials—The annual meeting, will be held at Atlantic City, N. J., June 22-26. The nominating committee has submitted the following nominations for officers: President, Professor Mansfield Merriman, New York; vice-president, General W. H. Bixby, Washington; executive committee, James H. Gibboney, Roanoke, Va.; William H. Hart, Lafayette, Ind.; John A. Matthews, Syracuse, N. Y.; Edward Orton, Jr., Columbus, Ohio.

Colorado School of Mines—Three new trustees have recently been appointed by Governor Carlson to fill vacancies in the board. They are Howard C. Parmelee, mining engineer and Western editor of "Metallurgical and Chemical Engineering," Denver; Harry M. Rubey of the Woods-Rubey National Bank, Golden; and Orvil R. Whitaker, mining engineer, Denver. These appointments are pleasing to all persons having the interests of this school at heart. The other members who hold over are Frank G. Willis, Cripple Creek and Capt. James T. Smith, Denver.

American Institute of Mining Engineers—The New York Section held a joint meeting with the New York Section of the Mining and Metallurgical Society of America at the Machinery Club, New York, May 19. The meeting was for consideration of the advisabilty and practicability of the societies appointing representatives on a committee of engineers, already appointed by national and local engineering societies with headquarters in New York, to present recommendations to the New York Constitutional Convention relative to changes in the state constitution.

American Iron & Steel Institute—The eighth general meeting, to be held at the Waldorf-Astoria, New York, May 28, will be opened with an address by the president, Elbert H. Gary. Papers will be read as follows: "Waste Heat Boilers," by Charles J. Bacon, steam engineer, Illinois Steel Co., South Chicago, Ill.; "The Commercial Production of Sound and Homogeneous Steel," by Edward F. Kenney, metallurgical engineer, Cambria Steel Co., Johnstown, Penn.; "Blast Furnace Advancement," by Andrew E. Maccoun, superintendent, Edgar Thomson blast furnaces, Carnegie Steel Co., Braddock, Penn.; "Merchant Rolling Mills," by Jerome R. George, chief engineer, Morgan Construction Co., Worcester, Mass.; "Recent Progress in Corrosion Resistance," by Daniel M. Buck, metallurgical engineer, American Sheet & Tin Plate Co., Pittsburgh, Penn. At the banquet in the evening the principal paper will be on "Welfare Work of the Tennessee Coal, Iron & R.R. Co. No formal discussion has been provided for on the program. It is hoped and expected, however, that there will be considerable informal discussion.

American Institute of Mining Engineers—The spring meeting of the Chicago Section was held Apr 30 at the Chicago Engineers' Club. There were 29 members and guests present. After the dinner F K. Copeland, presiding, introduced the president of the Institute, W. L. Saunders, who talked of the newer lines of activity of the Institute and the mining engineering profession in Chicago. Carl Scholz spoke of the condition of the coal mining industry in Illinois. Moving pictures of the Gary steel mills were shown and explained by Mr. Bruner. The annual election of officers resulted in the unanimous election of the present officers R. W Hunt, chairman: J. A. Ede, vice-chairman; H. W. Nichols, secretary.

The St. Louis Section held its annual meeting at the St. Louis Club on the evening of May 1 Addresses were made by the guests of the evening, W. L. Saunders, of New York, the president of the Institute, on "The Institute"; by H. W. Gepp, of Australia, on the "Lead and Zinc Deposits of Broken Hill, Australia"; and by V. H. Hughes, of Tulsa, Okla., on the "Cushing Oil Pool." The officers elected for the ensuing year were: Arthur Thacher, chairman; R. A. Bull, vice-chairman, Prof. W. E. McCourt, secretary and treasurer, H A. Buehler, R. R. S. Parsons and H. A. Wheeler, executive committee. The meeting was preceded by an excursion in automobiles to the fine new works of the Granby Mining & Smelting Co. at East St. Louis, where the sulphur is utilized in making sulphuric acid. The Section was the guest of E. S. Gatch, the president of the Granby company Among those who attended were J. W. Malcolmson, of the Lucky Tiger Mine, Mexico; H. G. Hixon, of Iola, Kan.; and F. W. DeWolf, state geologist of Illinois

INDUSTRIAL NEWS

The Cook Well Co. is retiring from active business and will be succeeded by A. D. Cook, Lawrenceburg, Ind.

The Butters Patent Vacuum Filter Co., Inc., announces that it has moved its offices to Room 2852, Equitable Bldg., 120 Broadway, New York.

Electric furnaces are to be installed by the Michigan Steel Castings Co. at Detroit, in place of the small converter now used. Two Heroult furnaces, one of two tons and one of six tons capacity, will be used.

M. T. Davis, Jr., of the Kanawha Mine Car Co., Charleston, W. Va., advises that it has changed its name to the Kanawha Manufacturing Co. There will be no change in the policy or administration of the company.

Chalmers & Williams has recently sold to the Marsh Mining Co., at Wallace, Idaho, one 5x10-ft. adjustable quick-discharge tube mill, and to Balfour-Williamson & Co., for shipment to India, one 5x12-ft. adjustable quick-discharge tube mill.

The James McKay Co. is now operating its new forging plant at McKees Rocks, Penn., on crank and cam shafts, connecting rods and other miscellaneous forgings. Its board and steam drop hammers range in weight from 200 lb. to 9000 pounds.

Elmer E. Bratt, who for a number of years was the sales engineer of the Marshall Foundry Co., of Pittsburgh, Penn., has recently taken charge of the sales of the Webb City & Carterville Foundry and Machine Works, Webb City, Mo. Mr. Bratt intends to give the most of his time to new quarry and mine installations.

The Webb City & Carterville Foundry & Machine Works was recently awarded the contract for furnishing the entire equipment for the new 500-ton plant of the Granby Mining Co. at Granby, Mo. The equipment will consist of a 12x24-in. jaw crusher; one set of 42x16-in., two sets of 36x14-in., one set of 30x14-in. Cornish rolls and one set of 30x14-in. heavy-duty rolls, also one 8-in. centrifugal pump, besides the screens, elevators, jigs, etc. This company will also erect the plant.

The steel plant of the International High Speed Steel Co. at Rockaway, N. J., is now rapidly nearing completion, and it is expected that it will be in full operation by the latter part of June. The product will be confined to the highest qualities of tool steels, alloy steels, high-speed steels of all shapes and sizes; solid-octagon and cruciform, and hollow-hexagon and round rock-drill steels, for which the company has already achieved an enviable reputation in its famous Bulldog brand.

TRADE CATALOGS

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog U. Brownhoist transfer cars and larries. 32 pp., illus., 6x9 inches.

Jeffrey Mfg. Co., Columbus, Ohio. General Catalog No. 83. Elevating, conveying, crushing, screening, power transmission machinery. 384 pp., illus., 6x9 inches

The Richardson-Phenix Co., Milwaukee, Wis. Bulletin No. 10. Peterson power plant oil filter and accessory apparatus for central oiling systems. 32 pp., illus., 8½x11 inches.

General Electric Co., Schenectady, N. Y. (Power and Mining Department). Bulletins 48,904 and 48,905, Electric Arc Welding These bulletins take up the general subject of electric arc welding with supplementary notes regarding welding equipments, materials and special applications of electric welding. Bulletin 48,905 describes the stationary and portable welding apparatus developed by the company's engineers. The bulletins are well illustrated and contain much information that will be useful to those who contemplate [illegible] electric welding

Editorial Correspondence

DENVER—May 13

Roosevelt Tunnel has been pushed about 300 ft. since work resumed two months ago after the shutdown caused by the burning of the El Paso shaft that connects with this drainage adit. Heavy flow of water renders work difficult and the present progress is considered good. A. E. Carlton, heavily interested in this project, states that he has secured subscriptions of $200,000 from mine owners that will be benefited by the completion of this bore. This amount will suffice to drive the breast an additional 8700 ft. and bring it into Vindicator territory. With the adit finished that distance, drainage will be afforded to practically every important mine in the district proper, for it is recognized that the Cripple Creek crater acts as a water-basin. Hence if an outlet for water be provided at some central portion, general water level will be lowered in every mine. Probably two years will be required to finish this task. The breast is approaching the edge of the crater and better progress is anticipated after entering the eruptive rocks, chiefly breccia. Elkton shaft will be reached in about 2000 ft. more.

BUTTE—May 13

The Hoist at the Mountain View mine of the Anaconda company, since the morning of May 10, has been in steady operation. During the shut down of almost a year the frame was taken down, moved and set about 4 ft. from the original location to conform to the other changes made to the shaft and hoisting engine. By the end of the week it is expected the total working force at this mine will be 750 men.

Anaconda, in the course of time, will doubtless become a large producer of spelter. Large bodies of zinc ore have been opened in a number of its mines and processes for treating the ore are being rapidly developed at the Washoe works of the company. At these works the manufacture of sulphuric acid will also enable the company to make acid phosphate from the Montana phosphate deposits in which the company has taken an active interest.

SALT LAKE CITY—May 13

The Zinc Ore Producers appear to have more trouble ahead of them says the Eureka "Reporter" of the Tintic district. During the last few weeks smelters have been accepting nothing but the high-grade zinc, carrying from 36 to 40%, which means a material decrease in zinc shipments from Tintic. Some of the properties will be able to make occasional shipments of the high-grade zinc, but where from 15 to 20 carloads of zinc ore are now being sent out under the present arrangements with the smelters the future shipments will probably drop down to two or three cars. It is said that all of the mines with the possible exception of the May Day, Lower Mammoth and Uncle Sam, are without zinc contracts, their ore being sold on the open market through the Utah Ore Sampling Co. Much of the zinc ore sent out from the Tintic during the past few months has carried under 30%, and the supply of high-grade zinc is very limited. As all the Tintic ores are a carbonate there is still a small market, which may be cut off at any time.

SEATTLE—May 14

The Alaska Coal Land Fraud Cases, so-called, pending in the United States District Court since 1911 have been nolle prossed at the request of the Attorney General, through his assistant, Ernest Knaebel. The land involved was worth $50,000,000. The action of the prosecution, it is understood, was caused by lack of evidence.

Important Court Decision has been rendered by the U. S. District Court at Juneau in favor of the Ebner Gold Mining Co., over the Alaska Juneau Gold Mining Co., which over a year ago brought suit against the former company to prevent it from using the water of Gold Creek near Juneau. The decision is considered important as the Ebner company has a mill in operation while the Alaska Juneau mill is still in contemplation. While the Alaska Juneau was defeated in this suit it won another in a recent suit against the Worthen Mill Co., involving valuable tideland rights in front of the Alaska Juneau mill site. In the decision the court held that the owners of the land abutting on the tidelands had riparian and littoral rights to the tidelands and that the land could only be held by occupation and not on the claim that it might be needed some day. Immediately after the decision the Alaska Juneau announced that work would shortly be commenced on the erection of an 8000-ton milling plant, part of the work under the $4,000,000 appropriation made by the company a month ago. Large wharves will also be erected on the property awarded by the court which will be used in assembling machinery and other materials for the mill. Among other improvements to be made by the company will be a large hydro-electric plant costing $1,000,000 and the construction of a 30,000-gal. oil-storage tank.

GALENA, KAN.—May 15

Highest Zinc Assay on Record—The last zinc ore produced by the Buck Eye mine is a record breaker, assaying 64.30% Zn. and selling on a basis price of $79.80 per ton. Galena is justly proud of this report as it excels anything in the entire district and is the highest assay ever known in the history of the lead and zinc mines of the Missouri, Oklahoma, and Kansas district.

The Horseshoe Mill on the 40-acre lease of the McElroy and Luscomb land is to resume operation after an idleness of more than a year. It will be used as a custom mill to treat dirt from the subleases on the Horseshoe tract south of Galena. Several improvements will be made in the mill. Electrical equipment will be installed and the capacity will be brought up to 200 tons per day. D. C. Wise and Pat Tabor have a first lease on this tract and already 11 subleases are beginning to sink new shafts or clean out old ones. The ore is encountered at the 85-ft. level, and the ground is soft at this depth. Formerly this ground was mined only for lead ore and the best grade of zinc, resulting in large quantities of zinc ore being stored away with the waste underground or thrown away when hoisted to the surface.

JOPLIN—May 15

A Franchise to Operate a Lighting and Power System in the city of Granby was voted to the Empire District Electric Co. at a special election at which not a dissenting vote was cast. The installation of electric power in the Granby district should be a great benefit to the mining industry, as heretofore the only power available was steam. The Granby M. & S. Co., which is building a 500-ton mill, will install electrical equipment to light and operate its plant; the mill will be modern and embody the latest improvements in milling design and methods as practiced in the Joplin district, including a large sludge department. This will be the first concentrating plant to be operated by electricity in the Granby district.

The Zinc Smeltery of the Collinsville Zinc Smelting Co. at Collinsville, Ill., has been leased by the Picher Lead Co. of Joplin. The Collinsville smeltery is a comparatively small one, having only 1536 retorts; it is coal-fired and has no acid plant; the plant has been idle about three years. When operated at full capacity it will treat about 300 tons of zinc concentrates per week. The entry of the Picher company into the zinc-smelting business is undoubtedly in line with its recent entry into the zinc-mining industry in Oklahoma where extensive mining development is being carried on. It is possible that the necessary ore required for the new smeltery can be supplied from the Oklahoma mines in the not distant future. The length of lease upon the Collinsville plant has not been stated, but it is known to be for a number of years. It is expected to have the smeltery ready for operation by June 1 when the Picher Lead Co. will be in the field for about 10 cars of ore per week.

The Installation of a Large Fan at the Chicago Mines Co.'s property, south of Carterville, Mo., is one of the most important results of the campaign that is being waged against tuberculosis in the Joplin district. The three state mine inspectors in this district, Clem Harland, Lee Burch and Walter Holmes, are coöperating with the Jasper County Anti-Tuberculosis Society and with physicians from the government in creating better working conditions in the mines. Other large mine companies contemplate the installation of fans for ventilation purposes. The fan at the Chicago property is 14 ft. in diameter, 4 ft. wide, and is operated by a 20-hp. motor. It is installed at the Mohawk shaft of the M. S. mine on a lease of the Connor Realty Co. A. J. Burnham, manager of the Chicago Mines Co., has aided in the anti-tuberculosis crusade not only by the installation of the fan, which acts either as an exhauster or blower, but also by issuing orders to his workmen to discontinue the use of squibbing during regular shift hours. Drill men, who in the past would correct a crooked or clogged hole by the use of a squib, are now required to drill an entirely new hole. When the order first went into effect many new holes were drilled, but in the past week or two the workmen have shown more care, and imperfect holes are now the exception instead of the rule. It is Mr. Burnham's contention that 95% of the fine rock dust that irritates the lungs of the workmen comes from shots and not from the ordinary shoveling of ore. By eliminating the practice of squibbing during the regular shift hours he believes the dust evil will be largely overcome.

LORDSBURG—May 12

The Flow of Tailings from Mogollon Concentrators into the 'Frisco River, whereby farming lands in Arizona are affected may yet result in suits against offending companies in New Mexico. Wiley E. Jones, Attorney General of the State of Arizona in reply to a letter written him by S. J. Kidder, manager of the Ernestine Mining Co.—see "Journal" of May 1—apropos of editorial correspondence on the subject appearing in the "Journal" of Apr. 3, 1915, states: "It does not seem to me that the publication of the article mentioned can in any way injure either of the Mogollon companies for it would not in any way cause me to begin suit in the matter to abate the nuisance occasioned by said discharge. This office is now looking into the matter, upon complaint of citizens of Graham and Greenlee counties, and upon our information gained from our own inspections will depend the action of this office. I wrote a strong letter of caution and protest to the New Mexico mining companies and threatened action on behalf of the State if the nuisance was not abated. Of course it is hardly necessary to state that I have no feeling in any way against them, and would desire to encourage them and all such industries in every way, but it is likely the residents along the river have just cause for complaint, and under the decisions of the United States Court, such nuisances can be abated by suit against the companies. My warning to them was with the express desire and hope of avoiding any suit whatever, but I must bring suit if compelled to do so."

KINGMAN—May 11

Drilling for Water in Wallapai Valley east of Kingman has been going on for some time and present indications lead to the hope of finding artesian water at a not much greater depth. Edward M. Fowler who is prosecuting this work has already spent about $11,000. The State of Arizona has also appropriated $8500 for this work. This valley is about 50 miles in length and averages about 15 miles in width; the greater part of the land is flat with a very easy gradient; the soil is very fertile and the climate equable.

The Miners' Lien Law was radically and wisely changed by the last legislature. As the law now reads, a mining claim under bond and lease is not subject to lien for bills due the supply man, as was the case under the old law, but only for laborers' wages and the laborer has lien rights only to the amount of two weeks' wages. The semi-monthly pay day is provided for by separate law and if the miner permits his employer to pass a regular pay day without payment of wages he accepts personal responsibility and cannot place a lien on the property for more than one-half month's wages.

CHIHUAHUA—May 1

Operations of the A. S. & R. Co. in Mexico are at a standstill with the exception of the Chihuahua plant and the mines at Parral. Another furnace has been started at Chihuahua making five in all in operation. There is no activity at Aguascalientes and Monterey except that at Monterey some ore is being shipped in.

TORONTO—May 11

At the Annual Meeting of the McIntyre Mining Co., held May 5, the long-expected change in the directorate was made. Col. A. M. Hay of Toronto, president of the Trethewey, was elected president and Sir Henry Pellatt was made vice-president. The other directors are W. J. Shepard, J. B. Tudhope, J. P. Bickell, [illegible], [illegible] and M. P. Vander Voort. Canadian interests are in the majority. The new directorate will do much to restore public confidence in the company, whose affairs now appear to have passed the critical stage. The financial position has been greatly improved and the property is reported to be under careful and intelligent management. The financial statement for the year ended Mar. 31 shows assets as of that date of $102,782 of which [illegible] is cash and $46,791 gold bullion. The current liabilities are [illegible], which includes [illegible] bank overdraft. The net deficit on current account is [illegible].

CHRISTIANIA—Apr. 21

Swedish Zinc—The prohibition of Swedish export took effect from Apr. 20.

Norway Nickel—The Ringerike smeltery in 1913 dealt with the following: Norway nickel ore, [illegible] tons; [illegible] ore, 9914 tons; Australian ore, 236 tons; ferronickel, [illegible] tons, and Egyptian ore, 49 tons. The total metallic output for Norway in 1913 was 690 tons.

Swedish Iron Ore—Owing to the situation arising out of the overhauling of the Swedish ore boat, "Sir E. Cassel," the Grangesberg Coy, on Apr. 16, wired orders for the detention of three large ore boats bound for England from Norwegian ports. In the Baltic three German vessels engaged in ore traffic with Swedish ports are reported lost at sea, presumably from mines or torpedoes.

A Rich Copper Find in Tyrol is reported. The Austrian "Die Zeit" states that the well-known mineralogist Doelter has discovered a large copper deposit near Mitterberg, in Tyrol. The body of ore is described as being sufficiently large to ameliorate Germany and Austria's present copper famine. The copper works which had been shut down for a length of time are to be again started, and in a short time it is expected that 8000 tons of copper will be produced.

Nitrates to Germany—The Norwegian paper "Varden" notices the arrival at Langesund, Norway, week ending Apr. 10, from Odda near Bergen, of a German steamer with a consignment of raw material for explosives. The steamer which had followed the coast line from Odda to Langesund proceeded with its cargo (stated to be Norwegian owned) to Germany—presumably along the Swedish coast to Lübeck in the Baltic. There is no Norwegian export prohibition on nitrates.

Nitrogen Fixation—Since last Christmas the hands employed at Rjukan II construction in Telemarken have increased to 500. Some discharges took place at Easter, but it is expected that the staff will again be increased very shortly, as the intention is to complete the work next autumn. At Notodden the same company (Norsk-Hydro) is enlarging the layout of the nitrate works, and especially the packing department. Four new acid towers are also to be put up, and other developments on a large scale are to be carried out. The new large ammonia factory is working full time. The liquid raw material hitherto imported from England has been replaced by the home article.

The Copper Produced in Norway and Sweden is insufficient for home requirements. The annual import of copper to Sweden alone is from 17,000,000 to 18,000,000 kg. The latter country has to send its refined copper abroad for rolling or drawing, though recently a copper-wire mill has been established in Drammen. The export of the metal is at present prohibited from both countries. "Thereon," a Norwegian paper, comments: "It is only two or three weeks ago that Government permission had to be obtained to export (to Germany) some refined copper from Röros mines. It (about 12 tons) was to be exchanged for German electric cables. Whether the Germans sent the cables history does not say."

The Regulating of the Porjus Falls in Sweden was commenced in 1910. When quite completed the capacity will be [illegible] hp. The consequent electrification of the railway from the Kiruna iron mines to the Norwegian frontier (Riksgraensen), from whence steam is used to Narvik port, was effected on Jan. 19 this year, and from Feb. 15 all the trains had been electrically run on the Swedish section. The latter is 113 km. in length, and whereas the time previously required for the ore trains to pass it was 7 hours it is now only 3 hours. The general results of the electrification have been very encouraging, and it is stated that the remainder of the line, from Kiruna to Lulea on the Baltic, will be shortly taken in hand. Over the northern section to Narvik port, in Norway, there is now an annual transit of over 5,000,000 tons of ore.

Copper Smuggling—The Swedish government is having an eye to the strenuous attempts to smuggle copper to Germany in all possible ways. Many of these attempts are known to have succeeded after the event. At Trelleborg, on Apr. 11, quite a large consignment was seized. The delinquent was an engineering firm in Stockholm. Permission had been obtained from the Government to export a parcel of copper scrap to Germany to the amount of 15,000 kilos, on the understanding that the firm might import 15,000 kronor worth of electric lighting apparatus from Germany. When the scrap was searched a quantity of copper plates and wire was found concealed within it. A Hamburg firm on the other hand, has been more fortunate, for with the [illegible] a Swedish middleman in Gothenburg and a legal [illegible] export embargo they bagged a fine assortment [illegible] utensils specially designed to contain copper [illegible]. The revenue authorities have had the legal vacuum filled in.

The Mining News

ALASKA

THE CIRCLE DISTRICT is expected to increase its output over last year. John Stark and Anton Sutter have installed two new hydraulic plants on Mastodon Creek and J. F. Kelly has installed one on Miller Creek. New Berry dredge will be placed in operation in June and should make a good showing. Coal and Woodchopper creeks were prospected during the winter and additional ground suitable for dredging is reported to have been found.

CAMEL BACK GROUP—Four claims comprising Camel Back Group, situated in Mineral Lake district, Prince of Wales Island, have been bonded by William Armstrong for $40,000.

WILDCAT CREEK (Fairbanks)—Wilson & Samson have discovered pay on Wildcat Creek on claim above Zero, on which Finlayson & Rowson have been working in fair pay for several years.

BERRY BROS. (Circle)—Union Const. Co., of San Francisco, has brought in parts and will set up mammoth dredge on Mastodon Creek for Berry Bros. Will have capacity of 2000 cu.yd. per day.

JORGENSON LEASE (Tofty)—Jorgenson lease on Bock ground on Sullivan Creek, Hot Springs district, has been sold to Howell & Cleveland for $5000, purchasers assuming debts incurred in prospecting and opening up during winter.

GRANITE GOLD (Valdez)—Now has its new plant in operation. Is expected to crush from 65 to 70 tons of ore per day. New tunnel to strike lead at depth of 340 ft. has been driven 270 ft. More than 2000 ft. of tunnel has been driven on property.

GALENA MINE (Mayo)—Tom Atkin has purchased interest in this property on Stewart River, Yukon. Thirteen hundred tons of ore, expected to average $200 net per ton, has been freighted to steamboat landing and sent down via Dawson to Puget Sound.

HAPPY CREEK (Fairbanks)—John Fahy and Letendre, Strauss & Cosgrove are sluicing dumps taken out during winter, representing about 18,000 sq.ft. of bedrock and are expected to clean-up total of nearly $30,000. Letendre and associates plan to sink new shaft at once.

GRANBY MINING, POWER & SMELTING (Valdez)—George E. Smith, superintendent of the Midas mine here, states that development work will be pushed on this property during summer. Crew will be put to work to develop orebodies and another crew will complete construction work on aërial tram from mine to beach. During past year over $200,000 worth of development work was completed on this property.

ALASKA JUNEAU (Juneau)—Has probable ore above Gold Creek Tunnel amounting to between 80,000,000 and 100,000,000 tons, on which profit from 70c. to $1 per ton will be realized. There is, in addition below Gold Creek Tunnel to depth equal to present bottom level of Douglas Island Mines, two miles away, at least twice this tonnage probable, in which case company has total of from 240,000,000 to 300,000,000 tons of ore. It is not commercially feasible, because of tremendous cost involved, actually to block out any large part of this tonnage at present. Certain facts having important bearing upon probable ore and its value are: Length of about 7000 ft. on the mineralized belt; development of three distinct horizons of pay ore; on surface, where 30-stamp mill operated for years, at point 800 ft. vertically below these surface workings, main crosscut tunnel approximately 1200 ft. below these surface workings, at all of which points milling results indicate practically uniform values. Wherever development has been done in ore, same approximate gold value has been determined. It is reasonable, therefore, to assume that quartz masses throughout property from main crosscut tunnel level to surface are of approximately same gold value per ton. Company has secured George O. Bradley to design and supervise erection of 8000-ton mill.

ARIZONA

Gila County

INTERNATIONAL SMELTERY (Miami)—Is virtually in operation now in way of drying out converters, fusing lining of reverberatory furnaces, bedding ore and fluxes. Original estimated cost, $2,000,000. Capacity will be about 250 tons of copper daily, although production of copper from Inspiration and Miami concentrates, which it was built primarily to handle, for a time will be about 160 tons per day.

ARIZONA COMMERCIAL (Globe)—Three stopes in sulphide ore on 1300 and one on 1200 levels being worked and 175 tons of ore being shipped daily to Old Dominion smeltery. No drifting in progress on 1400, cutting of pump station having finished all work on that level for some time. The pumping plant is lifting about 450,000 gal. daily from 1400 level to 1200, whence it runs to Old Dominion shaft by connecting drift 8000 ft. long.

OLD DOMINION (Globe)—Third furnace started on account of ore shipments to smeltery from Arizona Commercial and outlying mines. In concentrator three full shifts are running and over 600 tons are being put through plant daily. Oil flotation being used as clean-up for vanner tailings and flotation concentrates thus made are now being dried in new Oliver filter plant instead of being settled in wooden bins, as formerly. Tonnage treated lately has been about 800 tons per day, which is larger tonnage than at any time since last July. Water on 1000 and 1200 levels decreased somewhat, but is still heavy and takes the full capacity of the normal pumping equipment. Steps being taken to unwater west winze from 1600 to 1800 level.

Warren County

COPPER QUEEN (Bisbee)—Has made tentative gift of $10,000 to local Y. M. C. A. for general improvement purposes including installation of bathing and swimming facilities. Offer contingent on doubling of present membership of 500.

CALIFORNIA

Amador County

KEYSTONE (Amador City)—Good grade of ore, some of which shows free gold, disclosed in hanging wall on 1200 level.

TREASURE MINE CO. (Amador City)—Assessment No. 38 of 5c. per share has been levied for further development. Pay ore has been blocked out but it is considered advisable to continue development before installation of mill. E. McCurdy is superintendent.

OLD EUREKA (Sutter Creek)—Reported that Col. Edward Green, of New York, has secured controlling interest in this old property, which consists of three mines and mill site, by levying assessments of 50c. a share on outstanding stock. Particular purpose of assessments was to reimburse Mrs. Hetty Green for amount expended for taxes in past 25 years that mine has been idle.

Butte County

GOLD HILL (Stirling)—Reported that mine will be reopened. Construction of mile of ditch and dam will be necessary.

Calaveras County

FORD (San Andreas)—Exploring of 100 level in progress with good extractions. Sample shipment of high-grade ore sent to Selby. Vein is about 6 in. wide and widening with advancement of drift.

WHATCHEER (San Andreas)—Property comprising 140 acres of blue lead channel at Chili Gulch reported to have been purchased by John Johnstone of Seattle, member of the firm of Johnstone, McKenzie & McDonald of Alaska. Twenty men are employed in development, and payment on purchase price said to have been made. There is large amount of rock already extracted said to average about $3 per ton.

Eldorado County

RED MOUNT (Placerville)—This property situated in Garden Valley district has been leased to W. E. Gill of St. Louis.

MONTEZUMA (Nashville)—Electrical machinery is being installed and as soon as old workings can be put in shape, underground development will be undertaken on large scale. Albert Burch of San Francisco, representing Bewick-Moreing company, is manager.

ALPINE (Georgetown)—Mine being unwatered and retimbered preparatory to resumption of development. Mine owned by Los Angeles men and was operated two or three years ago when disagreement of owners caused closing down. Sam W. Collins is superintendent.

RISING HOPE (Placerville)—Installation of rotary gravel mill with capacity of 80 to 100 tons in 24 hours is about completed. Development has been in progress for last three years. Large body of gold-bearing gravel blocked out in channel. George W. Englehardt is manager.

Fresno County

FRESNO COPPER (Clovis)—Property reported sold to J. S. Douglas of Douglas, Ariz. C. C. Leavitt of San Francisco is making survey, and upon report future of the property will be decided.

Humboldt County

CORONA DE ORO (Eureka)—Recent cleanup from this gravel mine valued at $6000, averaging production of $400 per day. Water is available only six or seven hours in 24 but two shifts are maintained. William B. Olmsted, manager and principal owner, was one of early prospectors and operators in Alaska, going there in 1894.

Inyo County

CERRO GORDO (Keeler)—Twenty-five men employed on reconstruction of aërial tramway between mine and Keeler. All necessary timber received and two carloads of machinery from St. Louis. Ore bins at railroad station are about completed. Intermediate control station will be constructed at Flat Top, half way between mine and railroad. Recently two new zinc orebodies have been opened. Fifty men on pay roll at mine. Development work being prosecuted at four different points.

Kern County

GOLDEN (Caliente)—Joseph Ferris, owner, has given leases upon this property in Amalie district.

GOLD PEAK (Caliente)—Mill has started on good ore. New machinery is being added to equipment.

SYCAMORE (Caliente)—J. W. Kelly and R. Pile are developing this property in Long Tom district. A 3-ft. vein of high-grade ore is reported.

GLADYS (Randsburg)—High-grade ore was recently disclosed and it is believed the vein is an extension of Sunshine. Vein is 18 in. wide at the 110 level.

ZENDA (Caliente)—Cooper Shapley and associates of Bakersfield and Caliente have taken over this mine and mill. Reported that cyanide plant will be increased.

CHURCHILL (Johannesburg)—Two shifts of men employed at this tungsten mine about four miles from Randsburg. Reported that 12-in. vein of high-grade ore has been disclosed.

SUNSHINE (Randsburg)—Sulphide ledge encountered at 500 ft. carries a 5-ft. vein with ore milling as high as $100 per ton. Leasers say there is a large amount of ore in sight.

Nevada County

BRUNSWICK CONSOLIDATED (Grass Valley)—Four carloads of cement and six carloads of machinery for construction of new mill have been received.

CLEVELAND (Nevada City)—James Hawke, owner, contemplates installation of dry-land dredge on this placer on Deer Creek. He controls about 2300 ft. of bed of creek which has yielded gold since 1849.

GOLDEN CENTER (Grass Valley)—Concentrates amounting to 120 tons accumulated at mill are being hauled to Pioneer Reduction Works for treatment. It is stated that concentrates average $80 per ton.

CHARLES B. O'CONNOR of Lake City is reported to have discovered good gold-bearing gravel near that town in old bed of Kennebec Creek. Ground has been prospected by shafts and opencuts. Tests have been made for distance of 3700 ft. along course of gravel channel.

Placer County

HARMON (Westville)—Reported that an electric plant will be installed this spring.

KING (Loomis)—Property leased to Auburn men for one year, considered one of best gravel mines in old river bed.

WHISKEY DIGGINGS (Lincoln)—Reported that Wallace Gibson will reopen the mine. It is one of the oldest properties in Valley View district.

BOREALIS CONSOLIDATED (Auburn)—Compressed-air drills and 1500-ft. electric hoist have been installed. Drifting for 225 ft. on 260 level has disclosed shoot of high-grade ore. Contract signed for increasing 10-ton mill to capacity of 20 tons. Cyanide plant also contemplated. Property is situated in Ophir district about three miles from Van Trent Copper Co. mines.

Plumas County

ENGELS (Taylorsville)—Concentrator at this copper mine resumed operation and arrangements made for regular shipments to Utah smelteries. Reported that other copper mines in this region are being reopened.

JOSEPH (Quincy)—San Francisco men have taken bond on this gravel mine situated south of Genessee Valley. Property has been owned and operated with profit by Anthony Joseph of Quincy for the past 28 years. Method of operation has been by hydraulic elevator and derrick.

Shasta County

ASBESTOS DEPOSITS covered by 12 claims have been located on Mears Creek west of Simms by H. R. Stevens and L. M. Emmons of Redding.

DREDGING GROUND amounting to 1277 acres on Churn Creek, east of Redding, is said to have been bonded by Eastern men who it is reported contemplate installation of dredges. The owners are T. Neilson, George Meding, W. C. Hawley, and Perry Mark of Redding. Perry Mark is superintending drilling.

VICTOR POWER & DEVELOPMENT (Knob)—Lane mill has been installed at Midas mines in Harrison Gulch district. Additional units will be installed. Recent cleanup of $6000 shipped to U. S. Mint at San Francisco. R. D. Jackson, general manager.

SHASTA BELMONT (Heroult)—This copper property situated on Pit River between Copper City and Heroult will probably resume operations, according to advice from the head offices at Carson City, Nevada. Development was suspended at breaking out of war.

DRY CONSOLIDATED (Redding)—New hoist and other equipment will be installed for thorough development of 6-ft. ledge which shows good-grade of ore at depth of 75 ft. It is reported also that Dr. McEntyre is contemplating installation of dredge near Copley.

SHASTA DREDGING (Redding)—Dredge which operated for number of years at Horsetown is being removed to Gas Point. Smith Center will be the name of new town to be built near dredge. Seventeen cottages are being constructed for employees. G. V. Smith is superintendent.

Sierra County

JIM CROW CAÑON (Downieville)—Papoose quartz group is undergoing an exhaustive examination by A. F. Hughes, M. E. of Berkeley, on behalf of the owners, Captain H. S. Howland of San Francisco and associates.

Siskiyou County

ISABELLA COPPER (Yreka)—Advancement of main tunnel 100 ft. has commenced and development of main orebody will be prosecuted.

Tulare County

TULARE MINING (Portersville)—Tramway 4000 ft. long is being constructed for carrying ore from this magnesite mine. There is vertical drop of 700 ft. from mine to mill site.

Tuolumne County

KNOX & BOYLE (Santa Ysabel)—Property will be operated under lease. Car track and pipe line being laid and water will be pumped out, preparatory to installing machinery.

EXPERIMENTAL (Sonora)—A 3½-ft. vein of good ore disclosed in breast of long tunnel, a distance of 2700 ft. from portal. Tunnel has been driven through barren country. At point 270 ft. beyond vein disclosure, large vein has been tapped by shaft.

BUCKEYE (Sonora)—Company has been formed by Gibson B. Kelly and George L. Gary and development will be prosecuted on large scale. Is one of old mines of Table Mountain district. Said to be situated in same channel as the Springfield tunnel mine. M. J. Lidstone is manager. Installation of mill and hoist is contemplated.

COLORADO

Boulder County

HERALD (Sugar Loaf)—Strike comparing with those made in this district 30 years ago has been made. Leasers Brown, Clark, Davis & Rinn opened 2-ft. vein filled with sylvanite and have mined carload lot that will be [illegible] and sold immediately. Results are expected to be spectacular.

Chaffee County

MONARCH-MADONNA (Monarch)—In preparation for sinking third shaft, air-compressing plant has been purchased and moved to mine from Salida copper mine. Reserves show well but main shaft is in such treacherous ground that it is necessary to abandon it as soon as new shaft can be sunk 350 ft. Upper levels worked through adits by 25 sets of leasers. Company employs 30 men.

Gunnison County

YUKON (Parlin)—Shipments have resumed for usual summer season. Although but a small mine, fair-sized orebodies have been developed and it will be possible to ship small tonnage of high-grade copper-gold ore.

Lake County

WESTERN ZINC OXIDE CO. (Leadville)—New incorporation owns works erected last year to manufacture zinc pigment from carbonate and silicate ores of this district. Officers for first year are: President, Howard E. Burton, local mining man and assayer; vice-president and general manager, A. B. Augustine, one of the two original owners of the plant. Experiments have been conducted to determine grade of fuel most suitable for this reverberatory treatment of the local non-sulphide ores with result that anthracite and coke have been selected for use during regular working conditions, with bituminous coal as a kindler. Twelve of the plant's 16 furnaces are handling about 40 tons of 15% crude ore per day. Daily production of oxide varies, of course, with grade of heads but during recent research with different fuels, daily output averaged about 6 tons of 75% zinc. Both quantity and grade of product will be materially increased in near future, it being Mr. Augustine's purpose to manufacture an 80% pigment. Employment is given to 25 men.

San Juan County

INTERSECTION (Silverton)—Stamp mill has resumed and will keep busy all summer on ore stocked during past winter.

SAN ANTONIO (Red Mountain)—Was bought at sheriff's sale by G. A. Niemann of Denver. Has been idle two years because of differences among owners. John F. Roper will be superintendent and intends to push mining of large bodies of copper-lead ores carrying gold and silver.

GOLD KING (Gladstone)—Mine production keeps mill running at capacity. Louis Bastian, mill superintendent, constructed an oil-flotation experimental machine with which he has conducted experiments that produced 16 carloads of fine concentrates. He is nearly ready to install several commercial-sized machines.

Teller County

DOCTOR-JACK POT (Anaconda)—Powell lease in shaft No. 6 on Work claim is to be equipped with electric hoist.

ABE LINCOLN (Cripple Creek)—Brothers & Strauss, leasing 500 level, have 8 ft. of shipping ore. Kenzie & Fabry, on 700 level, are shipping from 6-ft. vein developed in winze and have been stoping.

COMMONWEALTH (Cripple Creek)—Philip Merriweather has taken contract to lift upraise 800 ft. from Roosevelt tunnel level to connect with bottom of present 800-ft. shaft. This property lies in saddle between Gold Dollar mine on Beacon Hill and Elkton mine on Raven Hill. Proposed work will result in vertical shaft having two cage compartments, 1600 ft. deep.

IDAHO

Custer County

EMPIRE COPPER (Mackay)—Output is now 3600 tons per month; 220 men are employed. On payment of June installment of purchase price control will be turned over to Godbe interests of Salt Lake who negotiated deal.

KANSAS

H. L. & S. S. MINING CO. (Lawton)—Concentrating plant swallowed by cave-in. Shaft situated at mill not injured. New mill will be built.

MICHIGAN

Copper

SMITH-CLOSE (Ontonagon)—Has awarded 75,000-ft. diamond drilling contract to Cole & McDonald. Drilling will be done in Porcupine district, near White Pine Copper Co.

MOHAWK (Mohawk)—Is contemplating erection of electric light and power plant this summer. Electrical equipment of this company has been very little, but electrification of rock houses, underground haulage and pumping has been talked of. Not probable that electric mine pumping will be considered as it is not very large item. Telephone system is now being installed underground.

Iron

JUDSON (Alpha)—Is again on full time, going from four days per week to six, force has also been added to.

FORBES (Iron River)—Working force has been doubled this week. No ore is being shipped at present, all that is hoisted being stocked.

ROLLING MILL (Negaunee)—Fifty men have been added to underground force this week. About 200 men are now working. Regular shipments of 500 tons daily being made.

AMASA-PORTER (Amasa)—Number of mine buildings and homes for employees to be built this summer. Present buildings are only temporary structures. Most of men walk from Amasa, four miles away.

IRON MOUNTAIN LAKE (Ishpeming)—More exploration work is to be done with diamond drills before any other further work is carried on. Drilling will start immediately. Not unlikely that present shaft will be abandoned and new one, much larger, sunk.

MINNESOTA

Duluth

ZENITH FURNACE (Duluth)—Contracts have been secured from Eastern explosive manufactures to take output for more than a year after completion, not contingent on the European war, of plant being built to recover benzol and toluol from byproduct gas from company's coke ovens. Plant will be of sufficient capacity to handle entire volume of gas from coke plant.

Mesabi Range

BIWABIK—Drills working on Merritt Hill have encountered orebody, situated between Biwabik and Bangor location.

HAWKINS (Nashwauk)—Stripping commenced here May 4. One shovel is being worked two shifts. Two engines are hauling ore from pit.

OLIVER IRON MINING (Chisholm)—Work has been started on new shaft to be sunk near Great Northern station on lands developed last fall. Steel headframe will be erected. Shop buildings will be of concrete. Small crew now employed getting shaft started. Company will put down shaft on Myers property. Work on this mine was started last Saturday.

MISSOURI

ORONOGO MUTUAL (Oronogo) — Has secured mining leases on greater portion of town lots, Oronogo, and is now driving faces west under these lots; leases extend west about 1100 ft. from mill. New shaft 6x6 ft. in clear and 205 ft. deep has been sunk on one lot 1000 ft. west of mill, a 400-ton hopper and derrick has been erected over this shaft and drifting has been started. Ore will be transported to mill by an aërial tram, buckets will hold 3000 lb. of ore; tram will be operated by 25-hp. motor installed at shaft. Tramway stretches across southern portion of town and will be completed within 30 days. Ore occurs in sheet-ground formation and shows 4½ to 5% blende; face is 12 to 15 ft. in height.

MONTANA

Hill County

HAVRE NATIONAL GAS (Havre)—Third gas well of this company will be started within a few days. Will be located about a mile east of Hill County fair grounds. It is believed that the main gas flow which is known to exist in this field will be tapped by new well.

Lewis & Clark and Madison Counties

BARNES-KING DEVELOPMENT—Estimated clean-up of company for April of North Moccasin mine at Kendall, Madison County was $43,900 from 4608 tons of ore. This would make an estimated yield of $9.53 per ton of ore. Work on power line to company's Piegan-Gloster mines near Marysville, Lewis & Clark County, has been delayed on account of recent storms. Montana Power is pushing work on line between Great Falls and Deerlodge which will supply Milwaukee railroad which passes through country adjacent to Barnes King property. Branch line to main line from mines has already been constructed.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Quarterly report period ended Mar. 31 gives tons ore milled, 117,860; average zinc contents, 17.35%; assay of concentrates, 52.92%; total zinc in concentrates, 36,382,742 lb.; mill recovery, 91.32%; total net profits, $1,163,156.

NORTH BUTTE (Butte)—By middle of month will begin hoisting at new Granite Mountain shaft and transfer most of work from Speculator to new hoist. At present about 800 men are working and output is nearly normal.

PILOT-BUTTE (Butte)—Employing 50 men at present for work in ground not in dispute with Anaconda. During past month about 19 cars of 7 to 8½% copper ore were mined and shipped to Washoe. Tonnage for April close to 1000 tons. Company has large bodies of zinc ore in sight but no arrangements for handling it have yet been perfected and it is therefore not brought to surface.

BUTTE-NEW YORK COPPER (Butte)—Company has authorized issue of $500,000 of 10-year mortgage convertible bonds. Object is to raise money for development work. Butte-New York is a holding company only, controlling Butte-Milwaukee, which is a subsidiary of Butte & Superior. Butte-Milwaukee claims which adjoin Butte & Superior property are developed under direction of latter company.

NEVADA

Elko County

ELKO PRINCE (Midas)—Will install 50-ton mill; construction to begin as soon as possible.

CLOVER (Wells)—This leasing company, incorporated recently, working Polar Star mine and adjoining ground 6 miles south of Wells. Good grade lead-zinc ore being mined; regular shipments made via Tobar, on Western Pacific R.R. Net smelter returns average $15 per ton.

Esmeralda County

KEWANAS (Goldfield)—Has made side-line agreement with Booth giving 250,000 shares treasury stock for relinquishment of extralateral rights.

ATLANTA (Goldfield)—Air raise connection made and production will be increased to 60 tons daily. New raise, 1011-A, is in full face of ore assaying $27 per ton.

LONE STAR (Goldfield)—Has made side-line agreement with Booth and will resume development and exploration work stopped when apex litigation threatened.

MERGER MINES (Goldfield)—Receivership made permanent by U. S. District Court at Seattle. Counsel for plaintiffs announce that further suits will be brought against Merger directors for alleged abandonment and loss of corporate property and against Jumbo Extension for recovery of Velvet claim.

Humboldt County

NEVADA SHORT LINE R.R. has begun extension from mill of Rochester Mines Co. to Upper Rochester. Work will be completed in 60 days.

NEVADA PACKARD (Rochester)—Large block treasury stock sold and work on new milling plant will begin soon. Several springs, large enough to furnish sufficient water supply, acquired. Estimated value of ore developed, $2,000,000.

LINCOLN HILL M. & M. (Rochester)—Total production to date from two-stamp mill, $50,000. Addition of five stamps and cyanide plant will be made. At mine, compressor and drills will be installed. Crosscut tunnel to be driven to cut Spur and Peerless veins; 200-ft. winze will also be sunk. New road from lower tunnel to mill being built; this will shorten wagon haul of ore by two miles. Power for mine and mill furnished by Nevada Valleys Power Co.

Lander County

COPPER QUEEN (Battle Mountain)—Development work on this group in Copper Basin progressing with satisfactory results. Property being worked by W. P. Hammon, of San Francisco. Options secured on 118 claims in Copper Basin; these will be prospected by churn drilling.

Lyon County

PRESCOTT (Ludwig)—Shoot high-grade copper ore opened in drift on tunnel level. This property just east of Nevada-Douglas, formerly operated by Greenwood company.

NEVADA PROGRESSIVE (Yerington)—Sinking of working shaft progressing rapidly, now nearly 300 ft. deep. Other development work under way and satisfactory progress being made.

NEW CYANIDE PLANT FOR SPRING VALLEY DISTRICT, near Mound House, will be built. Plant will treat old mine dumps in this district. Experimental work carried on for several months before decision made to build plant.

Mineral County

BURNS & BLACKBURN (Hawthorne)—Rich channel on bedrock opened in 140-ft. shaft. Gold is coarse, one nugget found valued at $16. Pans $6 to $12 per cu.yd. Discovery made below Pamlico mine in Pamlico mining district. Expected channel will be three miles long; many claims being staked.

Nye County

TONOPAH ORE SHIPMENTS for week ended May 8 totaled 9871 tons, estimated at $203,638, compared with 10,665 tons week previous. Shippers were: Tonopah Belmont, 3493; Tonopah Mining, 2600; Tonopah Extension, 1678; West End, 878; Jim Butler, 900; Tonopah Merger, 262; North Star, 60 tons.

TONOPAH BELMONT (Tonopah)—Has taken option on Potosi mine, in Nicaragua, covering 265 acres and placer rights along two rivers for 30 miles.

TONOPAH MINING VS. TONOPAH EXTENSION—By stipulation filed in court apex suit is withdrawn and side-line agreement covering disputed Sand Grass claim entered into. Full terms of settlement not made known.

Storey County

JUSTICE MINE (Virginia City)—Dangerous ground at Pacific Bend being fenced in. This territory undermined and may cave.

NEW JERSEY

NEW JERSEY ZINC CO. (Franklin Furnace)—This company is reopening old Stirling mine, which has been closed for good many years. New shaft is being sunk.

NEW MEXICO

Colfax County

GOLDEN AJAX M. & D. (Elizabethtown)—This company, of Denver, Colo., will overhaul its 10-stamp mill and install cyanide machinery at mine near Elizabethtown.

Grant County

GEORGE S. CURTIS and FRANK J. DOLAN plan to begin development work upon group of 65 claims in Burro Mountains, near Silver City, N. M., upon which they recently obtained option. Ledge of high-grade copper ore 35 ft. wide has been uncovered on property.

SILVER CELL M. & S. (Pinos Altos)—Recently organized with capital stock of $300,000 for purpose of operating its mines in Pinos Altos district.

PHELPS, DODGE & CO. (Tyrone)—Has recently increased its operations at its mines in Tyrone district and its output of copper ore is being gradually enlarged.

Otero County

MACE & NICHOLAS of Sierra Blanca, Texas, are preparing to begin development work upon claim in Alamogordo district, which they recently bought from J. B. Knight.

San Miguel County

PECOS RIVER COPPER (Cowles)—W. C. Brace, of Denver, Colo., and associates have placed force of men at work developing this copper mine, which they have taken over under conditional bond and lease. David Brown, of Denver, mining engineer, is in charge of property.

PENNSYLVANIA

Susquehanna County

NEW JERSEY ZINC CO.—This company is doing churn-drill prospecting around old Ueberoth mine at Friedensville.

TENNESSEE

Polk County

DUCKTOWN SULPHUR, COPPER & IRON CO., LTD. (Ducktown)—U. S. Supreme Court on May 10 decided in favor of State, suit brought by State of Georgia for an injunction to prevent company from diffusing sulphurous fumes over Georgia border from operation of its plant in Tennessee. Court held that amount of sulphurous fumes must be restricted and an inspector appointed to fix limitations.

UTAH

Beaver County

HORN SILVER (Frisco)—Much development being done from 500- to 900-ft. level. Seventy men are employed. Ore recently encountered near King David line is four to five sets wide. Annual report for 1914 showed total receipts of $205,279, of which $163,378 came from sale of ore. Operating expenses were $190,599, leaving net profits of $13,698.

Juab County

TINTIC ORE SHIPMENTS for April amounted to 580 carloads, estimated 29,000 tons, value $725,000. This compares with 356 cars for month previous. Shippers were: Iron Blossom, 101 cars; Centennial-Eureka, 99; Sioux mill dump, 95; Eagle & Blue Bell, 55; Chief Consolidated, 50; Gemini, 39; Dragon Consolidated, 23; May Day, 18; Lower Mammoth, 16; Grand Central, 20; Gold Chain, 9; Eureka Hill, 7; Colorado, 7; Beck Tunnel, 7; Bullion Beck, 7; Victoria, 5; Carisa lease, 5; Yankee Consolidated, 5; Godiva, 2; Black Jack, 2; Sioux Consolidated, 2; Tintic Standard, 1; Opohongo, 1; Utah Ore Sampler, 1; Minnie Moore, 1; Uncle Sam, 1; Salvador, 1 car.

IRON BLOSSOM (Silver City)—Burning of the Knight mill has not affected profits, as there has as yet been no income from ore of character treated.

GEMINI (Eureka)—About 100 leasers are working at this property, between 500 and 1650 levels. April production amounted to 1900 tons valued at about $30 per ton.

MAY DAY (Eureka)—Dividend declared payable May 26. There is $44,601 in treasury, and five cars of ore shipped have not yet been settled for. Property in good condition; regular shipments can be continued for some time, and development being kept ahead of production. Eighteen cars shipped in April, about equally divided between lead-silver and zinc ore.

RIDGE & VALLEY (Eureka)—Stockholders have voted to increase capitalization from 250,000 shares to 500,000, par value $1. The additional shares will be placed in treasury, to be offered later to stockholders, funds accruing to be used in new development planned. Company owns extensive area adjoining Gemini, through which work can be carried on at depth. New directors and officers have been elected. W. R. Wallace, president, and J. C. McChrystal, vice-president and general manager.

TINTIC STANDARD (Eureka)—Statement to stockholders has been issued by E. J. Raddatz, president. Two cars of ore shipped since last statement (sent out Dec. 2), one in January and one in April, from 1200 level, where good milling ore has been opened, showing bunches and streaks of shipping grades. Assessment levied, delinquent June 1, to meet accumulated bills. Conditions are stated to be promising, and stockholders are advised to acquire treasury stock, which will be available on or before July 1. Company owns 10 patented and five unpatented lode claims, in East Tintic.

Salt Lake County

MONTANA-BINGHAM (Bingham)—The tunnel is now in approximately 3700 ft., face being in siliceous limestone in Bingham Amalgamated ground. It is thought that Congor vein will be reached within 300 feet.

WASATCH MINES (Alta)—Ore in Columbus Consolidated ground opened 600 ft. from surface on dip of vein, is developing satisfactorily; there are exposed 9 ft. of copper and silver ore with an excess of iron.

EMMA COPPER (Alta)—Two shifts working on crosscut, being driven for extension of orebody in Cabin Fraction adjoining. Work being done through Flagstaff tunnel; there is about 150 ft. still to go. Face is in limestone.

SALT LAKE & ALTA R.R. (Salt Lake City)—Has tentatively agreed to build $35,000 tramway from Tanner's Flat to railroad terminus at Wasatch, provided mining companies advance $15,000 to be returned to them in freights.

MICHIGAN-UTAH CONSOLIDATED MINES (Alta)—Cliff Mining Co. operating lease here is preparing to rebuild headhouse of aërial tramway, recently destroyed by fire. Considerable ore has been accumulated by this lease.

ALTA TUNNEL & TRANSPORTATION (Alta)—The tunnel is being driven to the south from head of Silver Fork Cañon. Beside opening up mineralizing fissures in its course, will provide transportation for nearby properties in Big and Little Cottonwood.

CARDIFF (Salt Lake)—Oreshoot, opened in October in lower tunnel, has produced about 1800 tons of ore. Has been followed 225 ft. on strike, and main raise is up 160 ft. with ore showing most of way. No shipments are being made at present owing to roads.

WEST TOLEDO MINES (Alta)—West Toledo property, adjoining Cardiff on south has been acquired by new interests, and stock listed on Salt Lake exchange. Capitalization is 500,000 shares, par value 10c., with 264,012 in treasury. A. S. Ross is president of new company.

SOUTH HECLA (Alta)—Drifting being done to get under Wedge fissure on both 100 and 200 levels, in order to develop western extension of main orebody above Dwyer level. Ample ore blocked out for regular shipments, which will start in June. During the 1914 shipping season, production amounted to $104,000.

PRICE MINING (Salt Lake City)—A new company has been incorporated to work in Big Cottonwood under above name. Property consists of 13 claims on Montreal Hill, nine unpatented and four patented, latter comprising the Clara M. group. Tunnel has been driven on Clara M., in which there is good showing. Capitalization is 1,000,000 shares, par value 25c., of which 500,000 remain in treasury. F. W. Price, vice-president of the Cardiff company, is largely interested.

NEW UTAH BINGHAM (Bingham)—Principal workings have been cleaned up, [illegible] timbers repaired and put in order for full force of men during present month. Three leases have been let in [illegible] tunnel, and one on Kilkenny. Other leasers are now figuring on ground upon which they hope to commence work during month. It is intended to let from 12 to 15 leases on some of less important workings.

Summit County

PARK CITY ORE SHIPMENTS for April amounted to 6500 tons valued at $250,000 compared with 7831 tons in March, [illegible] in February and 7859 tons in January. The shippers in April were: Silver King Coalition, [illegible]; Daly Judge, [illegible]; Daly West, 1344; Silver King Consolidated, [illegible]; Daly, [illegible]; others, 461 tons.

ONTARIO (Park City)—Strike of ore of good grade made by lessees near the 600 level. Reported that company will start work with thirty men.

SILVER KING CONSOLIDATED (Park City)—Following recent snow in mountains, soft roads are again interfering with shipments. Much ore has been developed.

PARK CITY MILLS (Park City)—Holt-Dern roaster has been started on its 30-day trial run, and is operating satisfactorily. The capacity is 35 tons daily, with a minimum extraction of 85 per cent.

Tooele County

GETHIN-LEROY (Silver Island)—Ten inches good clean high-grade ore in lower tunnel. Eighty sacks of ore averaging $2000 per ton ready for shipment.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—Expected to resume production from Mother Lode mine in June. Development on newly acquired Copper Mountain properties continues with good results.

Ontario

AWIONIA (Gauthier Township)—This mine is under option to L. H. and W. A. Timmins.

RIGHT OF WAY (Cobalt)—Vein found on 75-ft. level has widened to 2 in. assaying about 1500 oz. per ton.

PORCUPINE GOLD REEF—Mine has been unwatered. Compressor and other machinery will be installed.

CROWN CHARTERED (Porcupine)—Company is in liquidation, tenders for assets are called for up to June 8.

PRINCESS (Cobalt)—Mine has been leased by La Rose Consolidated to Sidney Smith of Haileybury on royalty basis.

CART LAKE (Cobalt)—This company has been put in liquidation on application of Peterson Lake Co., creditor for $1640.

FOLEY-O'BRIEN (South Porcupine)—Negotiating for purchase of plant of Swastika Mining Co. for installation on its property.

PORCUPINE IMPERIAL—A five-drill compressor and other machinery have been installed and driving will be undertaken at 100-ft. level.

NIPISSING—During April mined ore of net value of $170,577, and shipped bullion from Nipissing and customs ore of net value $380,921.

PORCUPINE CROWN—Mill has demonstrated practicability of treating Porcupine ore by continuous decantation process. Extraction of 98.6% obtained.

SILVER LEAF (Cobalt)—A 4-in. vein of high-grade ore has been opened up in winze below 75-ft. level. Together with several feet of good milling rock.

NORTH THOMPSON (Porcupine)—Sinking of three-compartment shaft, about 15 ft. from present working shaft has been commenced. Will be put down to 300 level.

DOME LAKE (Porcupine)—Operations resumed on more economical basis. Overhead expenses have been reduced, and mining confined to day shift, which provides sufficient ore to keep mill in operation day and night.

HOLLINGER—Experiments with steel pebbles in the tube mills indicate likelihood of an increase in tonnage milled. Stated that 20 tons per stamp may be treated daily. New central shaft has been connected with present working shaft at 425 level. Of 100 stamps in operation 70 are treating Hollinger ore and 30 are handling Acme output.

COBALT REDUCTION CO.—The new cyanide mill installed on the Townsite property for the treatment of slimes is in operation. It has a capacity of about [illegible] tons, most of which come from the Dominion Reduction plant which handles the City of Cobalt & Cobalt-Townsite ores, and the remainder from the Cobalt-Lake mill.

CANADIAN COPPER CO. (Sudbury)—Reverberatory-furnace department put in operation for first time since last August, will smelt 15,000 tons of ore per month. Ball mill and wedge-furnace plant will also be started to pulverize and roast ore. Construction of new 25-ft. blast furnace has been begun. Output of Creighton mine being increased. Work commenced on sinking of new inclined five-compartment shaft. Complete new hoisting and rock-crushing equipment will be installed.

Quebec

CANADA CEMENT CO. (Hull)—Canadian government has given company contract for 2,500,000 barrels of cement for use on Welland Canal extension.

CHILE

RECENT REPORTS FROM THE NITRATE DISTRICT indicate a slight improvement in the general situation, though high cost of transportation of nitrates by reason of scarcity of vessels and general advance in freights has added to difficulties of disposal of stocks of nitrate on hand. Shipments to United States show a slight improvement, having been somewhat in excess of the corresponding period of last year, and those to the United Kingdom are approximately [illegible] normal, though the impossibility of reaching Germany, the largest importer of nitrates, coupled with the reduced demand from other parts of continental Europe, has reduced the total demand by more than one-half. Stocks on hand are estimated sufficient to meet the demands of the remainder of the current year, unless some unexpected outlet presents itself. The number of "oficinas," or nitrate reduction works, in operation is reported to be but 13 against 113 at the beginning of the war.

The Market Report

METAL MARKETS

NEW YORK—May 19

Copper, tin and lead were all dull and weaker in tone. Spelter advanced to a new high figure upon large sales, chiefly for military purposes.

Copper—Copper was very dull and quotations are based rather on prices asked than on sales right through the week. Small sales were made at 18¾c., regular terms, in the early part of the week. In the latter part, copper was freely offered at the same price without finding buyers, and with indications that concessions would be made if necessary to consummate sales. Chile bars have been purchased at prices offering apparently a large profit on the sale of refined copper against them, but until it can be seen how the latter can be sold, the result of these transactions is problematical. The largest producers are nominally maintaining their asking price of 19c., regular terms, and sales at that figure have been reported, some of them rather substantial, but such sales appear to be to noncompetitive points or points whither delivery charges, etc., bring them down to the equivalent of 18¾c., regular terms (about 18.55c., cash, New York), or less. The lull in the market, natural enough under the circumstances, is rather tending to weaken the feeling of confidence and there are more of the producers competing for business than there were a week ago. However, the copper producers have no reason to be concerned over the immediate outlook or be otherwise than satisfied with the prices they are now enjoying. The large foreign order for copper to which we referred last week is still hanging fire.

Exports from the port of Baltimore during the week ended May 15 included 561 tons of copper bars.

Copper Sheets base price is now 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 20c. per lb. carload lots at mill.

Tin—Business in this metal has been rather light and the increase in supply is causing the price to soften a little.

Lead—Several large producers, including the leading interest, are now freely selling lead at 4.20c., New York. The consumer who must buy just in his own way, say, for a particular delivery or otherwise, may have to pay a small premium, but with respect to the general market, the tone is softer than it was last week. The advance in lead was apparently checked by fear of giving too great a stimulus to production.

Imports of lead into the United States in March were 5,609,079 lb. in 1914, and 9,432,278 lb. in 1915, nearly all, in both years, being lead contents of ore and base bullion. Exports in March were, in lb.:

	1914	1915	Increase
Domestic	......	14,246,708	14,246,708
Foreign	492,207	4,601,628	4,109,421
Total	492,207	18,848,336	18,356,129

The extraordinary increase is, of course, due to the demand for war munitions.

Spelter—A moderate business was done during the early part of the week up to May 15, when a large contract that had been in negotiation for several days was consummated. On May 17 a quite extraordinary business was done, both as to tonnage and as to price, the transactions amounting to some thousands of tons at the highest prices yet recorded for spelter up to that time. These transactions involved large quantities of high-grade, intermediate and brass special spelter, as well as prime Western, and especially high prices were demanded and received for the last as a consideration for supplying the higher grades. Concerns that were unable to supply the latter were not able to compete for the business. Transactions were lighter on May 18, but some fairly large sales were made again on May 19.

The sales of spelter during our last week of record were for all sorts of deliveries, such as May to December, July-August, August-October, etc., and even November-December.

Brass special spelter was sold at 16¼c. and intermediate at 19c., these prices being realized on large tonnages.

Recent reports from Belgium are to the effect that the Angleur and Valentin-Cocq smelteries of the Vieille Montagne company are in operation, supplying the Germans with spelter and apparently finding no trouble respecting ore supply.

Zinc sheets base price is now $18.50 per 100 lb. f.o.b. La Salle, Ill., less 8% discount. Usual extras charged. The makers are not anxious to sell just at present.

Other Metals

NEW YORK—May 19

Aluminum again shows some increase in demand and more sales. Prices are a shade firmer, 19¾@20c. per lb. being done for No. 1 ingots, New York.—**Antimony** is still scarce and there seems to be no hope of lower prices. A small quantity of Cookson's can be had at 45c., outside brands being 35c. No

DAILY PRICES OF METALS IN NEW YORK

May	Sterling Exchange	Silver, Cts. per Oz	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb	New York, Cts per Lb	St. Louis, Cts. per Lb.	St. Louis, Cts per Lb.
13	4 7950	50	18.50 @18.60	39½	4.20	4.10 @4.15	12½ @13½
14	4 7944	50	18.50 @18.60	39	4.20	4.10 @4.15	12½ @13½
15	4 7919	50	18.50 @18.60	38½	4.20	4.10 @4.15	12½ @13½
17	4 7913	50	18.50 @18.60	39	4.20	4.10 @4.15	13 @14
18	4 7905	49⅞	18.50 @18.60	38½	4.20	4.10 @4.15	13½ @14½
19	4 7963	49¾	18.50 @18.60	38	4.20	4.10 @4.15	13½ @14½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

May	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb
		£ per Ton	Cts. per Lb								
13	23⅝	78⅞	16.92	79⅞		163	163	19¾ @20⅜	4.31	61½	13.25
14	23⅝	78	16.73	79		162½	162½	20¼	4.35	61½	13.25
15	23 11/16										
17	23⅝	77¼	16.68	78¼		163¾	163¾	20⅛	4.38	62½	13.47
18	23 9/16	77½	16.63	78½		162½	162½	20⅜	4.38	66½	14.26
19	23½	75¼	16.14	76¼		160½	160½	20⅝ @20½	4.36	67½	14.48

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

future orders are being booked.—**Quicksilver** is quoted from $74 for large lots up to $75@80 per flask in New York, and from $65@75 in San Francisco. Italian war rumors have strengthened the market. London price is still £11 and 15s. and £11 12s. 6d. from second hands.

Gold, Silver and Platinum

Gold—Imports of gold for the week included $5,000,000 from France. Some more gold from Japan is reported at San Francisco.

Silver—During the week there was little activity in the silver market. The demand for silver on Indian account, which was active recently, has fallen off and the price has consequently shown a declining tendency, closing at 23½d. in London.

Shipments of silver from London to the East, Jan. 1 to Apr. 29, as reported by Messrs. Pixley & Abell:

	1914	1915	Decrease
India	£2,686,000	£1,877,000	£809,000
China	40,000	.	40,000
Total	£2,726,000	£1,877,000	£849,000

A considerable stock of silver is still held in London on Chinese account, about £1,000,000 in value, it is estimated.

Platinum—The market remains about the same, with only small business reported. Dealers ask $38@39 per oz. for refined platinum, while hard metal is held at $42@45 per oz., according to quality.

Our Russian correspondent reports under date of Apr. 25 that there is no change. In Petrograd prices are nominal, no transactions being reported. At Ekaterinburg small sales are reported at 9 rubles per zolotnik—equal to $30.08 per oz.—for crude metal, 83% platinum. Preparations for the season's work are being made by the large companies in the Urals, especially those owning dredges. The small producers are doing nothing. There is a demand for moderate quantities from Sweden, but it is doubtful whether the Government permission to export the metal can be secured, owing to a suspicion that the metal may be diverted from Sweden to Germany.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 16

The competitive base price paid this week for 60% zinc ore was $65@66 per ton. The base price paid for 80% lead ore was the same as last week, $51 per ton.

SHIPMENTS, WEEK ENDED MAY 15

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,969,470	90,000	687,160
Year	69,635,100	2,345,990	8,151,950

Shipped during week to separating plants, 4,482,800 lb. zinc ore.

JOPLIN, MO.—May 15

Blende, high price, $78; assay base, 60% zinc, premium ore, $75; medium grades, $70@65; lower grades down to $55 per ton. Calamine, base 40% zinc, $45@42 per ton; average, all grades of zinc, $69.70 per ton.

Lead, high price, $52.50, base, $51@52 per ton of 80% metal content; average, all grades of lead, $50.93 per ton. Following the distribution of the Australian consignment of concentrates the demand slackened materially for the medium to low grades of this district with a consequent lowering of price offerings this week.

SHIPMENTS, WEEK ENDED MAY 15

	Blende	Calamine	Lead	Values
Totals this week	13,879,170	826,550	1,561,380	$551,060
Totals this year	213,336,210	19,140,660	31,443,100	7,645,370

Blende value, the week, $491,400; 20 weeks, $6,529,420.

Calamine value, the week, $18,910; 20 weeks, $348,810.

Lead value, the week, $40,750; 20 weeks, $767,140.

Iron Trade Review

NEW YORK—May 19

The iron and steel markets just now are depending largely on foreign orders, but domestic business is improving on several lines.

Structural steel is beginning to show up better, and more contracts are reported. Orders for railroad cars are coming in better. The report of large orders for cars from Russia is confirmed, but no definite details have been made known. Scattering domestic orders are filling up the car shops. The agricultural-implement makers have begun to place orders for bars on a fair scale. The mills generally are running at 70 to 75% of capacity, and gaining slowly.

The pig-iron market has been rather quieter, and not so much new business is reported. Some good orders for basic iron have been placed, and prices are firm.

PITTSBURGH—May 18

The steel situation has materially improved, with greater export demand and with the heavy purchases of the Pennsylvania Lines, purchases which are expected to be followed by important buying by other roads.

Exports of tonnage products of iron and steel in March totaled 174,000 gross tons, or 27,000 tons more than in October, the best month until March since the war started. The exports are now believed to be running at the rate of 200,000 tons a month, in addition to which there is probably about 50,000 tons of iron and steel involved in automobiles, machinery, shrapnel, etc., the weight of which is not returned in the export statistics.

In the past two or three days the Pennsylvania has closed for about 14,000 freight cars, in addition to about 2500 cars lately ordered from its own shops at Altoona, and has purchased a few passenger cars and locomotives. The remainder, together with 138,000 tons of rails, are likely to be bought within the next week. The total purchases will amount to about 16,500 freight cars, about 194 locomotives, about 181 steel passenger cars and 138,000 tons of rails, involving altogether about 550,000 tons of iron and steel. The rolled steel involved is computed to represent about 4% of the steel industry's capacity for five months, during which time the major portion of the deliveries will be made. Inquiries from other roads total 15,000 to 20,000 cars and heavy orders are expected, now that the Pennsylvania has set an example.

The steel mills are operating at between 70 and 75% of capacity and with the increased business now being booked are expected to reach 85 or 90% by the end of July. It is not believed that the labor supply will permit of heavier operations and it is a distinct prospect that the mills will begin falling behind in deliveries, a condition that would undoubtedly bring out increased buying by jobbers and many manufacturing consumers, to replenish stocks which were reduced to abnormally low proportions when the buyers were able to secure prompt shipments from the mills.

Pig Iron—Buying of foundry iron in relatively small lots has increased, and more interest is being manifested in bessemer and basic. The furnaces are feeling in much stronger position and it is not likely that much more iron can be bought without at least slight advances in prices. There are many idle merchant furnaces but they will not get into blast until offered materially better prices. We quote the market unchanged but much firmer: Bessemer, $13.60; basic, $12.50; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—Deliveries of ferromanganese are increasing slowly. They remain much below current consumptive requirements but the mills are less uneasy as they now expect their stocks to be replenished as needed. The contract price remains at $88, Baltimore, with little business being done. Small prompt lots command $90@95, but are in limited demand.

Steel—Deliveries of billets and sheet bars continue to increase, and mills are shipping not far from their full normal tonnages. Consumers are well covered by contracts and fresh transactions are limited. We quote billets at $18.50@19 and sheet bars at $19@19.50, maker's mill, Youngstown, and about 50c. higher, maker's mill, Pittsburgh. Rods are $25, Pittsburgh, with shipments good in domestic and export trade.

FERROALLOYS

Recent English quotations are as follows: Ferrotungsten, 75 to 85% tungsten and not over 1% carbon, $1.08 per lb. Ferromolybdenum, 70 to 80%, $4.32 per lb. Ferrochrome, 4 to 6% carbon, $131 per ton; 6 to 8% carbon, $126.50; 8 to 10% carbon, $121.50. Ferrosilicon, 45%, $68.50; 25%, $49 per ton.

Chemicals

NEW YORK—May 19

The general market remains rather quiet and steady, with business on a moderate scale in most lines.

Arsenic—Business is slightly more active. There are sufficient supplies to meet all current demands. Prices remain about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business remains ste[illegible] are fair. Prices are firm. Quotations are $7 pe[illegible]rload lots, and $7.25 per 100 lb. for smaller pa[illegible]

Nitrate of Soda—Business is again [illegible] improving, with prices firm and unchanged. Quot[illegible] per 100 lb. for spot and all positions this year.

Assessments

Company	Delinq.	Sale	Amt
Advance, Mont	May 1	June 1	$0.005
Andes Silver, Nev....	May 4	May 25	0.03
Argenta, Ida................	May 10	June 10	0.001
Belcher, Nev......	May 15	June 8	0.15
Best & Belcher, Nev..	May 12	June 1	0.05
Caledonia, Nev	May 11	June 1	0.05
Cash Boy, Nev.....	May 17	June 17	0.01
Cedar Creek, Ida.	May 5	June 5	0.005
Con. Virginia, Nev	May 4	May 25	0.10
Contact Copper, Mich	May 15		0.50
Crown Point, Nev	May 17	June 8	0.15
Diam'field Black Butte, Nev	Apr. 30	June 3	0.01
Emerald, Utah (three instal.)	.....	June 9	0.01
Exchequer, Nev.......	May 11	June 1	0.03
Gold Mt., Utah....	May 10	May 27	0.0025
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan.		1.00
Houghton, Mich.	May 25		1.00
Idaho-Nevada, Ida	May 10	June 5	0.002
Idora, Ida	June 3	July 2	0.005
Jack Waite, Ida. (post)		May 22	0.01
Laclede, Ida. ..	May 24	June 14	0.003
Majestic-Idol, Nev	Dec. 15	Jul 20	0.005
Mullan, Ida.	Apr 24	May 24	0.002
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich	Dec. 1		0.50
New Hope, Ida	May 5	June 2	0.002
O. K. Silver, Utah....	May 3	June 5	0.0025
Ophir, Nev	June 4	June 25	0.05
Overman, Nev..	May 19	June 8	0.05
Raven, Ida......	May 15	June 14	0.0006
Royal, Ida................	June 1	July 6	0.0015
Samson, Ida (post)		June 3	0.002
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Cliff, Ida. (post)		May 29	0.0025
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida	May 15	June 15	0.002
Silver Pick, Nev....	June 5	July 12	0.01
Tarbox, Ida...	Apr. 26	May 28	0.0025
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Virginia, Ida	May 10	May 29	0.02
Wisconsin, Ida....	May 15	June 15	0.003
Yellow Jacket, Nev	May 14	June 8	0.15

Stock Quotations

The course of the week was a great break in prices over the President's "Lusitania" note, followed by a partial recovery of prices, and another fall, anticipating an unfavorable reply by Germany.

COLO. SPRINGS May 18 Name of Comp.	Bid.
Acacia	04¼
Cripple Cr'k Con...	01⅜
C. K. & N.........	03
Doctor Jack Pot	10½
Elkton Con	.41
El Paso	1.01
Findlay	04
Gold Dollar	.04
Gold Sovereign	05¼
Golden Cycle ..	1.75
Isabella	.18½
Jack Pot	.07½
Jennie Sample.	.02
Jerry Johnson	04½
Lexington	‡ 008
Mary McKinney...	.34
Pharmacist	.01½
Portland	1.25
Raven B. H	.03
Vindicator	1.76

SALT LAKE May 18 Name of Comp.	Bid
Beck Tunnel	04
Black Jack	09
Colorado Mining	10
Crown Point	01
Daly-Judge	5.25
Gold Chain	10
Grand Central..	50
Iron Blossom	69
Little Bell	14
Lower Mammoth	04
Mason Valley	‡3.00
May Day......	12½
Opohongo	01¼
Prince Con...	40
Seven Troughs	01½
Silver King Coal'n	3.07½
Silver King Con	1.80
Sioux Con	02¼
Uncle Sam	04¼
Yankee	02

TORONTO May 18			
Bailey	02	Dome Exten	08
Coniagas	04½	Foley O'Brien.	33
Peterson Lake	24	Hollinger	26.00
Right of Way	03	Imperial	06
Seneca Superior	1.25	Jupiter	10
Silver Queen	01	McIntyre	44
T. & Hudson Ba	‡18.00	Pearl Lake....	01
Timiskaming	35	Porcu. Crown.	80
Wettlaufer-Lor	04	Preston E. D.	01
Big Dome	12.50	Rea	10

SAN FRANCISCO May 18			
Comstock Stocks		Misc. Nev. & Cal	
Alta	‡ 01	Belmont	1.25
Andes	05	Jim Butler	80
Belcher	13	Lone Star	07
Best & Belcher	.06	MacNamara	.03
Caledonia	22	Midway	16
Challenge Con	‡ 06	Mont.-Tonopah	35
Confidence	08	North Star	17
Con. Virginia	11	Rescue Eula	11
Gould & Curry	02	West End Con	.70
Hale & Norcross	03	Atlanta	52
Julia	‡ 01	Booth	40
Mexican	32	C.O.D. Con.	04
Occidental	.79	Comb. Frac.	.09
Ophir	06	Jumbo Extension	1.20
Overman	06	Pitts.-Silver Peak	11
Potosi	‡ 01	Round Mountain	41
Savage	02	Sandstorm Kendall	07
Sierra Nevada	09	Silver Pick	.07
Union Con....	.15	Central Eureka	16
Yellow Jacket	18	So. Eureka	12.25

N. Y. EXCH. May 18 Name of Comp.	Clg.
Amalgamated	65¾
Am. Sm. & Ref., com	64¼
Am. Sm. & Ref., pf	102¾
Am. Sm. Sec., pf. B	‡80
Anaconda	31⅜
Batopilas Min	1
Bethlehem Steel...	131¼
Bethlehem Steel, pf.	111
Chino.	42¼
Colo. Fuel & Iron..	26
Federal M. & S., pf.	26
Great Nor., ore., ctf.	31⅜
Guggen. Exp.	56½
Homestake.	116½
Inspiration Con...	28½
Mex. Petroleum	67
Miami Copper	23½
Nat'l Lead, com	56½
National Lead, pf..	108½
Nev. Consol ..	14
Ontario Min ...	3⅜
Quicksilver, pf. .	1
Ray Con...	22½
Republic I&S, com.	26½
Republic I&S, pf..	‡83½
SlossSheffi'd, com..	30
Tennessee Copper. .	32¼
Utah Copper......	63¼
U. S. Steel, com...	52
U. S. Steel, pf. ..	105¼

N. Y. CURB May 18 Name of Comp.	Clg.
Alaska Juneau, w.i..	13⅞
Alta Con	1
Beaver Con	34
Big Four	07
Blue Bell	03
Braden Copper.	7
Buffalo Mines	.50
Can. Cop. Corpn..	15/16
Can. G. & S	03
Caribou	‡.50
Cashboy ..	.08
Chambers Ferland	.16
Con. Ariz. Sm	13/16
Con. Coppermines.	1⅝
Davis-Daly..	1
Diam'field-Daisy	.05
Dia. Black B.	.04
Florence.........	.49
Goldfield Con	1 7/16
Goldfield Merger.	24
Greene Cananea.	.28½
Kerr Lake......	4¼
La Rose	1 9/16
McKinley-Dar-Sa	28
Mines of Am	2⅜
Nevada Hills	23
New Utah Bingham	1⅜
Nipissing Mines	5⅝
Ohio Copper.	25
Oro.........	09
Pacific Smelt	‡ 09⅜
South Utah	‡⅜
Stand'd Oil of N.J	400
Standard S. L.	1½
Stewart	1¼
Tonopah	6 15/16
Tonopah Ex	3
Tonopah Merger	.39
Tularosa	3/16
West End Ex.	.05
Yukon Gold	2½

LONDON May 7	£	s	d
Alaska Tre'dwell	£7	7s	6d
Cam & Motor..	0	14	9
Camp Bird	0	6	3
El Oro.	0	8	0
Esperanza.	0	8	3
Mexico Mines.	3	17	6
Oroville	0	12	3
Santa Gert'dis	0	7	6
Tomboy	1	4	6
Tough Oakes...	0	14	6

BOSTON EXCH May 18 Name of Comp.	Clg.
Adventure	2¼
Ahmeek	280
Alaska Gold M	32
Algomah	3
Allouez	52
Am. Zinc.	39¼
Ariz. Com., ctfs..	7
Bonanza	35
Butte-Ballaklava	3
Butte & Superior	62¼
Calumet & Ariz	63
Calumet & Hecla	560
Centennial	18
Cliff	1½
Copper Range	50¼
Daly West	3
East Butte	11½
Franklin	9¼
Granby..	79
Hancock	19
Hedley ..	28
Helvetia	70
Indiana	8
Island Cr'k, com	42
Island Cr'k, pfd	87
Isle Royale	25½
Keweenaw	2¼
Lake.	12
La Salle	6½
Mass.	13
Mayflower	5
Michigan	1½
Mohawk	68
New Arcadian	9½
North Butte	30⅝
North Lake	2½
Ojibway.	2¼
Old Colony	5
Old Dominion	50
Osceola	75
Quincy	83½
Santa Fe........	2¼
Shannon	8⅞
Shattuck-Ariz..	26
Superior	29
Superior & Bost.	3½
Tamarack.. ...	33¼
Trinity...	5¼
Tuolumne	40
U. S. Smelting	34
U. S. Smelt'g, pf.	44
Utah Apex	2⅞
Utah Con...	11¼
Victoria.	2¾
Winona	3½
Wolverine	56
Wyandot	1⅛

BOSTON CURB May 18 Name of Comp.	Bid
Alvarado	65
Bingham Mines.	5½
Boston Ely...	25
Butte & Lon'n Dev	23
Calaveras	1⅝
Calumet-Corbin	11
Chief Con......	80
Corbin..........	.90
Cortez.........	25
Crown Reserve...	75
Eagle & Blue Bell	1
First Nat. Cop	2 3/16
Houghton Copper	3
Iron Cap Cop. pf	5
Majestic..	40
Mexican Metals	17
Nevada-Douglas	70
New Baltic	3
Oneco.....	1⅝
Raven Copper	07
Smokey Dev	35
So. Lake	6½
Tonopah Victor.	.22
Trethewey	14
United Verde Ext	3 15/16

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175		27.825	26.701	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	......

New York quotations cents per ounce troy, fine silver, London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February..	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	14.787	64.276	66.152	69.170	*
April.	14.211	16.811	64.747	75.069	69.313	*
May	13.996	..	63.182		67.786	
June	13.603	..	61.336		66.274	
July.	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October..	*		‡		‡	
November.	11.739		53.227		*	
December .	12.801		56.841		*	
Year					.	

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March.	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	...	150.702	
June	30.577		138.321	
July.	31.707		142.517	
August.	*		‡	
September	32.675		‡	
October...	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	.
Av. year	34.301		...	

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January...	4.111	3.729	4.011	3.548	19.665	18.606
February..	4.048	3.827	3.937	3.718	19.606	19.122
March.....	3.970	4.053	3.850	3.997	19.651	21.883
April.	3.810	4.221	3.688	4.142	18.225	21.094
May......	3.900	.	3.808	.	18.503	.
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August....	3.875		3.715		‡	
September	3.828		3.658		‡	
October ...	3.528		3.384		‡	
November.	3.683		3.585		18.500	
December .	3.800		3.662		19.097	
Year	3.862		3.737		..	

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February..	5.377	8.436	5.228	8.255	21.413	39.819
March.....	5.250	8.541	5.100	8.366	21.460	44.141
April......	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074		4.924		21.393	.
June	5.000		4.850		21.345	
July. ..	4.920		4.770		21.568	
August....	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November.	5.112		4.962		25.016	
December .	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January...	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	13.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90		13.90		14.27	
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.81		13.75		13.97	
November	14.59		13.43		13.83	
December .	14.70		13.45		13.83	
Year..	$14.88		$13.78		$14.01	

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The Mother Lode Blast

By F. S. Norcross, Jr.*

SYNOPSIS—Mining large blocks of ground, 150 to 250 ft. deep, 200 ft. long, from foot to hanging at one blast. Drilling, loading and shooting the largest blast on record for underground mining; 100,000 sticks of dynamite required; 400,000 tons of rock broken. No galvanometer used to test circuit. Ground blasted was drilled to within 30 ft. of corner of shaft; buildings and plant all within radius of from 25 to 200 yd. of blast. No accidents and no damage; operation a complete success.

On Labor Day, 1913, an electric blast was set off at the British Columbia Copper Co.'s Mother Lode mine, Greenwood, B. C., which to the best of my knowledge was a world's record for a strictly underground blast, not only in the amount of powder used but also in the amount of ground broken, number of holes exploded, and wire used, which were as follows: Number of holes, 4830; number of detonators, 5040; depth of holes, 15 ft.; dynamite, 40%, 49,550 lb.; wire, 18.5 miles; estimated amount broken, 400,000 tons.

THE GREAT BLAST AT THE MOTHER LODE MINE, BRITISH COLUMBIA

At the instant of blast, showing first smoke-shoots from tunnels, shaft-collar, glory-hole, etc., and 30 sec. after blast

MINING SYSTEM

This system of mining is rather unusual, but existing conditions left no alternative. The Mother Lode deposit is a pear-shaped lens, 1100 ft. long, 260 ft. wide, and 500 ft. deep, with the long axis horizontal. Owing to the different methods of mining employed at different periods, the mine became a honeycomb in structure, making further stoping impossible. Moreover, as the best ore had been removed, further progress depended on a method which was safe and which guaranteed low cost—obviously a caving system of some sort. As the ground is hard and tough, the caving system to be used must also provide for a well-broken product, as only the upper portion of each blasted section would be accessible for block-holing. To meet these conditions the system of blasting large blocks or slices of ground was resorted to.

These so-called blocks were usually 200-ft. sections along the strike of the orebody, extended from foot wall to hanging, and were from 150 to 250 ft. in depth. Each block was thoroughly drilled, and those portions not thoroughly honeycombed by stoping were cut up by a series of parallel raises 30 ft. apart. In many cases three or four raises were placed one above the other on the same vertical plane. All the raises on any one plane were connected by back-raises, making an inverted V.

In the old stoped-out portions all the accessible wall and pillars were drilled, but wherever the raise system of opening up had been used, only alternate raises were drilled, a complete circle of holes being placed every 4 ft throughout its length. When near the wall rock, the back of every top raise was drilled in order to insure a clean break, and the same method was followed in the footwall raises. Sullivan and Rand $3\frac{1}{4}$-in. piston drills were used, the holes being 15 ft. deep, except in thin walls. In a few cases 18-ft. holes were drilled.

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*Superintendent of Mines, British Columbia Copper Co., Greenwood, B. C.

In the early application of this method, under Superintendent E. Hibbert, the blocks blasted were comparatively small and contained only 100 to 600 holes, and one of 2000 holes; but as the country surrounding the shaft was approached they became larger and more complicated. In this particular blast a feature which caused great anxiety was the proximity of the main hoist to the blast. The hoist sets out over the workings, as the good ore under it had been partly stoped out in the earlier days, leaving short pillars to support it. To avoid a "drag" on this ground due to any caving subsequent to the blast, "cut-off" raises were run up and apexed 30 ft. from the corner of the hoist and drilled up on the side away from it. This brought the blast closer, but insured a clean break and left a straight supporting wall free of weight.

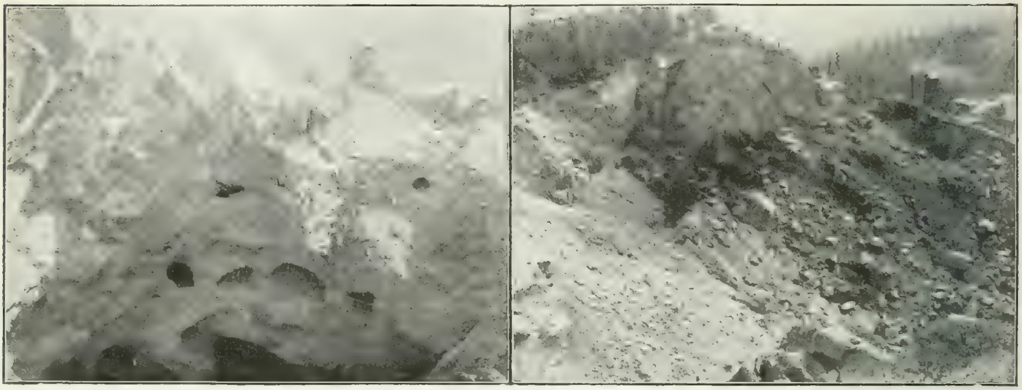
This blast was the largest ever employed here, for several reasons: (a) The included stopes were larger; (b) the hanging wall was sure to fall at the next explosion; therefore, to have cut the blast in two would have meant the loss of whatever ore remained standing; (c) last, but not least, the ground in question was composed of two dissimilar ores, one portion was a self-fluxing lime-silicate; the other a heavy magnetite, containing from 25 to 40% iron. As the company's smeltery operated on a basis of self-fluxing ores, a mixture of these two grades of ore was economically essential.

To provide for the handling of the broken rock, passages or muck-runs were necessary. A series of these muck-runs or raises (approximately 10 ft. square) was laid out from the 200 level down to the 300 and 400 levels. As this blasted country lay over the 200 level, this arrangement permitted simultaneous tramming on three different levels. Side connections or "bulldozing chutes and manways" tapped the upper side of these muck-runs to allow trammer gangs to blockhole and bulldoze large rocks before they reached the chutes.

Preparation Prior to Loading

Six days were allowed for loading and wiring. Owing to the smeltery needs, only one day's shutdown was permissible, so Labor Day was selected for the day of blast.

Before any powder entered the mine and a few days before the drilling was completed, the following details were covered: (1) Detailed plans and notes of the wiring system were drawn up and the electrician made thoroughly familiar with every detail, both of the wiring plans and of the mine workings. (2) Sprags were placed and all the main lead wires strung. The smaller sub-branches were also measured and connected at the same time, and then coiled up on the various poles until holes were ready to connect. (3) Any openings connecting portions of the mine on different leads (six in all) were fenced up, leaving only two passageways to each. (4) Temporary tracks and board chutes were placed for handling powder to the main distributing points. As approximately 100,000 sticks of dynamite were to be handled, any delay would have been serious. (5) Two sprags were connected by one cross-piece, sets being not more than 14 ft. apart, placed at all loading points. The loaders could then slide a single plank from bar to bar in level places to load back holes, and in sharp inclines one end of a plank was placed on the ground. (6) Safety fences and hand ropes were placed above and adjacent to all big stopes, breakthroughs, muck-runs, etc.



Before the Blast and After

Explosives

The powder used was 40% dynamite, furnished by the Giant Powder Co. It was not thought necessary to use the non-freezing explosives, as the mine was free of ice and water at this time of the year. A previous blast set off in April of the same year contained 1800 holes, 70% of which were full of ice, and had to be thawed out with steampipes before loading, after which they again froze solid. As this blast was a complete success, no trouble from wet or frozen holes was anticipated. The use of 60% dynamite would have insured a better broken product and, through sympathetic detonation, might have remedied any small circuit break, but was not used, however, as missed holes would have been a constant source of danger to crushermen, also to miners blockholing or plugging the larger rocks in subsequent operations.

A hammer drill actually penetrated a missed hole left from a previous blast containing 40% dynamite without exploding it.

The wire used ranged in size from No. 1 to No. 22, and was waterproof. The detonators used were Nobel's No. 7 low-tension caps carrying 95% fulminate of mercury and 5% chlorate of potash.

LOADING

Foreman, shiftbosses and electrician were provided with lists of places, the order in which they were to be loaded and when the various bulkheads (to break air blasts in shaft country) were to be placed. Work was begun on Tuesday night.

Three men made primers inserting the detonator, scraping the fuse-wire ends and coiling wires around sticks of powder ready for delivery. These primers all had the detonator stuck straight into the end, no bend or double puncture being used (see Fig. 1).

Six men packed powder in boxes with top loose, and 26 to 30 men per shift loaded holes. Loaders worked day and night shifts for 1½ days, finishing Saturday at midnight.

Loading was begun in the topmost portion of drilled ground nearest the shaft, and worked downward and away from the shaft to the point of exit on the 200 level. This avoided any chance of falling powder, rock-slides, etc., on those below, and possible broken connections in wire circuits.

Loaders worked in pairs; each hole was well packed, but no tamping was used. The primer was the last stick put in the hole, and the fuse wires were hung in loose coils ready for the wiremen. In bench and floor holes the wires were uncoiled from around the primer and coiled in the top of the hole or on a small stick in easy reach of the electricians.

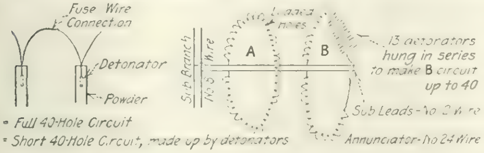


FIG. 1. METHOD OF INSERTING AND CONNECTING DETONATORS

Headache tablets and fresh washing water were constantly kept on hand, as the men suffered severely from powder-headache. Only one man, working without gloves, was able to go through without losing time.

WIRING

The wiring gang was composed of a head electrician and six helpers. Loaders were given one day's start before wiremen began work. The wiremen worked in pairs and on day shifts only. The sub-branches previously prepared were strung out and nailed to end sprags, and the holes connected in series of 40 across these branches. No. 22 annunciator wire was used in case of distant holes. All main leads and subs had their ends nailed to sprags, and the overhang was cut short to avoid possibility of someone connecting them, thereby causing a short and possible cutouts in the individual series.

No insulation tape was used on the fuse-wire connections between detonators; time required made it prohibitive. Instead, care was taken to bend such connections away from the ground. All the main-lead and sub-branch connections, however, were carefully insulated.

When less than 40 holes were available, a sufficient number of detonators were connected in the series (see Fig. 1), in order to keep the resistance of each series equal. As each place was completed, a gate was placed across the entry and hung with a sign marked *Keep Out*, to avoid any reëntry by workers.

No galvanometer tests were made of the circuits because of both disinclination and lack of time. For this reason particular care was exercised in keeping away from all completed sections and in double-checking each circuit by the two men working on it. Of course, a defective detonator or fuse would not be discovered. A proportion of the detonators were tested before using. If this had been an initial blast, and more or less of an experiment, it would have been wise to have had all detonators tested or sent from the factory under a special guarantee; but in previous blasts they had given such satisfaction that no trouble was anticipated.

Many engineers have questioned the policy of not using galvanometer tests, as practiced elsewhere. In the first place, there is no comparison to be made with other practice, which almost invariably consists of one set of lead wires with a single series across them, thus making it possible to test the connections through the leads near the switch. With us such tests meant the trial of 126 circuits to be made within 10 ft. of the holes, the possibility of a short through only one detonator instead of 40, and the necessity of walking through or over the small circuits after testing, thus bending connections to ground or breaking them.

Wiring was completed Sunday afternoon. All entries to the mine were blocked, skips and cage removed from shaft, top three lengths of ladders removed, and watchmen placed. Connections (see Fig. 2) now stood as follows: Open switch main line to transformers; open switch transformer side to main No. 1 lead down shaft; broken screw connection main lead to branch on 60 level, from which B, C, D, E branches run; broken screw connection main lead to branch F on 200 level.

To explode it was necessary to make three screw connections and close two switches, progressing from 200 level up through the shaft by transformers to the main-line switch.

The only real danger of the six days occurred during a short electric storm the same night (Sunday), several wires, including the main lead wires, being exposed in places.

EXPLOSION

Notices posted at 6 o'clock Sunday night gave to all residents in the camp full details of the procedure to be followed, such as removing windows, putting out fires, wedging all doors open, etc., warning whistle and final blasting signal. All were ordered to leave the hill by 8 a.m. Monday. The three roads leading to the camp were blocked. Only three men remained at the mine during the explosion. As the mine buildings and houses were all within a 25- to 200-yd. radius, these precautions were necessary.

The blast was set off at 9 a.m. Monday, as previously planned, and was a complete success. No missed holes have been found. A few holes in the foot wall, which had been overlooked and never connected, were found unexploded, which fact, by the way, verifies our theory that the 40% dynamite is not subject to sympathetic detonation.

ELECTRICAL DISCUSSION

Two things were to be determined—plan of wiring and number of holes in a series.

The plan of wiring was one of "parallel series," 40 holes being connected in series across the branch leads, and these 40-hole series being in parallel with each other. This method gives low resistance. Two important factors were influenced by the number of holes connected in series: (a) The fewer the number of holes per series, the more series circuits in parallel; therefore, less resistance and more current necessary. (b) Failure of one detonator to explode due to a defective detonator or a single poor connection may prevent explosion of this particular series; for this reason it was not expedient to place too many holes in series.

Past experience has verified the fact that 40% dynamite is not usually subject to sympathetic detonation, so this could not be depended upon to counteract the irregularities mentioned.

A previous blast of 2400 holes successfully exploded was wired in 25-hole series. Using this as a basis, 40-hole series were chosen for the larger blast.

Owing to the irregularity of the ground and the position of the holes, it was impossible to lay out a system where the various branches would bear equal loads and also permit safe and rapid connection. However, branches were made as nearly equal as possible.

CURRENT AND VOLTAGE

On an instantaneous blast of this character a very sensitive recording instrument to register current, etc., would be necessary. Not having such an instrument available makes it necessary to use partial experimental data to determine probable current and voltage required.

The detonators used were Nobel's No. 7 low-tension exploders. By test these give a resistance, including 8-ft. wire fuse leads, of 1.25 to 1.50 ohms each. This resistance is more or less variable and depends on the length, etc., of the bridge connecting the two lead wires in the detonator, as this bridge must be raised to sufficient temperature to convey heat to the flashing composition. While many caps have bridges which take the same time, others are measurably slower or quicker. In order, therefore, to overcome these variations sufficient current has to pass through a series to bring the most refractory bridge to the required temperature before the most sensitive bridge has fused; hence, there will be a proportionate increase in the current required as detonators are added to the series.

For this reason, while it takes from 0.5 to 0.7 amp. only per detonator, it requires, by experiment, 1.1 amp. for 2 in series; 1.2 amp. for 10 in series; 1.5 amp. for 20 in series, and 2.75 amp. for 40 in series.

As it is proposed to fire 5040 detonators in series of 40, there will be 126 parallel circuits each requiring 2.75 amp. In order, therefore, to fire the whole simultaneously, 346.5 amp. would be necessary.

The resistance of each series being 60 ohms (by test), it would then require 165 volts to pass the current of 2.75 amp. through each series. We add 10 volts to cover line drop, etc. It is therefore evident that in this blast there will be ample current available, as its quantity is measured by $\frac{E}{R} = \frac{550}{0.52}$, or practically 1100 amp.

In the discussion following, however, it is assumed that only the current and voltage quantities (as per experimental data given in the foregoing) are available, and it is then shown that if limited to these amounts there might have been trouble unless conditions were ideal. As the resistance is the factor which will change the quantities of current and voltage, any increase in its value would, on the above-cited assumption, exceed the available power; therefore the effort to keep the series resistances equal. Hence excess power becomes the safety factor in the problem. It might be added here that the latter statement is contrary to the advice of the big powder companies.

RESISTANCE

Inasmuch as the system consisted of 126 circuits in parallel, it is evident that the total resistance of the blast will be very small, even though the amount of wire used was quite large. Computing this resistance gave a result of 0.52 ohm.

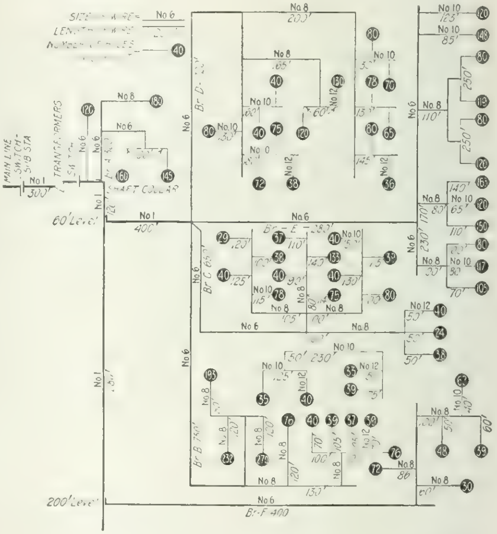


FIG. 2. SINGLE-LINE WIRING DIAGRAM OF MOTHER LODE BLAST

Should the resistance of any series be less than 60 ohms, and only 165 volts available, the amperage such series would get individually would be proportionately greater, the whole available amperage being divided among 126 series in direct proportion to their individual resistance. Thus it is evident that if only 346.5 amp. are available, and a number of the series are of unequal resistance, the result would be cut-outs in some of the series.

For example: To fire five series of 40 detonators in parallel, each testing 60 ohms, would require 165 volts and 13.75 amp. If instead of 5 equal series we had three of 40 and two of 30, and the volts are still 165 (required for the 40-hole series), the current for the two 30-hole series (according to Ohm's law) would be 7.3 amp.;

therefore the three 40-hole series would take 8.25 amp., a total of 15.55 amp. As there are only 13.75 amp. available, each series would get proportionately less—the 40-series something less than 2.75 and the 30-series less than 3.66 each. Thus cut-outs would possibly occur in the 40-hole series.

To provide for such possible inequalities in the 126 series a surplus of power was necessary, and for this reason the current was taken from a main power line through three delta-connected 2200-volt-550-volt 50-kw. transformers.

Theory vs. Practice

According to test on single detonators the current necessary was 0.5 amp.; resistance, 1.50 ohms; voltage (current × resistance), 0.75 volt.

Therefore to explode 40 in series we would have, by Ohm's law, a resistance of 50 to 60 ohms to overcome, with a current of 0.5 amp. necessary per series. By actual tests, however, the current per series is found to range from 2 to 2.75 amp. and the resistance to be 60 ohms. Using these experimental values, voltage was determined for the 126 series to be 165 volts, and the current necessary, 346.5 amp. These figures neglect wire resistance and line loss.

The resistance of the blast, with wire included, is 0.52 ohm, computed on the basis of 60 ohms per series. Using this resistance factor and the experimental current value there was as a check the following voltage, which should cover everything, as the resistance used is assumed to be the blast total:

$$E = IR = 346.5 \times 0.52 = 180.2 \text{ volts}$$

To sum up, there were the following data:

Theoretically—For one series: Current necessary, 0.5 amp.; voltage necessary, 30.0 volts; resistance, 60.0 ohms. For 126 series: Current necessary, 63.0 amp.; voltage necessary, 30.0 volts; resistance, 0.476 ohm.

Experimentally—For one series: Current necessary, 2.75 amp.; voltage necessary, 165 volts; resistance, 60.0 ohms. For 126 series: Current necessary, 346.5 amp.; voltage necessary, 165 volts; resistance, 0.476 ohm. For entire blast: Current necessary, 346.5 amp.; voltage, 180.2 volts; resistance, including wire, etc., 0.52 ohm.

Remarks

The experimental data for the entire blast as given above were accepted as final. With the excessive transformer capacity, extra-size wires and current from the main power line of high voltage we had a safety factor to offset unequal resistance, line loss, ground leakage and other possible discrepancies. The blast might have been fired from a line of much less power, but with so much at stake there was nothing to gain and a great deal to lose. Too little power, which must trust to overload capacities, or just enough, which must depend on ideal conditions, might both be successful, but dangerous. An excess of power is imperative and is not a drawback provided the wires will carry.

The mine electrician, A. Davison, deserves great credit for the thorough manner in which the wiring was carried out; also the shift-bosses and miners, who by their interest and loyalty completed a painful and dangerous task and made the blast a success.

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Tantalum Apparatus Is Entirely Out of the Market, it is understood, owing to the cutting off of shipments from Germany. This disposes of one suggested substitute for platinum.

Mr. Hoover, the [illegible] Specialist

Under the above caption our gay [illegible] contemporary *Life* published an article about H. C. Hoover, showing that the non-professional press is beginning to appreciate Mr. Hoover's merits and achievements. The article was as follows, except for a few [illegible] statements of fact that we have taken the liberty to correct and the excellent picture of Mr. Hoover that we have added:

The London "Nation" declares that "Mr. Hoover's American commission for the feeding of the starving Belgians" has done a "miracle of diplomacy" in obtaining and distributing its supplies. Brand Whitlock and a good many others have shared in that miracle and will come in if there should be some time an adjustment of credit.

There seem to have been extraordinarily good American men on this job of feeding the Belgians. That the Rockefeller Foundation's men should be intelligent and efficient was to be expected, but that a man with such a spirit inside of him and such a human experience as Mr. Whitlock should have been appointed Minister to Belgium was a wonderful piece of luck, or perhaps a political Providence.

Herbert Clark Hoover

And as for Mr. Hoover, how did he happen? When the war suddenly exploded one began to read of the activities in London of an American named Hoover, a business man full of business, and considerably full of money, who got right in and took hold of the work of salvaging distressed tourists, finding money for them, and getting them home. It has not been possible since that time to intrude far into salvage activities without running into this Mr. Hoover. His performance has been like that of a man in a play who transpires, say, from L. U. E. at the critical moment and straightens out the situation that was as good as lost. Mr. Hoover, however, seems to belong to real life. One reads from "Who's Who" that he's an engineer, mining and associated, 40 years old, born in Iowa, a graduate (and trustee) of Leland Stanford University, a resident of London, with offices in New York and San Francisco, a director of a lot of [illegible] companies, which operate in many parts of the world, and a member of numerous engineering societies in America, England, France and Belgium.

Mr. Hoover, it would seem, will emerge from the war with a large advertisement as a handy man in [illegible] service. That is a serious prospect for a mining specialist only 40 years old. People who are known to be [illegible] helpful in the work of looking after other folks are liable to be drafted for that employment.

The New York *Evening Post* contributes the following editorial appreciation:

> The story of how the Belgian Commission has supported a people requiring $65,000,000 in food supplies with but $10,000,000 in foreign contributions does equal credit to the financial resourcefulness of Mr. Hoover and his associates and to the recuperative power of the small kingdom. The English press has consistently asserted that it is not the generosity of Americans for which Belgium should be most grateful, but the commission's organizing genius. The dispatches show how huge was its problem. It was necessary to utilize the credit of a population deprived of all metallic and almost all paper currency; to do a systematic banking business across enemy lines—remaining the only institution carrying one on; and it had so to organize its charity that the destitute in Belgium should be aided by their own countrymen. Its direct efficiency is attested by the fact that by careful purchases, the chartering of ships, and the substitution of volunteer effort for middlemen it has kept the price of bread in Belgium below that in London, and yet made $6,000,000 profit on its sales. The scope of its work is shown by the dependence of the communes upon it for money to pay their officers, teachers, and social agents, and to keep up their normal activities. This country has had reason to be proud of the initiative and ability of its ambassadors, ministers, and consuls in solving the problems thrust upon them by the war; in the Belgian Commission it has been served by a display of American practical resourcefulness fully as great.

Copper Operations at Katanga

P. K. Horner, manager of the Union Minière du Haut Katanga, who is visiting some of the important copper mines in the United States, stated that his company is producing copper at the rate of from 1000 to 1200 metric tons per month. The company is smelting oxidized ores averaging above 15% Cu and makes a high-grade black copper running about 96% Cu. Two 48x192-in. Allis-Chalmers furnaces are being run continuously, and occasionally a third furnace, which was completed about the middle of 1914. An addition of four 42x240-in. furnaces was under order and practically ready to ship at the outbreak of the war, but as the complete program is impracticable, under the present conditions, the company is proceeding with the erection of two furnaces, which are from the Traylor Engineering & Manufacturing Co. It is expected that they will be in operation by the end of 1915. This should nearly double the present copper production. Last year the company's copper production amounted to about 10,700 metric tons, including 325 tons of 70% matte. The production of the current year is expected to exceed this materially, notwithstanding that some of the force have been taken for military service. At present about 200 whites and from 3000 to 4000 natives are employed at the property. Railroad connection has been established to the principal mines, and the monthly production of ore is from 8000 to 10,000 tons. The greater part of the ore comes from the Star of the Congo and the Kambove mines, a small amount being obtained from mines under development.

The company has erected an elaborate testing works, and extensive experiments are being carried out for the treatment of the lower-grade ores. The testing works comprise a concentration section and a leaching adjunct. The concentration section, the machinery for which was supplied by the Power & Mining Machinery Co., has a capacity of 150 tons per day. Archer E. Wheeler, consulting engineer, is now at the properties making an examination. The operating staff of the company comprises P. K. Horner, manager; Jules Cousin, assistant manager; Frank Kehew, smelter superintendent; Frank Moore, superintendent of the Star of the Congo mine; Mr. Johnson, superintendent of the Kambove mine, and M. Vandermaelen, chief chemist.

Surface Rights under Mining Leases

By A. L. H. Street*

A deed or lease for mining purposes implies right in the grantee to make such use of the surface as is reasonably necessary to secure enjoyment of the grant, according to the decision of the United States Circuit Court of Appeals, Eighth Circuit, lately announced in the case of Himrod vs. Ft. Pitt Mining & Milling Co., 220 *Federal Reporter* 80. "There are obvious degrees of necessity for the use of the surface in the conduct of subterranean mining operations," the court holds, "from the absolute necessity of sinking shafts or making other entrances to the minerals to the practical necessities of business operations, such as the placing of steam engines and machinery at the mouth of the entrances, of constructing ponds of water to supply the engines, of laying and operating rail- or tramways to bring in supplies and to carry out the ore, of storage of minerals on the surface pending sales, of assembling houses, stores and shops for the use of the miners; but such uses have been declared in the cases cited to be implied in the grants, if found to be necessary."

Covering the concrete question involved in the Himrod case, the Circuit Court of Appeals holds that grant of a right to bore a tunnel or to sink a shaft may imply the right, as a reasonable necessity, to use the surface for the deposit of waste and débris brought from the tunnel or shaft.

Allouez

The Allouez Mining Co., Calumet, Mich., for 1914 reports a profit of $114,530 from a production of 6,056,548 lb. of refined copper sold at 12.853c. per lb. Silver sales amounted to $13,402, making total receipts $791,821. Expenses for operations were $672,114 and interest payments, $5176. From 354,457 tons of ore stamped 9,408,470 lb. of mineral was obtained, which contained 64.37% of refined copper. The yield per ton of rock stamped was 17.09 lb. of copper. The cost of producing copper during the year was 11.18c. per lb. The following table gives a comparative record of the Allouez operations for the last four years:

	1911	1912	1913	1914
Tons of rock treated..	288,610	333,618	236,663	354,457
Yield, lb. refined copper per ton of rock..........	16.56	16.56	17.29	17.09
Cost per lb. of copper (in cents)				
Mining, milling and transportation..........	10.07	9.74	9.76	9.26
Construction..........	0.90	1.60	0.16	.....
Smelting, freights, commissions, etc..........	1.95	1.87	1.94	1.83
Interest paid..........	0.38	0.31	0.23	0.09
Total cost per lb. of refined copper..........	13.30	13.52	12.09	11.18
Development work included in foregoing costs:				
Shafts..........	419 ft.	278 ft.	102 ft.	..
Openings..........	7229 ft.	8517 ft.	4399 ft.	3526 ft.
Percentage of rock hoisted, discarded..........	2.049	1.868	1.269	0.484

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*Attorney, St. Paul, Minn.

Recent Progress in Flotation

By O. C. Ralston and F. Cameron

SYNOPSIS—A review of the progress that has been made in the United States in the development of the process of concentrating ores by flotation. The work of many experimenters has been shrouded in secrecy by fear of litigation. However, without revealing confidences, some of this progress is now discussed from a purely technical point of view.

A review of recent work in flotation has proved practically impossible for the engineering journals to obtain on account of the peculiar existing conditions. Beyond a few isolated articles and occasional notes in the current news of the mining camps, little information on the subject of flotation is to be had. And yet there are between fifty and one hundred concentrating mills in this country operating or experimenting on a fairly large scale on the treatment of slimes from the mill circuit or on finely ground ores.

PROSPECT OF LITIGATION HINDERS EXCHANGE OF IDEAS

As has been pointed out in the columns of the JOURNAL, the cause of this silence lies in the litigation situation. Minerals Separation, Ltd., in trying to exploit processes for the concentration of ores by flotation based on numerous patents which it holds, found that it would have to sue those whom it considered infringers. Accordingly, suit was brought against James Hyde. Hyde had worked out a process for treating the zinc ores of the now famous Butte & Superior Copper Co., at Butte, Mont. The history of the case is well known. It has now reached the Supreme Court of the United States, where, in view of the crowded docket, it will probably not be considered for more than a year. Meantime the Minerals Separation company is suing the Miami Copper Co., of Miami, Ariz., in another of the district courts of the United States.

The condition with many millmen is this: The decision of the U. S. Circuit Court of Appeals in San Francisco was against Minerals Separation, and hence they feel that the paying of royalties or fees to this company before the consideration of the suit in the U. S. Supreme Court might be a waste of money. Meanwhile it is imperative that the valuable minerals in the slimes from their mills should be recovered, if possible. The larger companies have carried on serious investigations, and in most cases have obtained good results. However, publication of what they are doing is regarded as prejudicial to their interests, as it is hard to tell who may enter suit against them in the future for royalty payments.

If Minerals Separation wins its suit on the basic patent, most of these people are ready to pay up back royalties. If Minerals Separation should lose, many of them might still be liable to suit from other patentees of processes and ideas. Hence, a decision by the Supreme Court would not clear the situation immediately nor at an early date bring about a dissemination of literature on the subject. [We do not agree with this opinion.—EDITOR.]

This is regrettable, especially as a recent trip through part of the West by one of the authors has revealed the fact that, as a result of some excellent research work and experimentation which are going on, there is a healthy state of progress in this new field of metallurgical work. Much of the work that is being done will doubtless be kept secret for some time to come. Therefore in the following discussion of the subject we can only give out such information as will not betray the confidence of any of the operators interviewed. For that reason no localities, mills or companies are mentioned.

GENERAL PROGRESS OF FLOTATION METHOD

Certain progress in the more general details of flotation milling is of interest. For instance, it now looks as if much of the older concentrating machinery is going to be displaced by flotation machinery. The first application of flotation was to re-treat slimes carrying valuable sulphides, and it was hence merely an addition to slime-treating machinery, such as vanners and slime tables. Soon the vanner heads instead of the tails were being tested in the flotation machines, and the results have varied greatly. In some places the flotation machines are still treating the vanner or slime-table tails; in others the tests have shown better work with the older slime-treating machinery entirely eliminated. Of course, the criterion used has been the economy of concentrating the various ores in question.

Although slime-treating machinery could now be almost entirely dispensed with, there is still some doubt in many cases as to the advisability of doing so. However, some men have gone much farther and have suggested that it may be advisable to displace the sand-concentrating tables and to grind all material for direct treatment by flotation. In fact, one large copper company has decided to displace all concentrating machinery with the exception of rougher tables and regrind the tails from these for flotation. But with, say, a lead- or a zinc-sulphide ore containing the valuable minerals in large clean crystals it is hard to see why such a practice should be necessary. It would seem that only the fines and slimes, which are inevitably produced by any crushing, should require flotation treatment. This, of course, leaves out of consideration the cases where heavy gangue minerals make mechanical concentration of other kinds difficult. Considerable experimenting along these lines is now going on and it may be that this question will be settled by the end of another year.

"CLEANING" FLOTATION PRODUCTS

The practice of "cleaning" both flotation concentrates and tails is another development, at least in American practice. Australian engineers make the claim that all of these ideas were worked out long ago in Australia, but nevertheless much honest new work has been done in this country, notwithstanding the claim that the ideas are old. English conservative methods of withholding

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Note—Communicated by D. A. Lyon, metallurgist in charge of the Utah Experiment Station of the U. S. Bureau of Mines, in coöperation with the State of Utah; O. C. Ralston, assistant metallurgist; F. Cameron, research fellow. Published with the permission of the Director of the Bureau of Mines.

much of this kind of information have caused American experimenters to carry out to a conclusion and at their own expense some of these ideas.

Only a few years ago "rougher" and "cleaner" units were not commonly spoken of. Now almost every installation, of whatever type, is re-treating the concentrates from a "rougher" machine in a "cleaner" machine in order to drop out most of the gangue material and some of the middlings which need further treatment. Moreover, it is becoming customary to add suitable oils to the tailings for further flotation treatment in order to produce clean tailings and a low-grade middling product. These various middling products are reground in the best practice and returned to the circuit, while in other instances simple return of middlings without regrinding is common. Another point of interest has been the installation of all manner of "drag" devices for removing any froth that may form on the pulp in the subsequent handling of tailings, such as in dewatering or thickening. It is also a debated question as to whether further flotation treatment before discharge is not better practice.

Another development when using pneumatic cells of the Callow type has been to add "recleaners" for further treatment of the concentrates from the froth "cleaners." Thus we have "roughing" machines followed by "cleaners" for the tailings, and, in some installations of the Callow type, "cleaners" and "recleaners" for the concentrates. As a matter of fact, the same general sequence of treatment is followed in the many compartments or cells, in series, of the Minerals Separation type of machine.

BREAKING UP THE FROTH

The further handling of froth concentrates has proved a serious problem for many operators when the froth has been tough and permanent. The most common method of breaking froth is by jets or sprays of water. A single strong jet of water turned on the flowing froth in a launder often results in material benefit, and a water pipe perforated with many holes to give more jets is better, while special sprays, such as rotating garden sprays (inverted), Buffalo sprays, etc., prove even more efficient. Direct feed into a filter of the pressure-filter type is most efficient, as the froth does not need to be broken up. The vacuum filters are not so well adapted to immediate treatment of the froth because it generally is too thin (25% to 35% solids) to cake well; vacuum filters of the Portland or Oliver type require approximately 50% solids in the pulp. However, by breaking the froth and dewatering, a vacuum filter is permissible. In a number of installations a bucket elevator seems to break up the froth to a satisfactory extent, actual tests made by one company indicating 80% efficiency in breaking froth, merely in the passage of the froth through the bucket elevator. Addition of chemicals, such as acid or lime, or of more oil to the froth, also tends to break it down and make the solids settle out well. If lime be used for this purpose, the mill water cannot be used again without neutralizing.

Settling of froth in bins for dewatering, while a common practice, is not satisfactory, as it practically imposes a canvas lining for the car in which the concentrates are shipped, and concentrates shipped in this manner will drain in such a "traveling filter" to about 25% or 30% moisture. In case of a long haul, this is expensive both in freight and leaks. Filters are being used in nearly all of the larger plants. Oliver and Portland filters turn out a satisfactory product with 10% to 15% moisture, and pressure filters like the Kelly, while more cumbersome and expensive to operate, are giving products ranging from 6% to 10% moisture.

FLOTATION PRACTICE WITH COMPLEX SULPHIDES

Where the flotation concentrates consist of several mixed sulphides which it is advisable to separate they are run over concentrating tables after breaking the froth. This idea is old, but its application in the United States is relatively new. Mixed concentrates made on Minerals Separation, Callow, McQuisten and De Bavay machines are now being treated in this manner in the United States.

The mention of separation of mixed sulphides in flotation concentrates suggests the work on preferential (selective) flotation. In this field there is much work being done in laboratories, and many seemingly good results are being obtained. However, most work of this kind is being guarded closely. In four separate and distinct places the idea has been adopted of separating galena selectively in the presence of sphalerite by an exact proportioning of a suitable oil, adding only enough to float the galena. This idea is old, but to see it worked out in detail and applied in the works (as it is in three instances) is gratifying.

Most of the preferential methods have consisted in the treatment of ore by some method which modifies one of the flotative minerals and prevents its floating. The Horwood process (a slight roast to deaden the surfaces of lead-sulphide particles and prevent their floating, while the zinc sulphide is unaffected) has been tried experimentally in at least five instances, and more or less encouraging results have been obtained. A patent of Greenway and Lowry reveals another proposal of adding chromates to the mill water to act on one sulphide while the other is unaffected and can still be floated. Still other methods of getting preferential flotation have been experimented with—by proper preliminary treatment of the oil, such as emulsifying, fractionally distilling, treatment with proper electrolytes, acids or other chemicals. This work is nearly all experimental-laboratory work.

RE-TREATMENT OF TAILINGS

The cleaning of tailings is being accomplished, as a rule, by further addition of oil and re-treatment in other flotation cells. The "step" addition of oils is claimed by the Butte metallurgists as a contribution of their own. Almost universally, oleic acid is used in the cleaning treatment of the tails of lead- or zinc-sulphide ores. It seems to be especially adapted to the purpose, though it is hard to get high-grade concentrates by its use.

Incidentally, the effect of adding an excess of any flotation oil seems to be the formation of lower-grade concentrates, which are hard to clean. Moreover, the froth is liable to be too tough and permanent to permit of its being easily broken after removal from the machine. Oil or substances immiscible with water and generally understood by that name are not necessary to flotation. Many soluble frothing agents are used that are not "oils" in any sense of the term. As the term "soluble frothing agents" has been mentioned in many of the more recent patents, the term "oil flotation" might be advantageously dropped before it gains too much headway.

Flotation Oils

The subject of oils is a most important one, and more experimental work has been done on this particular phase of the subject than on any other. Attempts to determine which oils may be best suited to the treatment of certain minerals have not resulted in deciding on any particular oil that will always concentrate a certain mineral in all cases. Pine oil is a favorite for floating both lead and zinc sulphides, though the wood creosotes are close competitors. Eucalyptus oil seems in many cases to work better than either of these, but it is too costly.

Petroleum products appear to be sufficiently selective for copper concentration; but in the concentration of lead or zinc sulphides they seem to float too much gangue. Such being the case, it may be said that petroleum oils are not well adapted to flotation work upon lead-zinc ores, as in the treatment of such ores it is necessary to produce concentrates which shall contain not less than 45% lead or zinc. On the other hand, particularly high-grade concentrates are not necessary in copper work, and a high extraction, with concentrates having a tenor of 10% to 25% Cu, is usually obtainable.

Delivered, pine oil costs from 25c. to 30c. per gal.; creosote, 18c. to 25c.; eucalyptus oil, $1.50 to $2 per gal. (Roughly, there are 8 lb. of oil in a gallon.) The petroleum products used can be bought for from 5c. to 10c. per gal.

Use of Acid in Flotation

In the use of acid in the mill water the practice differs sharply. The addition of acid seems to improve selective action, especially on galena, sphalerite and pyrite, and appears to be effective for the purpose of getting clean concentrates with a minimum of gangue. The removal of oxidized films from sulphide particles is one result. It could doubtless be used in many places where it is not now used. On the other hand, it has been found in certain instances that the presence of an acid was fatal to the process. As a rule sulphuric acid is the cheapest acid available and so is generally the one used. The amount of acid used is somewhat lower than formerly, when from 0.5% to 1% H_2SO_4 was used in the mill water. Now the average practice is from 0.2% to 0.5%.

The presence of any electrolyte seems to have a marked effect on flotation, and a set of experiments on some well-known ore, using distilled water instead of mill water, is therefore of great interest. In fact, the analysis of mill water from some of the mills where different methods are employed for treating ores that seem to be almost identical may reveal some interesting points. In our own laboratory the possibilities of new conditions arising from the use of water from the Great Salt Lake is a question under investigation.

Temperature Increases Selective Action

Whether temperature is an important item or not is also under dispute. On nearly every ore being treated it is possible to get good work done with unheated mill pulp; but a better grade of concentrates can often be obtained by heating the solution. It makes the oil and water less viscous, so that a given amount of oil will go a little farther. Moreover, less gangue rises through the more fluid water. The consideration of what would happen in the way of flotation of gangue if a mill solution composed of thick molasses were used illuminates this point. Further, the selective action due to the presence of an acid or electrolyte is promoted by a higher temperature. Hence, heating the mill pulp will be of value in those instances where concentrates of high metal tenor are wanted, as when working on lead- and zinc-sulphide ores. The temperature to which the mill water is heated is not over 65° C. (149° F.) in any case, and usually not over 50° C. (112° F.). The cost of heating to these temperatures is from 5c. to 10c. per ton of dry slimes.

Developments in Mechanical Agitation

The tendency in all mechanical-agitation methods of flotation (as distinguished from pneumatic methods) seems to be toward the more careful and rigid practice possible. A study is being made of the exact proportioning of compartments, of the beating blades or paddles on the impellers, and of the spitzkasten or settling boxes. For example, inclined blades seem to wear better than vertical ones.

The addition of froth rakes or hoes has also been made to nearly all such machines so as to remove the froth as fast as it is formed rather than to let it accumulate until it overflows by gravity. The removal of the froth in this manner avoids the breaking of bubbles and thus prevents the mineral getting back into the pulp and being lost. It also increases the capacity of the machine and permits the use of only enough oil to give a froth that breaks easily and carries little gangue.

Individual drive of each impeller from a small special motor has been adopted in one design, rather than the use of a line shaft with either belt or gear drive of each impeller. This drive doubtless costs much more for installation, but gives flexibility of control of each individual cell. Other mechanical means of mixing are being tried, such as the centrifugal pump which was used in Australia some time ago. This arrangement seems to give a low extraction and high-grade concentrates, a result capable of explanation on the assumption that the flotation conditions obtained are rather poor and that hence only the purest mineral floats, while middlings are unaffected. Such a practice makes cleaning of the tails by further treatment necessary. Having adjustable openings between beating compartments and spitzkasten seems to be nearly universal practice, though in a few of the mills visited the openings are hardly ever manipulated.

A preliminary mixing of the oil with the pulp is suggested as an interesting possibility as a result of some experiments conducted by three large companies, in which the addition of the oil was made before the material treated was passed through a tube mill. The mixing conditions were ideal and the tube-mill discharge could be run directly into a spitzkasten for separation of froth, or into pneumatic-flotation cells. This idea will doubtless be followed further.

Variation in Pneumatic-Flotation Cells

Contrary to the tendency in mechanical-agitation schemes, the pneumatic-flotation machinery is being modified, apparently, toward the greatest freedom of design possible. As an instance, the Callow cell is designed with a slanting bottom to facilitate discharge of tailings. Some mill men find flat bottoms to work just as well. In fact, every possible modification of a bottom seems to be at work. Single and quadruple thicknesses of canvas are used. The canvas may be clamped and bolted between two strong grids of perforated sheet steel or it may be supported against some wire cloth and tacked on. It may likewise not be supported in any manner, but simply stretched tight and held by a piece of rope driven in a groove which extends around the inside of the bottom of the machine. The last-cited method seems to be about as successful as any for changing bottoms when the canvas becomes worn out.

Before treatment in the pneumatic-flotation cell the pulp is commonly mixed with the oil in a Pachuca mixing tank. In several instances a number of these Pachucas are placed in series and a good grade of froth is drawn direct from the tops of them. It is quite likely that radical changes in design will result from this experimental work. Both wooden and metal constructions are used, the metal cells costing nearly twice as much as the wooden ones.

ELECTRICAL FLOTATION

Among the new proposals appearing during the last year was the Fields electric-flotation process. In this process it is proposed to accomplish flotation by means of hydrogen bubbles developed by electrolysis of the solution mixed with the pulp. Fields also proposes to use air lifts to keep the pulp is suspension. It is claimed that no oil is necessary, but that it helps. The special application of this process is stated to be on partly oxidized copper ores, where the copper sulphides can be floated, and by use of a solution of a sulphate or a chloride the oxidized copper will go into solution at the anode and a rough copper cathode will finally result. Promising results have been obtained, but at an expenditure of power of about 10 times that anticipated. Whether or not this process can be made commercially feasible is a matter of considerable interest.

FLOTATION OF OXIDIZED AND OTHER MINERALS

In the flotation of oxidized and other minerals much quiet work is being done. The most promising method proposed is that of "sulphidizing" oxidized minerals of copper and of lead by treatment with the proper soluble sulphide and then floating the artificial sulphides formed. This idea has been tried principally on copper ores with fair results. Treatment with hydrogen-sulphide gas, either of dry ore or suspended pulp, works well, or the sulphidizing may go on during flotation by use of ground matte and acid to react on each other and form H_2S; or solutions of hydrogen sulphide, alkaline sulphides, alkaline-earth sulphides and other compounds can be used with more or less success. The concentrates formed are never of high grade, as a great deal of gangue is carried up, especially iron. Similar work is being done in our laboratory on low-grade oxidized ores of lead, but a concentrate with only 20% of lead is a different thing from a 20% copper concentrate. The present outlook seems to be that the process will apply only to oxidized copper ores. Oxidized zinc ores seem to be unaffected by the process.

From two sources comes the welcome announcement that it seems possible to float fine metallic flake copper, and apparently native silver. Many more interesting things are being done, and it is a matter of regret that due to existing circumstances they cannot be reported in this discussion of the subject.

Coal Scarce in Germany

BERLIN CORRESPONDENCE

The scarcity of coal in Germany is still noticeable. The coal pool is not in a position to satisfy domestic demands, although the military authorities do everything in their power to increase the output of the collieries by releasing trained miners from the front and the home garrisons and by furnishing prisoners of war for mine work. The latter have proved efficient in underground work and appear to be glad to have found employment that will keep them in pocket money. So an increase in the output of the collieries may be expected during the coming months. It will not be sufficient, however, to cover the domestic requirements and the large foreign orders as well. For this reason the coal pool has seen fit to advise its customers that it cannot supply more than 60% of their orders.

The large demand for coal has in the meantime extended to coke, of which there is about 2,000,000 tons stacked up. As the iron industry under present circumstances will not be able to consume as much coke as it did before the war there will still be a large surplus to deal with. With such an amount of dead capital, and wages and operating materials rising in price, the collieries cannot get along with the prices of coal fixed a short time ago and are contemplating a further rise on Sept. 1.

Of the coal companies that have been able to show substantial gains during the past year the Oberschlesische Kokswerke und Chemische Fabriken is the only one that derived its profits, not from the main product for which it was built—coke—but from the byproducts—tar, benzol and ammonium sulphate. Benzol has been in increasing demand as a substitute for benzine, and ammonium sulphate as a source of nitrogen, so important for explosives and fertilizers, Germany imports in normal times $45,000,000 worth of niter. Being cut off from its sources of supply, it had to find ways and means to make good the deficiency at home. The problem has been solved by Professor Haber and other chemists of repute connected with powerful chemical works which extract nitrogen directly from the atmospheric air and make it subservient in the preparation of explosives. The manufacture has been taken in hand by the imperial government as a monopoly, and it is believed that nitrogen can be produced cheaper than by the old way.

Stanford University Yearbook and Directory

The Geological and Mining Society of Stanford University has issued its second "Yearbook," which aims to present to the alumni and former students of Stanford University, as well as to any others who may be interested, a directory of the geological and mining department and other interesting information. The directory comprises about half of the book, and gives the names of those who have ever registered in the department, with details as to the time spent therein, degrees conferred, positions held, etc. The remainder of the volume consists of articles on various geological and allied subjects, contributed by A. H. Purdue, G. H. Clevenger, H. W. Young, A. F. Rogers, C. F. Tolman, Jr., and other alumni of the university. The book is well printed and illustrated.

Meerschaum Deposits of New Mexico

By Faris V. Bush*

SYNOPSIS—Large deposits of meerschaum are known to exist near Silver City, N. M., and about 2,000,000 lb. of the material has been shipped. Ill-advised mining and milling processes have put the operating companies into receiverships.

Until recent years Europe and Asia Minor produced practically all the meerschaum used on the two hemispheres in the manufacture of sundry smoking articles; but America has taken its place as a meerschaum producer, and extensive orebodies have been opened up in Grant County, New Mexico, from which thousands of tons of the mineral have been mined, milled and manufactured into satisfactory meerschaum smoking articles. With the discontinuance of importation of foreign meerschaum the demand has been greatly increased for the United States product and negotiations have been attempted for shipments to Europe.

DEPOSITS DISCOVERED IN 1875

Sepiolite or meerschaum, a hydrated magnesium silicate, was discovered, by prospectors *en route* to the Upper Gila country, in Grant County, New Mexico, early in 1875, being found as float and later in distinct veins at the surface near the Sapillo Creek. Shortly afterward Cornelius McCarty and William H. Hicks located several claims on the main vein, but were forced to abandon them owing to lack of transportation facilities. In prospectors' cabins throughout the country at the time meerschaum pipes began to take their place with briar, clay and corncob, showing the mineral's value was recognized early. Doctor Sauers and associates of Silver City, N. M., purchased the claims in 1901 and held them by doing the annual assessment. He later abandoned them and the next owner became Ed Moulton of Georgetown, N. M. About 1901 James Hill, a Colorado miner, heard of the deposits and, securing the services of James Crittenden, staked 20 claims, which were then open for location. Hill brought the property to the attention of New York parties who were tobacco dealers and who realized the commercial value of the mineral. They bought his interests, and after experimental work on milling and manufacturing meerschaum, organized the Meerschaum Co. of America in 1905 and began operations in a small way with a factory in New York. Impractical methods of mining, milling and manufacturing forced the company into the hands of a receiver. However, the product, when finished, was of a good grade and a large demand was created. The company reorganized in 1912 under the name of the American Meerschaum & Pipe Corporation, and a factory was established at Ogdensburg, N. Y., where impractical machinery and methods were installed. Contrary to the advice of engineers employed, the mines were operated without regard for the future and no effort was made to block out ore reserves. Although handicapped by limited means, the late management extracted a large tonnage of meerschaum, driving the main adit about 1500 ft. in continuous ore and stoping in many places to the surface. Early in 1914 the company was again in the hands of a receiver with a large tonnage of ore still in sight in the mines.

AMERICAN MEERSCHAUM MILL

LOADING BURROS AT THE MINE

SITUATION OF MINES

The American meerschaum mines are located in the mountains north of Sapillo Creek and south of the Gila River in the Alunogen mining district, Grant County, New Mexico. They are 29 miles north of Silver City, over a road almost impassable, and 30 miles northwest of Hanover, the loading point on the Santa Fé Railroad, over comparatively good roads. There are 20 claims in the group, upon each of which meerschaum [illegible] are traceable for hundreds of feet. The mines are 17 miles from the Dorsey meerschaum property on Bear Creek.[1] I have not had an opportunity to visit the Dorsey mines, but am told they are not being operated on account of the large amount of water encountered at depth and cannot therefore be examined. The meerschaum of the Dorsey property differs from the American meerschaum in that the mineral occurs in nodular form in limestone and in small, irregular seams, while the mineral at the latter property occurs in distinct fissures of uniform width in a breccia. From samples I have seen the Dorsey meerschaum is of a good grade, resembling the foreign product.

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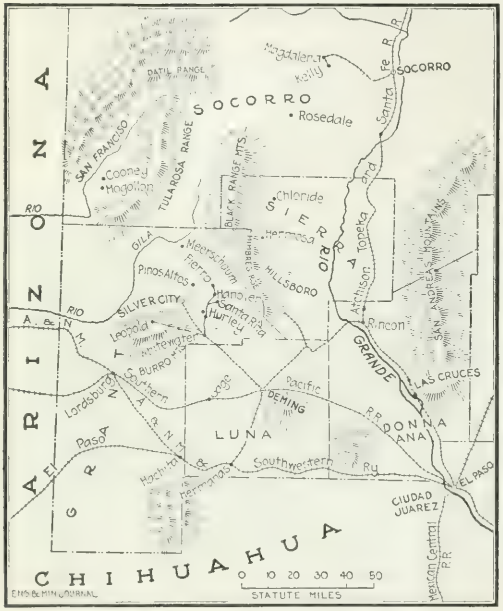
*Mining engineer, Silver City, New Mexico.

[1] Sterrett, D. B., "Bull 340-M," U. S. [illegible]

The meerschaum deposits of the Alunogen district occur as a fissure filling in a breccia, greatly resembling a conglomerate. It is composed of coarse fragments, angular in appearance, irregular and unhomogeneous in character. In it are recognizable limestone, sandstone, quartz, flint, chert (which is classed as an impure flint), and calcite. The cement of the breccia is calcareous in nature, with some consolidated sand and volcanic tuff. The weathering throughout the region has been extensive and the country rock in general is exposed. It is difficult to tell how it originated. The rock shows no evidence of stratification and would be classed as a volcanic breccia, being evidently an accumulation of igneous particles through volcanic action. The color of the breccia is variable, brown predominating. Renewed movement or contraction (probably both) caused the fissures in the rock. There are no faults in the vicinity of the meerschaum veins or its walls, showing it is not a friction breccia. Surrounding this area are found the Palomas gravels.



Silver City Mining District, New Mexico

Occurs as Fissure Filling in Breccia

The American meerschaum occurs as a fissure filling in the breccia, development work proving the veins to be from 1 to 2 ft. in width. The strike of the veins is almost north and south and the dip practically vertical. The analysis of the meerschaum filling is: SiO_2, 60%; MgO, 10%; H_2O, 20%; Al_2O_3, 9%; CaO, slight. The present country rock was doubtless covered by a preceding rock mass containing magnesium-bearing silicates, calcite and the characteristic alumina for which the district is named. Infiltrating waters carrying these ingredients in solution deposited them in the fissures. Later erosion has left no trace of the preceding rock masses. All indications substantiate the belief that the mineralization was formed by percolating surface waters. Meerschaum is chalk white to cream colored, fibrous, tough and breaks evenly. The texture is even throughout. The specific gravity is about 2. It is easily carved, takes a high polish and absorbs fluids rapidly.

Due to the contour of the country no shaft-sinking to any great depth has been necessary to keep the factory supplied with ore. The main workings have been in tunneling and stoping from the south side of Sapillo Mountain. The portal is located in a deep cañon cut through breccia. The adit has been driven about 1500 ft. north and stoping to the surface of the mountain has been done in many places. The greatest distance from the surface reached in the tunnel is 230 ft. All mining has been done by hand. No timbering is required other than for chutes, ladderways, etc. A raise has been made from the tunnel to the surface, and preparations were under way by the late management to sink to a depth of 100 ft. from the tunnel level and drift north and south along the strike of the vein. Thus in a short time a large tonnage could have been blocked out. Numerous small shafts, drifts and opencuts in many places on the property, consisting of 400 acres, have proved the existence of many commercially valuable meerschaum veins.

Milling Processes Were Experiments

While choice meerschaum, that can be carved and polished into beautiful smoking articles, is encountered in the mines, the bulk of the mineral requires a concentrating treatment to eliminate the particles of rock and foreign matter that in many places have become associated with it. The first meerschaum mill in the United States was erected about a mile from the mines of Sapillo Creek, where there is a large water supply the year round. In outward appearance it was the same as any other small treatment plant, but inwardly it was the hive of an unknown and heretofore unthought-of meerschaum-separating process. The early equipment consisted of a coal-breaker, where the ore was supposed to have been crushed to about 2-in. cubes, after which it was spread on a large drying floor in the sun and a large percentage of the water evaporated. The mineral was then pulverized in a coffee-mill to pass a 14-mesh screen. Sizing was done in a small trommel composed of a series of 50-, 30-, 20- and 14-mesh screens. After this the sized ore was treated on what is known as the Krom concentrator, a machine that could be classified as a dry jig, the principle being air pulsation under the ore passing over screens. Due to improper sizing it was impossible to obtain a perfectly clean concentrate, and only 50% of the worthless material was separated from the meerschaum. This impractical and unsuccessful method of concentration was improved upon by the later management, but only in an experimental way. An automatic drier took the place of the sun-drying platform, and wet concentration was embodied in the mill, the latter being most successful and turning out an almost pure product. The most recent flow sheet of the mill was as follows: From mine to grizzlies to Samson crusher to Blake crusher; the material is then 2 in. or under; elevator to automatic drier to sizing trommel; oversize to coffee-mills, undersize to fine ore bins; part of fine ore to Krom concentrator, other as sized to Wilfley table; all tailings from Krom concentrator treated over Wilfley table with a 98% recovery. The meerschaum, being lighter than its gangue, reversed the process of wet concentration of copper, lead, zinc, etc. The meerschaum was washed over the table and recovered in vats at the side of the machine, while the waste material was carried to the head and discharged. The concentrate was then dried and shipped, being practically pure.

FACTORY

Krom concentrators were installed at the factory and all material shipped from the mill of low percentage was reconcentrated. All meerschaum then passed through a washing machine, where foreign matter that may have collected in transit was floated off. It was next pulverized to pass 115 mesh in an ink-pulp machine. The fine product was placed in a mixing machine and thoroughly agitated, being drawn off in liquid form into molds. The drying process took from 60 to 90 days of even temperature to solidify the blocks of pure meerschaum ready for the lathes and pipe-making machinery and waxing process.

MEERSCHAUM DIRECT FROM VEIN

As yet no commercial use other than for the purposes herewith stated has been found for this American meerschaum or sepiolite. It could possibly be substituted for asbestos, but the cost of mining, milling and transportation limits its usefulness. Doubtless future experimental work will reveal other commercial uses for the mineral.

It is estimated that since the discovery of the meerschaum deposits in New Mexico about 2,000,000 lb. of the material has been mined and turned into manufactured products. At periods, two to three cars a month were shipped east to the factory. Recent investigations have been made by French capitalists and others relative to shipping the meerschaum abroad for manufacturing into pipes and for other purposes to which it appears adaptable.

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Changes in Rand Practice

In the course of his annual review as consulting engineer to the Central Mining & Investment Corporation, whose report has just been published, Hugh F. Marriott, says the *Financial Times*, London, May 5, 1915, makes the following statements concerning metallurgical and mechanical practice on the Witwatersrand:

"The latest mill design includes tube mills in the proportion of one to sixteen 1250-lb. stamps, with screening of 10 mesh (I. M. M. standard). With the heavier stamps more recently erected on the Rand [illegible] is proportionately varied. . . . The machine-drill problem continues to receive close attention, with [illegible] satisfactory results. Heavy piston drills still remain the chief factor in general stoping work, but the smaller types of both reciprocating and hammer drills are taking an increasing share in mining operations and have been proved of greater efficiency in certain branches of development work and in subsidiary operations. It is generally found that the smaller types now in use cost more in maintenance than the heavy machines, but are capable of considerably greater drilling speed. The consumption of drill steel, and the expenditure of compressed air per unit of work have been materially reduced in the course of the year."

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National Mine-Rescue Meet at Panama-Pacific Exposition

The third annual Joint Field Meet of the United States Bureau of Mines, the American Mine Safety Association and the California Metal Producers' Association will be held at the Panama-Pacific Exposition, Sept. 23 and 24. It is expected that there will be a large attendance of mining men, as the joint meet will either precede or follow the annual meetings of a number of institutions allied with the mining interests, such as the American Institute of Mining Engineers, Sept. 17 and 18; the International Engineering Congress, Sept. 20 to 25; the American Mining Congress, Sept. 20 to 22; the California State Mine-Rescue and First-Aid Contest, Sept 22; and the National Safety Conference, under the joint auspices of the National Safety Council and the California Industrial Accidents Commission, Sept. 27 to 30.

On Sept. 23, on the athletic field of the Panama-Pacific International Exposition, there will be a mine-rescue demonstration at 10 o'clock; at 2 o'clock in the afternoon there will be a first-aid demonstration; and at 4 o'clock a demonstration of the explosibility of coal dust.

On Sept. 24, at 10 o'clock, will be held a first-aid contest for interstate supremacy; at 2 o'clock in the afternoon, a rescue contest for interstate supremacy; at 4 o'clock, a rock-drilling contest; and at 8 o'clock in the evening there will be an award of prizes and souvenirs at the Convention Hall.

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United Globe

The United Globe Mines, Globe, Ariz., reports a production during 1914 of 11,086,674 lb. of refined copper, 91,582 oz. of silver and 1579 oz. of gold from 155,205 tons of ore. The average grade of all ore was 3.57% copper. The receipts from the sale of this ore amounted to $1,095,560. Expenses were $663,022, leaving a net profit of $432,538 for the year. This profit is before deducting depreciation. Dividends totaling $425,500 were paid, making dividends to date $1,955,000. The principal product of the United Globe Mines is [illegible] ore.

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A New Wall Map of Alaska, 82x55 in., [illegible] based from the Geological Survey, Washington, [illegible] copy. It includes the survey of the new Government railway from Seward to Fairbanks.

Details of Practical Mining

Bucket-Dumping Device

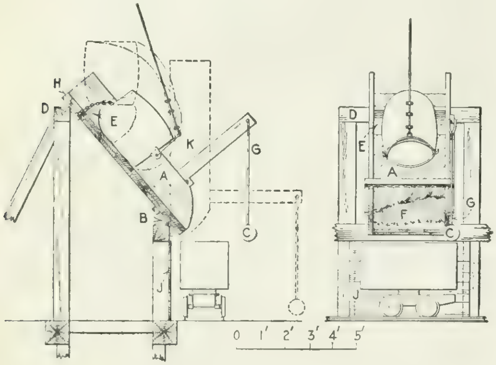
By Harold A. Linke*

A safe and serviceable device for dumping buckets at the collar of a shaft during sinking operations is constructed as follows:

A chute *A* is built of 2x10 plank, the width depending on the size of the bucket used. The sketch shows a convenient size for use with a bucket of 9-cu.ft. capacity. The floor is laid diagonally and doubled, one set of plank crossing the other at acute angles, as shown at *F*. The sides, two plank high and of single thickness, are reinforced with cleats and strap iron.

The chute is hinged at *B*. At the center of the chute at the upper end a slot *H* is cut about 12 in. long and 2¼ in. wide, reinforced around the top and bottom edges with bands of strap iron bolted together through the flooring. *C* represents a counterbalance to assist in raising and lowering the chute.

When the filled bucket reaches the collar of the shaft it is hoisted high enough to clear the chute, which, being raised, is in position *K*. As the bucket is then slowly lowered the topman simultaneously lowers the chute. A 6-in. plate of ¾-in. iron fastened to the end of a chain (about 21 in. long) suspended from the bottom of the bucket is caught in slot *H*. The bucket and chute are then slowly lowered until the top of the chute strikes the bumper *D*. As the bucket is lowered for dumping, the curved block *E*, gouged somewhat in the center to fit the bucket, thus preventing lateral motion, raises the bottom end of the bucket high enough to allow the contents to be completely removed. After dumping, the topman raises the chute while the bucket is being swung clear by pulling downward on the rope *G*.



Bucket-Dumping Device

An important detail to be observed in building a dumping chute of this sort is to make the block *E* about 15 in. long, curved as sketched and gouged to prevent the rolling motion of the bucket. Fasten securely five strips of strap iron on the block for the bucket bottom to slide on, facilitating dumping and affording protection against wear. Occasionally grease the iron strips.

It is advisable to board up the bent on the car side of the shaft, as shown at *J*, to prevent dirt from dropping down the shaft.

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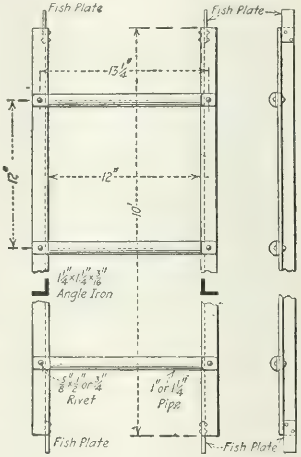
Capital Mine Steel Ladders

By Edward S. Wiard*



Mine Ladder of Angle Iron and Pipe

The details of the steel ladders used at the Capital mine, Georgetown, Colo., were worked out by the superintendent, E. C. Bauman. The principal advantages of these ladders as against wooden ones are lightness, portability, greater cheapness in the long run and great safety. The steel ladders are practically indestructible. The drawing shows the construction and dimensions. The rounds are made of old air pipe. This is cut up into suitable lengths, after which both ends are heated in the forge and mashed flat. The flattened ends are then ready to be drilled and cold-riveted to the angle iron forming the sides of the ladders. The ladders at the Capital mine are made in the easily handled length of 10 ft. and are held in place in the manways by ladder hooks placed in the usual way. To hold the ladder away from the wall plates—if this procedure is necessary to give a good foothold—blocks may be inserted between the ladder and the wall, the hook embracing both block and ladder. If desired, four pieces of steel of the same size and shape may be riveted in pairs to the two ends of the ladder to attain the same purpose—that of holding it away from the sides of the manways.

As fast as the ladders are put in place they are connected to the lengths above or below by fish-plates and bolts, so that each section receives the support not only of its own ladder hooks but of all the others—an advantage in security missing with wooden ladders put up in the ordinary way. The sections of the ladder are easily taken apart and moved from place to place.

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*Mining engineer, 122 Boston Building, Denver, Colo.

Wooden ladders, as is well known, are often injured beyond repair in being taken down. The steel ladders are free from rot, wear but slightly, and are little affected by falling objects. The strength of the steel ladders is great and the sense of security while using them is also great. They could not, of course, be recommended for use in manways where there is dripping coppery water.

The weight and cost of constructing these ladders at the mines are as follows:

	Weight, in Pounds		Cost
Rivets and bolts	3		$0.30
Angles	30		.83
Pipe	27	(half price)	.50
Fish-plates	1½		.04
Total	61½		
Labor			.86
Total cost			$2.53

If the pipe is considered worthless the cost will be reduced to $1.67. The material for wooden ladders will cost from one-fourth to one-half the steel; the labor cost will be as much or greater. The greater cost of the steel ladders is soon made up by the longer life.

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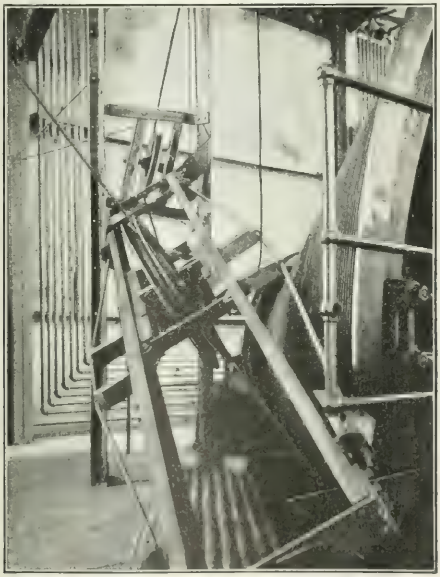
Fleeting Device for Hoist with Conical Drums

By F. H. Armstrong*

On the Brier Hill hoist of the Penn Iron Mining Co. are two 12-ft. cylindrical drums, one for the skip and the other for the cage. There are also two conical drums, from 11½ to 17 ft. in diameter, which are used for counterbalancing the dead loads. The hoist is located so near to the headframe that the sheave to which the counterbalance rope leads is in line with one end of the conical drum, thus pulling very heavily sidewise on the deep grooves.



Fleeting Device for Hoist with Conical Drum

To correct this a channel iron track was set up in the hoist house, in which runs a carriage carrying a sheave. The carriage and sheave are pulled up the track by a rope leading from the carriage to a drum that is driven by a worm and wormwheel from the main shaft of the conical drum. The speed of this small drum is such that it pulls the carriage across the face of the conical drum the distance between two adjacent grooves for every complete revolution of the conical drum. The illustrations show the carriage, sheave, track and rope leading to the small drum.

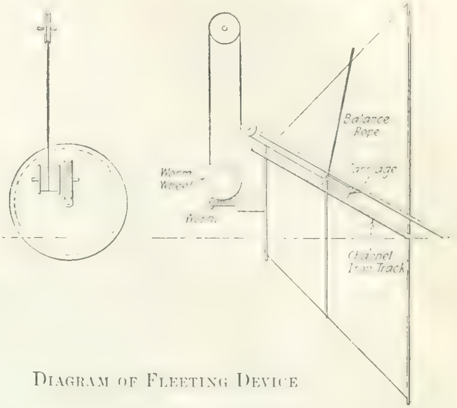


Diagram of Fleeting Device

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Mining Methods in Southern Kaolin Deposits

In the southern states where kaolin occurs in decomposed dikes from 15 to 25 ft. wide it is mined by sinking shafts or pits timbered in an interesting and ingenious way, described by Lloyd T. Emory* in *Engineering News,* Feb. 25, 1915. It was necessary to devise a plan by which the timber could be used repeatedly, and one which would also leave the pit free from braces, so that the hoisting of skips with a derrick would not be interfered with.

The shafts are from 20 to 25 ft. in diameter, depending on the width of the dike, and their average depth is about 60 ft., although they are frequently sunk to a depth of over 100 ft., even through soft and sometimes treacherous material.

The pit is first dug about 4 ft. deep, keeping the hole round by means of a piece of plank swung around a peg in the center, as a gage. The pit is then lined with 3x8-in. planks cut in 3-ft. lengths with mitered ends, laid *flat;* fitted together, a layer of these planks forms a complete ring around the pit. The first ring of timber is laid around the bottom of the pit, a second placed on top of it, breaking joint; these two are spiked together. Then the rest of the curbing to the top of the excavation is laid up, always breaking joint. Sections of 6 or 8 rings are placed at a time. Every fourth or sixth set of timber is spiked to the ring below with 40d. nails, to prevent slipping.

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It can readily be seen that this curbing will act as an arch, like the wall of a pipe under external pressure. Therefore considerable care is necessary to see that any vacant space behind the timbering is thoroughly tamped with dirt, as soft spots behind the wall will allow the timbering to be deflected from a circle, which will throw unequal stresses on different portions and may result in failure.

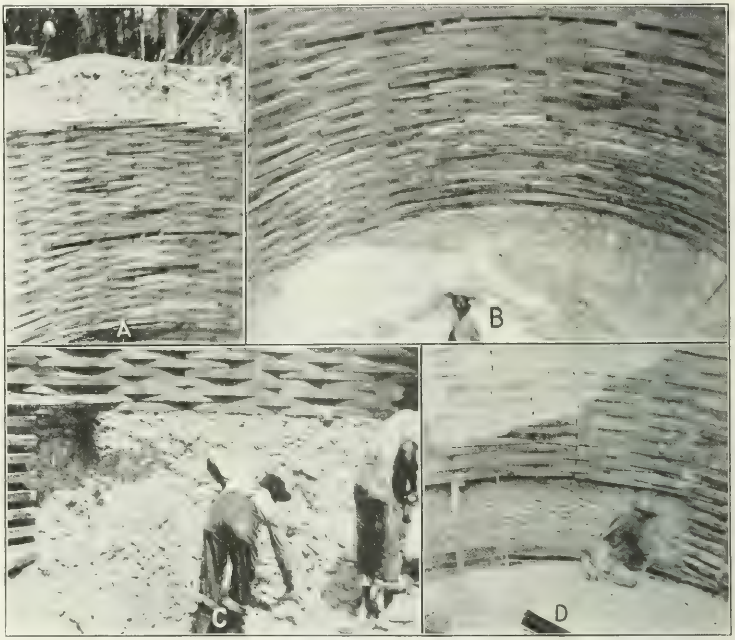
After thus curbing the shallow pit first dug, the work is continued by excavating another 4-ft.-depth, but using a smaller radius, leaving the timbering already in place resting on a ledge. If the material is firm, this ledge may be cut down almost straight with the inside edge of the timber. In case of very soft saturated material it may be necessary to leave a toe 6 to 10 in. wide and thence slope the material toward the center of the pit. In working in wet ground a small sump may be dug on one side of the pit and the floor kept so sloped that all the water can be either bailed or pumped from this depression.

When the pit has been excavated at the smaller radius to about 4 ft. below the bottom of the timbering, narrow vertical trenches are cut into the sides under the timber at frequent intervals around about a third of the circumference of the shaft and temporary wooden struts placed to support the bottom ring of timbering. The earth between the struts can then be excavated to the full radius and another section of timbering started. The second ring is always spiked to the bottom one, and every fourth or sixth spiked as previously described. The ends of this timbering where it will join the adjacent segments can be either "stepped down" or "sawtoothed." It is well to use the first method on one end and the latter on the other. As soon as this timbering is in place the performance is repeated with another segment, and so on until a complete section is in place.

Sometimes difficulty is experienced in putting in the last piece of timber of a section. If the ring cannot be sprung enough to get it in, a short piece of timber is used so as to allow a 3x3x8 in. key to be inserted which is toe-nailed to the adjoining timbers.

The number of rings which can be put in at a time depends upon the character of the soil and is best determined by experience. Where a trustworthy man is employed as foreman it is best to leave the number to his discretion. It is not advisable to place less than four rings, and eight rings are about the maximum that can be placed at one time.

To remove the timbering the shaft is backfilled with waste from other workings. The work is done in a similar way to the excavating, but in the reverse order. In most cases the pressure of the earth against the sides will make each section practically self-supporting, but as a precaution props extending toward the center of the shaft are placed so as to support the lining 4 or 5 ft. above the bottom. The lower section of timber is then removed from below the props and the shaft backfilled up to the bottom of the timbering. It is customary to excavate a new shaft as the old one is being filled. In this way the timbering can be handled by one derrick for both holes and the overburden and trimmings from the new excavation dumped into the old one as fast as taken out.



A—Upper Part of a Deep Shaft. B—Excavating in the Center before Starting a New Section. C—New Section of Lining Started. D—Preparing to Close a Set of Rings

The average cost of excavating by this method, for five shafts, was 54c. per cu.yd., exclusive of the cost of the timber, which was used repeatedly.

⁂

Failure and Heat Treatment of Drill Steel

In the Journal of Apr. 3, 1915, p. 613, the author intended the caption "Ruptures as Developed from a Partial Break in Steel," instead of "Sulphide Accretions in Steel."

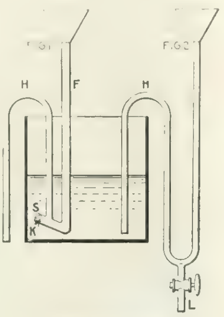
⁂

A Bulletin on Explosions in Metal Mines and quarries has been issued by the Bureau of Mines. The bulletin contains chapters on combustion and explosion, blasting and mine explosives, fuse, detonators, and electric detonators, firing blasts by electricity, the use of explosives in excavation work, the use of explosives in quarrying, the use of explosives in metal mining and tunneling; drilling and blasting methods on New York rapid transit tunnel; magazines and thaw houses; permissible explosives, etc. This publication is Bulletin 80

Details of Milling and Smelting

Acid-Siphons

Some new designs of acid-siphons are described by W. Szigeti (*Chem.-Zeit.*, p. 122, 1915; abstr. *Journ. Soc. Chem. Ind.*, Mar. 31, 1915). Two patterns of acid-siphons constructed entirely of metal (lead or aluminum) are illustrated. Both are started by pouring some of the acid into the funnel at the top. In Fig. 1 the vertical charging tube *F* is of larger bore than the siphon proper and is bent at an angle at the bottom terminating in a hole *S*, constricted to the size of the siphon tube *H*. When liquid is poured quickly into the funnel, a larger quantity passes down the tube *F*, than can flow through the hole *S*, and the excess rises in the tube *H*, starting the siphon. A glass ball, *K*, may be placed in the short branch to act as a check-valve in the hole *S* during starting, falling back again when the siphon starts. Fig. 2 shows a pattern constructed of aluminum for nitric acid, with a tap *L* for intermittent use without recharging.



ACID-SIPHONS

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Carbon as a Precipitant of Metal from Cyanide Solutions

The precipitating action of carbon and graphite upon gold in cyanide solutions has been commented upon and discussed at length in numerous papers. A new one has just appeared giving a description of the experiments of W. R. Feldtmann[1] upon some graphitic or carbonaceous schists occurring in the properties of several of the West African gold-mining companies. After a thorough description of the experiments undertaken and the explanation and tabulation of a large number of tests, Mr. Feldtmann expresses his conclusions as follows:

"It has been demonstrated that the graphitic schists of West Africa precipitate gold from auriferous cyanide solutions in a manner which is, in all important respects, analogous to the action of charcoal under like conditions. The gold is precipitated on the charcoal (and on the schist) not as a metal but as a compound—possibly a carbonyl aurocyanide. This gold compound is decomposed and the gold dissolved to a considerable extent by alkaline sulphide solution. Judging by the results of a large number of tests, the re-solution is effected rather more easily from the schist than from the charcoal.

Whether the discovery that alkaline-sulphide solutions will dissolve gold which has been precipitated on the carbonaceous schist can be turned to practical result in the cyanide treatment of ores containing such schists is the subject of experiments being carried on at present. By post-treating with sulphide solution the sand residue from which a maximum extraction had previously been recovered by cyanide treatment, a further extraction has been obtained from a large number of samples, and there is some promise that an economical post-treatment may be evolved on these lines. The precipitation of the gold from the sulphide solution in which the gold is held as alkaline aurocyanide, with hardly any free alkaline cyanide but with a large excess of alkaline sulphide, appears to be best effected by contact with metallic copper.

⁂

Electric-Arc Welding*

Electric welding comprises two general processes—electric-arc welding, which is best suited to general repair work, and resistance welding, which is most applicable to manufacturing processes where many duplicate pieces of light sheet work are to be welded. For general repair work, however, where cutting, joining and building up of metals are to be done, arc welding is employed.

Direct current is used in electric-arc welding because the alternating-current arc varies from a maximum to a minimum at each reversal of the current, and hence is not suitable for welding service. The direct-current arc is practically steady, the temperature obtained is high (approximately 3500° C. at the positive electrode), and the heat generated at the positive terminal is approximately 75% of the total heat generated in the arc.

The carbon arc is longer than the metallic arc and is, therefore, more stable and less liable to break. The metallic arc is extremely short, being only from 1/8 to 1/4 in. long. After the arc is established, it can be moved about over the work by merely moving the electrode. The carbon electrode can be used to preheat the work by keeping the electrode moving rapidly enough not to melt the work.

In working with the graphite electrode there must be a potential across the arc of from 35 to 50 volts, depending on the current being used. The current varies from 200 amp. up, depending on the type of work being done. In light work, small electrodes and less than 200 amp. can be used. The average type of welding done by this method will require from 300 to 400 amp. For cutting, the graphite or carbon electrode is unequaled for speed and low cost. The arc cuts rapidly, because the heat is concentrated on a small area. To augment the cutting speed, all that is necessary is an increase in current.

The metallic electrode permits much lower amperage than the carbon electrode. Currents as low as 15 amp. are used, and the upper limit is about 200 amp. The voltage at the arc is only from 20 to 25 volts. The metallic electrode can be used on much lighter stock than can the carbon electrode. It requires greater ability on the part of the operator, however, on account of the shortness of the arc and the consequent difficulty of maintaining it; but this is compensated for by the fact that certain classes of welding that are possible by this method cannot be done by the others. Among these is welding overhead or on vertical surfaces. Further, there is no possibility of carbon being carried into the weld.

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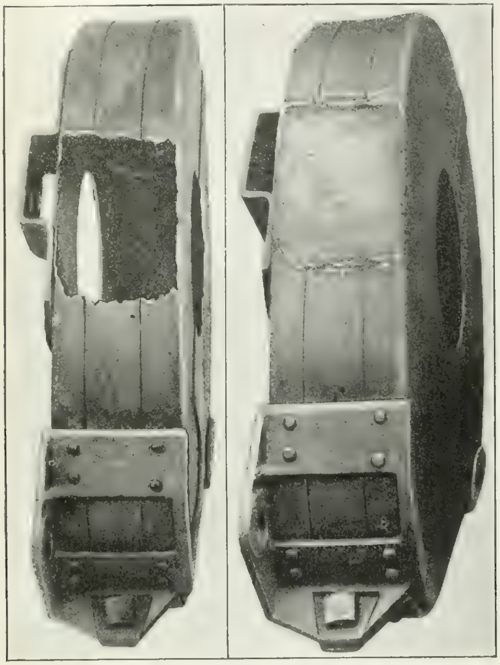
[1] "Bull. 127," I. M. M., Apr. 8, 1915.

*Abstract from General Electric Bull. No. [illegible]

Cast and malleable iron can be successfully welded by the electric arc provided certain precautions are taken. For this type of welding, the work should be preheated either by the use of the carbon electrode or by means of gas, coal or oil fires. The work should be brought up to a red heat and the heat carried back from the weld, or cooling strains, and probably cracks, will follow. The work should be kept hot during the time the weld is being made.



A Gear Case Welded with the Electric Arc

Flux is of great assistance in welding cast iron. One commonly used consists of a mixture of borax and red oxide of iron. The borax should be heated to drive out the water of crystallization before using the flux. This mixture is supposed to prevent carbon entering the weld, and also to keep the surface of the metal in the weld clean and so permit a better union of the metal.

Metallic electrodes for welding steel or iron consist of rods from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. in diameter and about 12 in. long. The better the material used, the better will be the weld. The carbon or graphite electrodes vary in size from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. and more in diameter and should consist of hard, solid and uncored carbon, similar to that used in arc lamps. The end of the electrode should be rounded off, but not brought to a sharp point. The filling material used with the carbon electrode should be of the same kind and quality as that which is being welded.

Any direct-current source can be used for arc welding, but the voltage must be reduced from 10 to 50 volts. This may be done by inserting resistance in series with the arc to absorb the excess voltage. This is plainly an inefficient method of operation, as the voltage absorbed by the rheostats is energy wasted. In order to avoid such losses, the General Electric Co. has developed a line of special, low-voltage generators and a method of control, which give the maximum of efficiency, combined with flexibility and protection. The generator should be wound for a voltage of from 60 to 75 volts. In no case is it necessary to have a generator of higher voltage than this for welding. Lower voltages may occasionally be used with extremely light currents.

The generators are usually furnished as part of a motor-generator set, although they can be supplied for belt drive if desired. The motor-generator set is the most desirable equipment for several reasons. It is a self-contained unit, does not demand constant attention when running, and the maintenance cost is low. The welding circuits and the shop circuits are electrically independent, so that short circuits in a welding circuit will not seriously interfere with the shop circuits. The voltage on the welding circuit can be regulated to suit the work in hand by adjustment of the generator field rheostat.

* * *

Zinc-Sodium Alloy as a Precipitant in Cyaniding

Having in mind the difficulty of producing mechanically a finely divided zinc product for use as a precipitant in cyanide operations, Prof. G. H. Clevenger (U. S. pat. 1,123,685) has conceived the idea of making an alloy of zinc with some other metal with the object of producing a compound which will be brittle and easily comminuted. Heretofore the forms of zinc used have been the filament, cut from sheet zinc on a lathe, and the zinc fume or zinc powder, which is a byproduct of zinc smelteries. By producing a brittle alloy it will be possible to use scrap zinc and to manufacture zinc dust at the plant where it is to be used.

Clevenger alloys the zinc with sodium, in quantity not over 3% of the latter, or with any other alkali or alkaline-earth metal which will impart brittleness to the resultant alloy. The alloy produced will have a much greater efficiency from a chemical point of view, as the presence of sodium and possibly lead in the alloy brings about a quicker action and necessitates the use of a smaller amount of precipitant, even though the mechanical subdivisions remain approximately the same as with the ordinary zinc dust of commerce.

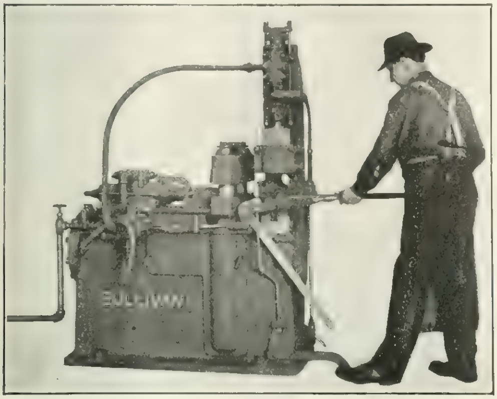
* * *

"Part of the Coke Used in the Mt. Lyell Blast Furnaces is put in merely to allow the metallurgist and his assistant to go home and sleep," said Robert Sticht at a dinner of the New York Section of the American Institute of Mining Engineers. "The metallurgist and his crew are only human beings, and we spend a lot of money annually keeping them sweet and fresh and in good, vigorous and healthy running order. If everyone around the furnace were a highly qualified academic chemist, who could give his unremitting personal attention to the descent within the furnace of every piece of ore and flux, then we might perhaps omit the coke altogether, but ordinary flesh and bone cannot do it. We have, of course, occasionally smelted without coke for a day or two, but cannot keep it up." The low coke percentages—0.1 to 1.5% achieved at Mt Lyell are no longer possible owing to the change in the constituents of the ore. Instead of having from 42 to 44% of iron, the Mt. Lyell ore now carries only 35%, and a corresponding amount of sulphur. The result of having a poorer ore is that from 3.5 to 5% of coke is now used.

Mining & Metallurgical Machinery

New Sullivan Drill Sharpener

A new drill-making and drill-sharpening machine is to be introduced by the Sullivan Machinery Co. This new Sullivan machine has been designed on the lines of the Imperial sharpener, for a number of years built by T. H. Proske, of Denver, who has granted the Sullivan company exclusive manufacturing and sales privileges. The Sullivan machine, however, bears only a family resemblance to its Denver prototype. The new machine is larger, more heavily built, more powerful, and is about double the weight of the old one.



New Sullivan Sharpener in Use

The Sullivan sharpener consists of two members, one horizontal, the other vertical, consisting of Sullivan $2\frac{5}{8}$-in. rock-drill cylinders, with differential air-thrown valve motion. The horizontal drill or hammer is used for upsetting the steel into the shape of the bit or shank by means of suitable steel dollies loosely set on the end of the shank or distance piece. The vertical member is used for shaping the wings of the bit, etc., and for drawing out and finishing the corners. This work is done by steel dies, one acting as an anvil and the other, attached to the piston rod above, as a swage or hammer. The steel is held in position while being upset by steel gripping dies set in a heavy vise, which is operated by air power.

This sharpener occupies a floor space of 5x2½ ft., is 6 ft. high and weighs 4000 lb. Safety is assured thus:

1. The operator cannot start the upsetting hammer until the clamp or vise is in operation.

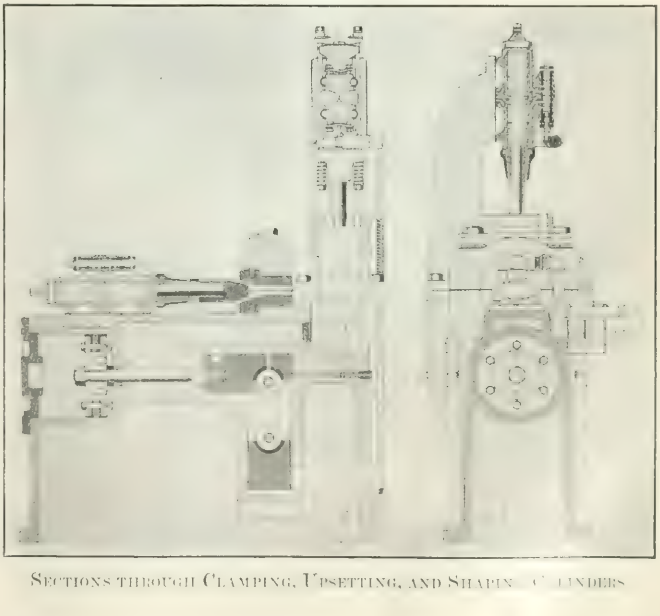
2. There is a positive guard against operating the vertical hammer while the horizontal one is at work.

The operating levers are so placed that the smith uses them conveniently with his left hand and left foot, bringing his right hand at a proper point to handle the steel readily.

The absence of a long carriage and tail block to hold the steel in position is a saving in floor space and in labor. A blacksmith can with a little practice finish new bits in from 50 sec. to one minute each.

Bits of any form and gage may be made on this machine, on steel of any shape, solid or hollow; and shanks also may be formed to order, provided proper dollies and dies are furnished. The collared shanks on hollow steel for rotators or hand-feed hammer drills and the lugged shanks for mounted water-jet hammer drills are two forms that are made economically and rapidly on this machine.

The clamp or vise is equipped at the front end of the jaws with steel plates, to permit its use as an ordinary vise. One use of this vise consists in removing the steel pins that are driven into the shank end of hollow steel to keep the hole open when the lugs or collar is formed. To pull these pins, they are gripped in the vise, and a purchase taken on the lugs or collar with the forked end of the loose lever hanging down below the operating handle. This device is speedy and convenient.



Sections through Clamping, Upsetting, and Shaping Cylinders

It is an accepted fact that, so far as the character of the steel is concerned, no improvement on or even satisfactory substitute for, the making and sharpening of drill bits by the handwork of a skillful blacksmith has been found. The drill-sharpening machine makes bits faster and more uniformly, as to shape and gage, than the most expert hand smith. But the qualities given the steel by the constant hammering of the bit on the anvil are not secured by mechanical means, such as squeezing or molding, sometimes used as a substitute. In other words, the hammering refines, toughens and aligns the structure of the steel in the direction that gives greatest resistance to wear and shock. This is the effect secured by the Sullivan sharpener, in which all work, from first to last, is done by hammering, so that to the uniformity of gage, etc., are added the qualities of increased durability, toughness and strength.

Another element in the efficiency of the "all-hammer" sharpener is that hammer-sharpened bits lose heat less rapidly than steel that is squeezed or molded into shape. This is an important time factor when many bits are to be made in a day.

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Halby Shoveling Machine for Underground Mining

The efficiency of drilling machines has been increased manyfold in the last few years, but a great loss of time and money in driving drifts and tunnels at present is still incurred in mucking. After the rock and ore are broken, with but few exceptions mine operators are still using the methods of loading and mucking by hand which were in vogue over two thousand years ago. Recently the Halby shoveling machine, manufactured by the Lake Shore Engine Works, of Marquette, Mich., has been operated successfully for six months in one of the iron mines of northern Michigan, under the most varied conditions.

The most important factors which a shoveling machine should possess were carefully considered in this design. They are as follows: The first cost should be moderately low. The machine must be handled by miners and should be free from all complications. It must handle material consisting of the finest grains up to large boulders, material both wet and dry, and stand severe treatment as well as great wear and tear. The cost of upkeep must be low. The motion must be such that if any firm object is struck the mechanism will not be damaged. The machine must be small and compact.

This shoveling machine was first demonstrated at the plant of the Lake Shore Engine Works last fall, at the meeting of the Lake Superior Mining Institute held on the Marquette Range. After the meeting it was shipped to the Judson mine at Alpha, where it is at present loading a 2-ton car in an 8x8 drift in 1½-min. when the loading conditions are average—that is, when there is a fair-sized bank of ore in front of the machine. At times the ore bank is small and scattered so that under these conditions it takes as much as 4 min. to load a 2-ton car; but an average loading time is a 2-ton car in about 3 minutes.

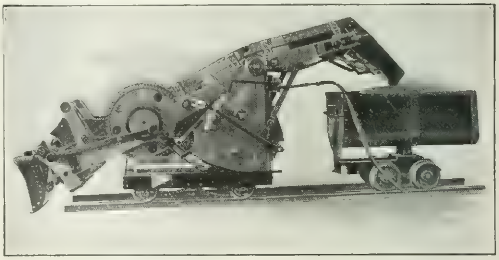
Under former conditions, with hand labor, it required two men shoveling 20 min. to load a 2-ton car under the same conditions as the machine is now working. The machine requires about 200 cu.ft. of air per min. The cost of operating for an 8-hr. shift is approximately as follows:

Power	$3.00
Runner	2.50
Interest on investment	.20
Repairs	.50
Oil, etc	.17
Total cost per 8-hr. shift	$6.37

Figuring 200 tons loaded per 8-hr. shift shows a net cost per ton of $0.031. The labor expense of two men loading for an 8-hr. shift would be $5 per day. Under similar conditions they would load approximately 40 tons in 8 hr., or a cost of $0.102 per ton. The Halby shoveling machine, therefore, loading for less than one-third the cost, at the same time loads five times the tonnage.

The overall length of the machine when ready for operation is approximately 15 ft., but the machine can in a few minutes be shortened to an overall length of 10 ft., if especially short curves or limited space should make this necessary. The overall height of the machine is 5 ft. 4 in., and the total width approximately 4 ft. The total weight is 7500 lb.

The machine is made up in three distinct sections, each forming a unit by itself. The top section contains all the working parts for the conveyor and shovel mechanism. The center or power section contains the motive power, all the clutches and the driving gears. The lower or truck section serves as a support for the entire machine. The top section can be lifted off the center section by removing two caps at the top of the side frames. The center section can simply be lifted from the truck, there being no bolted connections between them. This construction feature makes this loader especially adapted for mine and tunnel work where it often becomes necessary to move through openings too small to allow the entire machine to pass.



Halby Shoveling Machine

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Asbestos-Protected Metal

Asbestos-protected metal, brief mention of which was made in the Journal of Nov. 8, 1913, consists of steel sheets, of from 18 to 26 gage, immersed hot in melted asphalt, into which long-fiber asbestos is pressed. The asbestos surface is then finished with a waterproofing compound. By this process is developed a material with the strength of steel, but proof against weather, acid fumes and fire. In addition it is a protection against sudden changes of temperature, and in general it is claimed that a building covered with this material will be cheaper to heat in winter and will be cooler in summer than that of ordinary construction. The material is finished in one of three different colors, so that painting is unnecessary, and this expense is avoided.

NEVADA HILLS MINING CO., FAIRVIEW, NEV.

ARMOUR & CO.'S ACID PLANT, CHROME, N. J.,

Its use under two very dissimilar conditions is shown in the accompanying illustration. In the Nevada Hills plant it is used to eliminate interior condensation under trying daily extremes of temperature, while in Armour & Co.'s acid and fertilizer plant at Chrome, N. J., it is used as a protection against acid fumes, both from the plant itself and the nearby metallurgical works; while it also is exposed to the corrosion of moist sea air.

In addition to plain, beaded and corrugated sheets, asbestos-protected metal is furnished in ridge caps, flat flashing, etc. It is made by the Asbestos Protected Metal Co., First National Bank Building, Pittsburgh, Penn.

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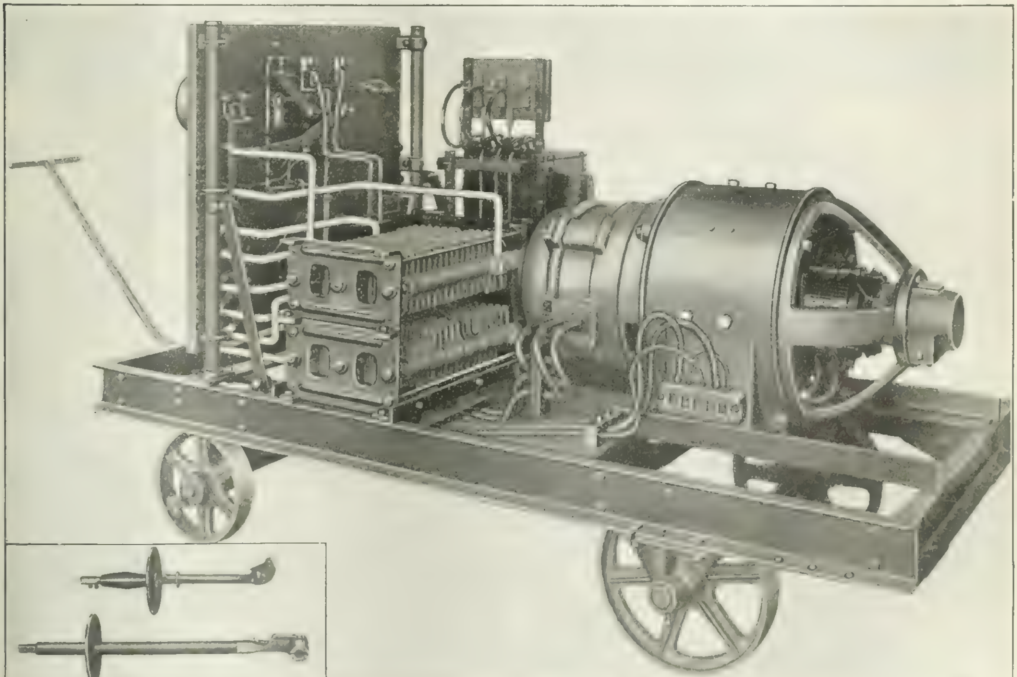
Some Useful Adjuncts to Mining



ARRANGEMENT OF 300-AMP. PORTABLE ARC WELDING EQUIPMENT

Electric-arc welding is being applied to repair work in cutting, joining and building up metals, special apparatus having been developed for this purpose. A portable equipment made by the General Electric Co., of Schenectady, N. Y., is shown in the accompanying illustration. This consists essentially of a driving motor, a welding generator, a main switchboard panel on which is mounted the necessary controlling and indicating apparatus, a face shield for the operator is supplied, and electrode holders shown in the lower left-hand corner of the engraving. The direct-current arc is used, the heat generated at the positive terminal is approximately 75% of the total heat generated in the arc. Either graphite or metallic electrodes may be used.

The Starting o

PANORAMA OF THE PROPERTY OF THE CH

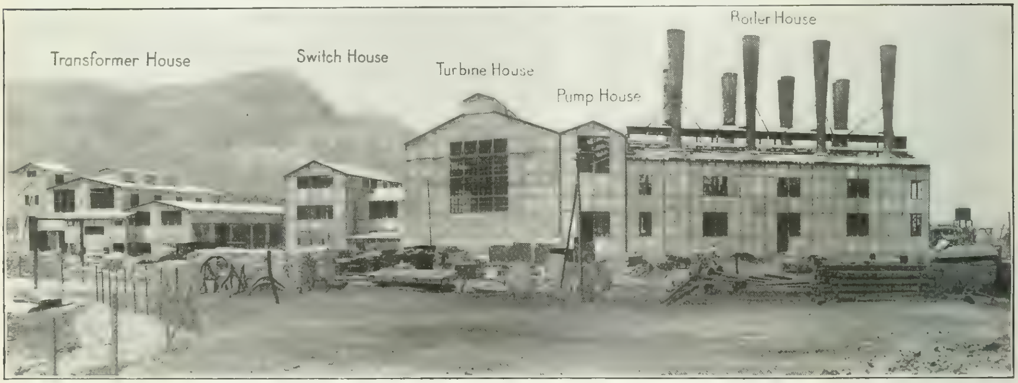
One of the world's great copper mines is at Chuquicamata, in northern Chile, about 90 miles from the coast.
Co. The latest estimates of the company's engineers show a total of 303,000,000 tons of developed ore.
reached, without, by any means, limiting still further possibilities. Roughly speaking, the orebody is a
ore is about 650 ft., but 10 holes have reached a depth of over 1000 ft. and are still in ore. The ore is granodiorite
depth. The above engravings present a continuous pan

Chuquicamata

xploration Co. at Chuquicamata, Chile

wned by the Chile Exploration Co., the operating company, all the stock of which is held by the Chile Copper
mining average of 2% copper, and they believe that indications make certain that 400,000,000 tons will be
000 ft. long and from 500 to 1500 ft wide. It will be mined with steam shovels. The average thickness of the [illegible]
ralized along cleavage planes. The chief copper-bearing mineral is brochantite. Sulphide ore of good grade o[illegible] in
a of the deposit and works of the company at Chuquicamata.

BENCH C, WHERE MINING BEGAN AT CHUQUICAMATA

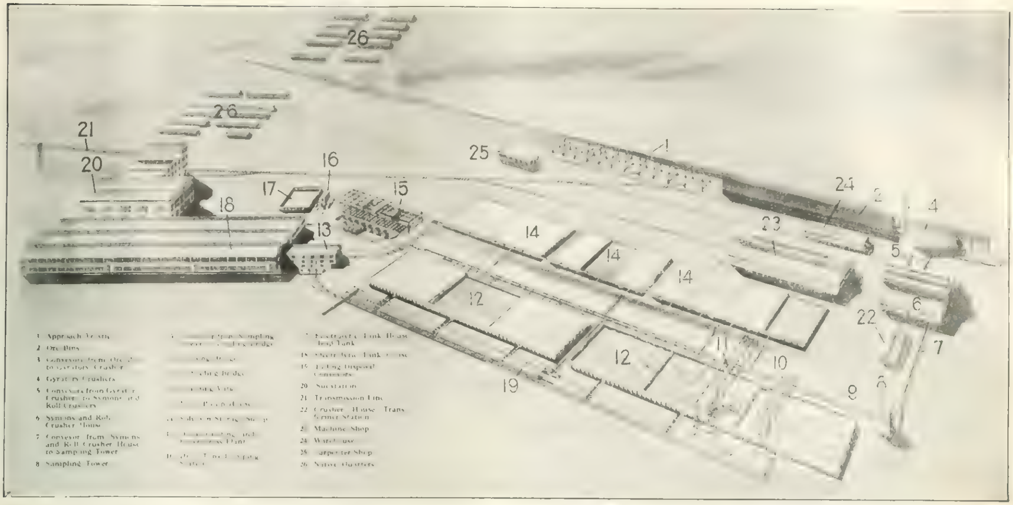


POWER PLANT OF THE CHILE EXPLORATION CO. AT THE PORT OF TOCOPILLA

From this 40,000-kw. power plant on the Pacific Coast power is sent to Chuquicamata, a distance of 86 miles, over a transmission line of No. 000 copper wire. The power plant comprises 16 Babcock & Wilcox water-tube boilers and four Zoelly steam turbines direct-connected to four Siemens generators of 10,000 kw. each. This equipment will give a spare unit of 10,000 kw. above the present power requirements of the reduction plant. At the outbreak of the European war much of the machinery for the power plant was en route on German ships, and this resulted in delay in the delivery of power at Chuquicamata. The power plant is designed so that either coal or oil may be used as fuel. Oil is used at present. The above photograph was taken on Mar. 1, 1915.

TWO VIEWS IN THE SMELTING AND MELTING PLANT AT CHUQUICAMATA

The reverberatory furnaces will be used for melting the cathodes produced in the electrolytic tank house. The cuprous chloride from the dechloridation plant will be smelted in the small blast furnace shown in the right-hand picture. These photographs were taken Mar. 22, 1915.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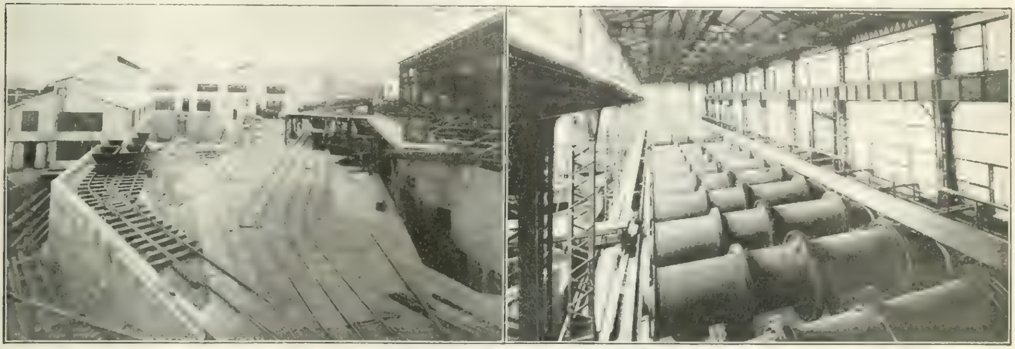
1 Approach Trestle
2 Ore Bins
3 Conveyors from Ore Bins to Gyratory Crusher
4 Gyratory Crushers
5 Conveyors from Gyratory Crushers to Symons and Roll Crushers
6 Symons and Roll Crusher House
7 Conveyor from Symons and Roll Crusher House to Sampling Tower
8 Sampling Tower
17 Electrolytic Tank House Head Tank
18 Electrolytic Tank House
19 Tailing Disposal Conveyors
20 Substation
21 Transmission Line
22 Crusher House Transformer Station
23 Machine Shop
24 Warehouse
25 Carpenter Shop
26 Native Quarters

Leaching Plant of the Chile Exploration Co., Which Started on May 18, 1915

Cable advice was received last week of the formal inauguration of the new leaching plant of the Chile Exploration Co. at Chuquicamata. The machinery was started by President Luco of Chile, who pressed a button at the presidential palace in Santiago, connection having been made over the government telegraph line. The present plant has a leaching capacity of 10,000 tons per day. Briefly, the plant comprises unloading bins, coarse-crushing plant, a fine-crushing plant containing disk crushers and rolls; six concrete leaching tanks, 110x150x16 ft., holding 10,000 tons each, solution tanks; dechlorinating plant, and an electrolytic tank house having a capacity of about 120,000,000 lb. per year.



The Precipitating and Dechlorinating Departments

On the left-hand side of the tracks is the electrolytic tank house; and on the right, the dechlorinating plant. An interior view of the dechlorinating plant is also shown

Two Interior Views in the Electrolytic Tank House at Chuquicamata

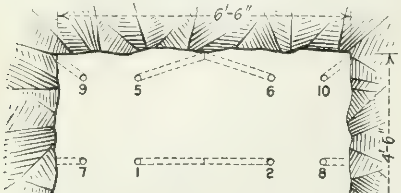
One of these pictures was taken on Sept. 21, 1914, and the other on Jan. 25, 1914. Over 88,000 [illegible] such as the electric crane is placing in the tanks are required for the present plant

Correspondence and Discussion

The Five-Hole Cut

Under "Details of Practical Mining," in the JOURNAL of Mar. 27, H. H. Hodgkinson contributed a description of the old five-hole cut used in raising at Franklin Furnace, N. J. I did not know that the five-hole cut was in use anywhere at this time but supposed that it had been relegated to a dusty attic along with the hoop skirt and the high-wheeled bicycle. However, no one can claim infallibility, and the method may be justified.

Although the nature of the ground was not described, except that it was repeatedly called "soft," his methods and reasons seem questionable. A summary of his contribution reveals that seventeen 6-ft. holes, equivalent to 102 drill-feet, and more than 30 lb. of 50% gelatin are used in breaking only 125 cu.ft. of material where the drilling rate is 16 to 20 ft. per hour.



V-CUT FOR RAISES

In my opinion the shape of the raise, 5x5 ft., should be modified to about 4½x6½ ft. for the following reasons:

1. It will break better because (a) the holes can be pointed to better advantage and (b) the arch of ground in the top of the raise will be weaker because of its greater length.

2. Twelve 6-ft. holes should be sufficient, saving 30% of the drilling cost.

3. A 5-ft. break would represent 146 cu.ft., 21 more then at present (advantageous when in ore, the reverse in waste).

4. The V-cut can be used and 14 lb. of 40% and 6 lb. of 60% gelatin should break 5 ft. or more, saving 30% of the blasting cost.

5. All the fuses may be ignited at the same time, and the less volume of powder gas will clear after a single period of waiting.

6. An opening of much greater economic value results, one having ample room for chute and manway.

7. Increased drilling speed because of greater working room.

The simple V-cut shown in the illustration herewith should break well at Franklin Furnace if the cut holes are so pointed that each one bottoms very close to the bottom of its fellow from the opposite end of the raise. The enormous charges of 50% gelatin now in use would seem to "overbalance" the resistance of the ground, and the object of using a less amount is, of course, with the purpose of exerting the disruptive force at the point of greatest resistance, namely, the bottoms of the holes. Emphasis may again be laid on the importance of heavy detonators and adequate stemming. The Bureau of Mines investigations reveal the fact that the drill holes at Franklin Furnace are not well tamped.*

The accompanying table shows the proper loading for the round:

Hole No.	Gelatin Sticks 40%	Gelatin Sticks 60%	Hole No.	Gelatin Sticks 40%	Gelatin Sticks 60%
1	4	1	8	4	2
2	4	1	9	3	2
3	3	1	10	3	2
4	3	1	11	3	2
5	3	1	12	3	2
6	3	1			
7	4	2	Totals	40	18

In all holes put the 60% gelatin in the bottom.

H. A. MORRISON.

Dedrick, Calif., Apr. 5, 1915.

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Bill McGinty, Prospector—II

Misther Editor—Well, we was stuck siv'ral hours at that Neveria place, Juan conductin' diplomatic relayshuns with the old lady in charge av the mule-waterin' concession jist the same as if it was the State Departmint at Washington an' him the invoy from some place.

Excelsior drifts along an' makes a motion to adjourn for the day, but I files a demurrer on the ground that we had not performed suffishent labor to hold a bed-claim—clinchin' me argymint by cinchin' me saddle.

Jist as the carga mules was ready, Rodrigo shows up with the missin' annymal, givin' away the saycrit av the moonshine still by his invious raymarks to Juan. We got away at 5 o'clock, ridin' hard enough to let Juan work off the iffiects av the grape-juice substitoot, an' continuin' by the light av the stars. As the brief twilight fell we did the same down a cutoff to Rio Chico, leavin' the wagon road entirely. *Chico* manes little, but there was no water at all. The day had been pretty hot, an' the ride in the cool av the evenin' was quite enjyable; but after losin' the trail wance we were glad to camp at Peñoles, near a village av charcoal-burners an' fuchure captains an' colonels.

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*Bureau of Mines, "Bulletin 48," pp. 14-17 inclusive, and "Technical Paper 17."

The water obtained from a tiny pool in the bed av the rocky arroyo luks cloudy an' bad, but tastes cool an' sweet when ye're thirsty. Juan said three Ave Marias an' wan *carramba,* atonin' for a few hundred *carajos.*

In the mornin' I had to crack the ice in me enamel cup to take a drink an' a bath. The prodigal mule ate the balance av her husks an' cornstalks with relish an' competition; an' Excelsior an' I had fried swine bosom an' drank some milk we bought from the guardian av the lean calf that was double-crossed by the chairman av the house committee. Thus I became an innocent acces'ry before the facts that came afterwards. The proud patrishun that gazes contempsh'ly on the horny-handed, sun-burned sons av Moctezuma seldom realizes until too late what the nach'ral cunnin' that replaces book learnin' can do whin it begins to cultivate local patriotism instead av mescal thirst an' the patrishun's cornfields on unequal shares.

Givin' the committee a little more small change for the waterin' privilege an' for helpin' us page the mules, we rode down a beautiful park-like valley called San Xavier, an' then climbed to a broken, well-timbered mesa, which proved to be the Continental Divide in wan av its many twistin's in this region. Thin we follyed the Arenales River north for a while to see that no wan stole it. Whin it completes its grand circle by way av the Santiago to the Nazas it runs theoretically to the Gulf; but what the irrigash'nistas don't steal sinks into the ground in the Laguna district near Torreon.

Stoppin' for lunch jist before leavin' the stream, we were soon j'ined by a felly I had met at the hotel in Durango. He was from a ranch up in Idyho an' had come to Mexico to try dry farmin' an' maybe marry some rich Mexican girl. He got the girl later, but she was about as rich as his tungsten prospect. He was a "full-fledged minin' engineer," as one av' his frinds said, havin' complated a three months' corryspondinse coorse while herdin' sheep. It wud be an insult to ask him to show a sheepskin; but, anyhow, he must have had wan. Havin' heard that I had hoped to do a little prospectin' whin not engaged on business, he was kind enough to j'ine us at lunch an' give me all kinds av cheap advice on how to find a rich mine. I noticed him guardin' his *morral* pretty close, but whin I passed him me box av Flores de Balsa he loosened up an' confided that down the river, near Maguey, he had struck a rich dayposit av tungsten ore. "Luk at that sample, will ye," sez he, pourin' into me hand a lot av steely black scales. "She'll run 85 per cint. metallic tungsten, an' me forchune is made."

I was overwhelmed, indade. Here was me, still wearin' overalls, now an' then, an' there was a young felly about to buy a Ford, op'ry tickets, an' pink socks. Edicayshun is a great thing. I spits on me finger an' picks up a flake av the min'ral, stickin' it on me seegar near the ash. After a few hard puffs I opens me knife an' hold the tip av wan blade close to the ind av the seegar, an' the speck av semi-rejooced min'ral jumps to the knife like a flee to a dog. Then I takes a rock out av me pocket as an excuse for the knife an' begins to peck at it in [illegible] way.

"What have ye there?" says the eddicated felly. Sez I: "'Tis a spicimin I picked up wan day. It has yellow specks in it like it was gold, maybe."

"Have ye tried the final test?" sez he. Says I, "'Tis too small for an assay."

"May the Lord forgive yer ign'rance," sez he. "The final test is to wiggle it in a strong light. If it stays bright an' yellow, 'tis gold; but if it's now ye see it an' now ye don't, 'tis fool's gold."

Sez I: "I understand the last part av the rule, for manny's the gold piece has slipped out av sight av the fool owner."

"Ye're right," sez he. "I've played poker against me own brother an' Hillman's crowd, an' that's why I came out here to prospect."

"Ah," sez I, "'tis the very name I've been tryin' to raymimber. Have ye iver run across a dayposit av *Hillmanite* or menaccynite?"

"I have not," sez he. "Have you? 'Tis rare an' vally'ble."

"Well," sez I, "I saw some not long ago, an' I think ye'll see it yersilf before *mañana* night, but I promise ye that ye'll hear about it whin the final test is made on the spicimins."

BILL MCGINTY.

Brooklyn, N. Y., May 10, 1915.

(Further Reminiscences Feared)

Mine Models Made of Celluloid

In the Apr. 24 issue of the JOURNAL was published my article, "Mine Models Made of Celluloid Sheets." I notice that a serious error was committed in the illustration, in that the drawing, in an important particular, was not reproduced as submitted. The draftsman altered the scheme, to suit himself, by introducing rods which fit through the tabs to hold them in place. This is an absurdity when compared with the method of support as described in the article itself. The method discussed is ample and sufficient to give stability and firmness to the structure, and required no revision or change. Emphasis was purposely laid upon the fact that this type of model needs no "extras" to give it strength and stability, and that in this feature it excels many other types of mine models now in use.

Madison, Wis., Apr. 28, 1915. MARK C. LAKE.

[This mistake occurred through a misinterpretation of notes on the original sketch submitted, and while regrettable, detracts in only a slight degree from the description. The moral is to make drawings so clear that they will not be misunderstood.—EDITOR.]

Heulandite in Oregon

Among some mineral samples sent in for identification I found a specimen of heulandite ($H_4CaAl_2Si_6O_{18} + 3H_2O$). As there is no record of this mineral having been found in Oregon before, I thought it would be interesting to publish this fact.

The mineral was found on Rowe River, one-half mile below Dorena, Lane County, Oregon. It occurred as a cavity lining in basalt.

GRAHAM J. M[illegible].

Eugene, Oregon, May 1, 1915.

Mining Engineers Discuss Recommendations to N. Y. Constitutional Convention

The annual meeting of the New York Section of the American Institute of Mining Engineers was held at Machinery Club, New York, May 19. After the customary reports the following officers were elected for the ensuing year: Chairman, D. H. Browne; vice-chairman, J. H. Janeway; secretary, F. E. Peirce; treasurer, P. A. Mosman.

Following this meeting there was a joint meeting of the New York Section of the American Institute of Mining Engineers and the New York Section of the Mining and Metallurgical Society of America to consider the recommendations which should be made to the New York State Constitutional Convention. A committee of the A. I. M. E. had met several times with representatives of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Chemical Engineers, after the A. I. M. E. had been given power, through its directors, to take such action, and had done considerable work in formulating a plan of action to make certain recommendations to the delegates of the New York State Constitutional Convention. The directors of the Institute had, however, eventually referred the matter to the New York Section, with power to act as a section only.

Arthur S. Tuttle, of the Society of Civil Engineers, gave a general review of the relations that the united committee from the various societies found existed between the engineering profession and the state.

The engineering work of the state amounts to hundreds of millions of dollars per year, and the engineering payroll alone amounts to $6,000,000.

The matter before the meeting for consideration was, briefly, Should the New York Section of the A. I. M. E. join in recommendations to the State Constitutional Convention? The fear was expressed that evil would result to the profession if engineers got into politics. The answer was this was not a movement to inject the engineer into politics but to take engineering matters away from politicians and turn them over to engineers.

J. Parke Channing and B. B. Lawrence had been appointed a committee of representation, without authority, to sit with the other joint committee, and they collaborated with, and approved of the recommendations drawn by, that joint committee. It was the view of some of those present that it resolved itself into a question of the society voting confidence in these two of their members who had given much more time and study to the question than was possible for the average individual member. Mr. Channing disclaimed for himself and Mr. Lawrence any feeling in the matter, regardless of the following vote.

It was pointed out that this was not the first entry of the society into questions of political significance, as demonstrated by the rules for the operations for metal mines which were presented by members for the Government and the decided though unofficial position taken by the societies on the apex question. Mr. Saunders here stated that he was authentically informed that the change in the apex law failed at the last Congress only because the change was not supported officially by the Institute.

After much interesting and illuminating discussion it was voted 25 to 11, and then made unanimous, to join the other engineering societies in this movement, and Messrs Saunders, Channing and Lawrence were continued as a committee for the section, with power to act.

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The Engineering Foundation Organizes

The gift of $250,000 by Ambrose Swazey, the Cleveland telescope builder, "for the benefit of mankind through fostering engineering research" has already been noted in the Journal. Formal organization of the Foundation was carried through on Tuesday, May 25, at the Engineering Societies Building, 29 West 39th St., New York City, by the United Engineering Society, which represents the national organizations of electrical, mining and mechanical engineers, and is acting in coöperation with the national organization of civil engineers, the combined bodies having more than 30,000 members.

There are already on hand a large number of applications from those who wish the use of some of the funds for research work. On account of the number of applications and the incomplete form in which many of them were received, a schedule of requirements with which applicants will have to comply is being drawn up by the following committee, which was appointed to consider the applications: Dr. A. R. Ledoux, past president of the A. I. M. E., chairman; J. Waldo Smith, chief engineer of the Board of Water Supply, Gas and Electricity; Dr M. I. Pupin, professor of electro-mechanics in Columbia University; Dr. Alexander C. Humphreys, president of Stevens Institute of Technology.

The members of the committee were chosen from the board which was selected at yesterday's meeting to administer the trust. Its other members are Edward D. Adams, banker; Gano Dunn, president of the J. G. White Engineering Corporation; Howard Elliott, president of the New York, New Haven & Hartford Railroad; Dr. Charles Warren Hunt, secretary of the American Society of Civil Engineers; Charles E. Scribner, chief engineer of the Western Electric Co.; Jesse M. Smith, past president of the A. S. M. E., and Benjamin B. Thayer, president of the Anaconda Copper Mining Co. The officers of the Foundation are Gano Dunn, chairman; Edward D. Adams, vice-chairman; F. R. Hutton, secretary, and Joseph Struthers, treasurer.

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Ontario Mineral Production for First Quarter of 1915

The total value of the mineral production of Ontario during the first quarter of 1915 amounted to $7,312,370 as compared with $9,484,299 for the corresponding period last year, according to the Bureau of Mines. This total was divided as follows: Silver, $2,488,909; gold, $1,568,013; nickel, $1,496,622; pig iron, $1,158,162; copper, $526,738; iron ore, $50,592; cobalt and nickel oxides, $19,086; cobalt, $3,718. The figures show gains in gold, nickel and iron ore as compared with the first quarter of 1914, but decreases in silver, copper, pig iron, cobalt, and cobalt and nickel oxides.

The gold was mainly the product of the Porcupine camp, where the Hollinger, Dome, McIntyre-Porcupine Porcupine Crown, Vipond, Acme and Mines Leasing companies are now all turning out bullion. In other parts of Ontario the producing mines were Canadian Exploration, Tough-Oakes and Cordova.

The number of mines marketing silver products, whether ore, concentrates or bullion, was 20. One large mine made no shipments during the quarter, and others produced more silver than they sold. Present low prices of silver offer no inducement to increase production, and the shortage of water for power purposes impeded mining and milling operations. Another cause of the falling off is the closing down or partial exhaustion of some properties which formerly produced freely.

The nickel-copper mines are working at high pressure. The Creighton mine is employing 750 men underground, and a seventh furnace is being put in at the Coppercliff smelting plant. At Coniston the Mond Nickel Co. is working every department at full capacity.

The Helen was the only iron mine making shipments during the quarter. The market for pig iron is depressed, and there will be a restricted output until a decided improvement is apparent in the demand.

The war has shut off all exports of cobalt or nickel oxide to the continent of Europe, where these materials, particularly the former, were in demand.

Raymond McCune Arrested

Raymond McCune, who for several years has been exploiting a Peruvian placer, was arrested on May 22 in New York on the charge of using the mails to defraud. The overt act on which the complaint was based was the mailing of a circular of the Peru Gold Placers, Inc., to J. A. Ellegood at the Equitable Building, Wilmington, Del.

Several years ago McCune returned from Peru, where he had been assisting his father in railroad building. He claimed to have found a remarkably rich gold placer and succeeded in interesting some wealthy men in New York, Wilmington, Del., and Springfield, Mass. The Peruvian Exploration Co. was formed, McCune receiving 49% of the stock and $51,000 being put in the treasury with which to make the preliminary examinations. As a result of glowing reports which McCune sent back, the "source of the fabulous wealth of the Incas" was assumed to have been found and the Peruvian Exploration Co., with its modest capital of $100,000, was deemed too small. Accordingly, the property was transferred to an operating company, the Marañon River Placers, Inc., all of the stock of which was held by the Peru Gold Placers, Inc. The directors of the latter company were: David T. Marvel, ex-Judge Supreme Court, Wilmington, Del.; Alexis I. du Pont, E. I. du Pont de Nemours Powder Co., Wilmington, Del.; John J. Raskob, E. I. du Pont de Nemours Powder Co., Wilmington, Del.; William R. Basset, Basset & Co., certified public accountants, New York; Otto R. Hartmann, importer, New York; Charles S. Miller, Miller, Franklin & Co., efficiency engineers, New York; Henry H. Bowman, president, Springfield National Bank, Springfield, Mass. The company was capitalized at $20,000,000 in 4,000,000 shares, 1,200,000 of which were placed in the treasury. On the strength of favorable reports submitted by Raymond McCune and his assistants, C. W. McHenry and A. J. Menard, 150,000 shares of the treasury stock were offered to the public at $2 per share.

Mining engineers generally were skeptical about the great profits estimated for this placer, but not until 1914 did the laymen directors became suspicious that all was not right. They accordingly sent an independent engineer, Frank R. Short, to the property, and as his report did not substantiate the earlier claims for the placer, the directors ordered the drilling discontinued and the equipment sold. The postal authorities here began an investigation, which culminated in McCune's arrest. The hearing has been set for June 12 and McCune released on $20,000 bail, which was furnished by the American Surety Co.

General Appraisers Considering Antimonial Compounds

The status for tariff purposes of antimony oxide or salts of antimony is about to be determined by the Board of General Appraisers. When the present tariff was made effective, the Treasury Department issued orders to collectors of customs to take duty at the rate of 25% ad valorem under the provision for "antimony oxide, salts, and compounds of." In a recent ruling, the board upset this classification, and held that the products are more fitly provided for at 15% ad valorem as "all chemical salts not specially provided for," according to the *Oil, Paint and Drug Reporter.* The Government did not take an appeal, but gave notice that a new test case will be made up, in which it is hoped the contention for the higher rate may be upheld. Meantime, collectors are directed to take the former rate of 25% on all importations.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

BUCKET. Herbert S. Atkinson, East Orange, N. J., assignor to The Hayward Co., New York, N. Y. (U. S. No. 1,138,614; May 11, 1915.)

CALCIUM CARBIDE—Multiple Carbide-Container. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,137,755; May 4, 1915.)

CASTING—Method of and Apparatus for Continuous Casting. Grenville Mellen, East Orange, N. J., assignor to Continuous Casting Corporation, Richmond, Va. (U. S. Nos. 1,139,885 and 1,139,887; May 18, 1915.)

CASTING RODS—Apparatus for Making Rods and Tubes from Plastic Metal. Grenville Mellen, East Orange, N. J., assignor to Continuous Casting Corporation, Richmond, Va. (U. S. No. 1,139,884; May 18, 1915.)

COPPER ELECTROLYSIS—Process of Recovering Metals by Electrolysis. Lawrence Addicks, Douglas, Ariz. (U. S. No. 1,138,921, May 11, 1915.)

CRUSHING Tube Mill. William B. Easton, Chicago, Ill. (U. S. No. 1,139,651; May 18, 1915.)

CRUSHING MILL. James D. Millar, Milwaukee, Wis., assignor to Edward F. McCool, Victor, Colo. (U. S. No. 1,139,790, May 18, 1915.)

DRILL—Rock Drill. William L. Smith, Chicago, Ill. (U. S. No. 1,139,139, May 11, 1915.)

FURNACE HEARTH John H Klepinger, Great Falls, Mont., and Frank R. Corwin, Douglas, Ariz. (U. S. No. 1,140,042 May 18, 1915.)

LADLE SKIMMER Mechanical Ladle Skimmer and Heat Protector Joseph Edward Fazakerley, Pittsfield, Mass. (U. S. No 1,139,960, May 18, 1915.)

MELTING FURNACE Using Oil Fuel William N. Best, New York, N. Y (U S No 1,137,378, Apr. 27, 1915.)

PHOSPHATE—Process of Producing Acid Mono-Calcium Phosphate. Robert Stewart, Logan, Utah. (U. S. No. 1,137,806, May 4, 1915.)

SEPARATOR George Allen Fowler, Miami, Ariz., assignor to Crown Mill Equipment Co., Phoenix, Ariz. (U. S No. 1,138,741 May 11, 1915.)

SMOKE Apparatus for Neutralizing Corrosive Fumes in Gases Thomas E. Murray and Edwin B Ricketts, New York, N. Y (U S No 1,139,053, May 11, 1915.)

STEEL MANUFACTURE. Edward F Ke[illegible], Westmont Borough, Penn (U S No. 1,137,144, Apr. 27 1915.)

SULPHUR GASES Process for Recovering Elemental Sulphur from Sulphur Gases William Fran[illegible] [illegible]eaux and Charles William Renwick, Isabella, Tenn. (U. S. No. 1,140,310, May 18, 1915.)

Editorials

The Situation in Copper

The lull in the buying of copper which began about three weeks ago naturally caused a halt in the advance of price and then a recession from the high mark. No matter how satisfactorily the big producers may have contracted for the delivery of their expected output a long way ahead, there are always many small producers, not only in this country but also in Chile, Japan, and elsewhere, whose affairs are not so fortunately arranged, who are willing to sell for what they can get; and refiners buying cheap raw material are anxious to cover their purchases by sales of refined and in turn are willing to take what they can get.

The small recession in price that has lately been recorded does not indicate a serious turn of the tide, but merely, we think, that the excitement has faded away, which in our opinion is a fortunate development rather than the opposite. A resumption of military buying on a large scale may temporarily stir up things again, but in default of it the market ought to become quiet and steady at a little lower level, pending the development of new governing factors.

As for new governing factors, one may be foreseen certainly. That is increasing production. The mines have gradually been resuming full gait and about the end of June the refineries ought to be getting into step. Later in the year the new Inspiration and Chuquicamata copper will begin to be felt. A market factor whereof the development is earnestly hoped is increase in consumption for peaceful purposes, especially domestic. There are unmistakable signs of the beginning of this, and considering the riches that are coming to the United States it is hard to see how an expansion in our internal business is to be avoided. In so far as the copper trade is concerned, however, it would be better to make a start from a market at 16@17c. than from one that is over 20c., for the former is not an extravagant price and the latter is.

Whatever may happen, the copper producers will have no ground for complaint. They have sold a lot of their 1915 output at better than 18c., which is a very fine price, and they have reason to expect for a long time to receive a price well above what is commonly regarded as a normal average price.

At the close of this week there appear to be signs of a renewed demand for copper and there is a general expectation among producers that the market will rally and go above 19c., which of course remains to be seen.

The Minor Metals

The demand for some of the minor metals has been affected by the war, and the markets are very much disturbed. The most notable instance is antimony, which has gone up to nearly five times its price of a year ago, and is selling at all sorts of fancy prices. At present about all of our supplies are coming from the East—China and Japan—and the quantities are limited. Hungarian antimony is inaccessible. The finer brands, which we usually obtain from Great Britain, are hardly to be had, and the prospects are that their prices will go out of sight altogether. The high prices have led to a movement to utilize ores in America, and arrangements are being discussed to open the gold-antimony mines in Nova Scotia, which were worked some years ago, but without much success.

Nickel has been in strong demand and exports have been large. There has been little change in prices here, though the quotations abroad have advanced.

Aluminum has been quiet, although the considerable quantity imported has been nearly all cut off by embargoes and by demand abroad. Production here has increased and now seems quite able to meet current demands.

Quicksilver has been disturbed and erratic. The supplies coming normally to this market are those originating on the Pacific Coast and in Texas, besides which there are considerable receipts from Mexico which have not been greatly interrupted by the internal troubles of that unhappy country. The domestic production is much smaller than it was a few years ago, and bearing this in mind some of the producers are disposed to hold their output for pretty stiff prices; but when they are actually realized Italian quicksilver has been brought hither and then the market has generally declined again. Other producers would apparently like to see the market maintained on a basis that would not inspire importations, but in this as in all other things the law of supply and demand governs. The entrance of Italy into the war has now altered conditions.

War Notes

Recent military events in Europe have been of much mining and metallurgical interest. The Austro-Germans, pushing the Russians eastward in Galacia, have regained the petroleum wells in the vicinity of Drohobycz, Boryslaw and Potok, south of Przemysl. If they can hold them they will probably be relieved from their shortage of gasoline. The newspapers made much of the taking of Kielce, in Russian Poland, and a copper mine there. The Germans will not get much copper from that mine, which exists but is not of sufficient importance to be known statistically.

The great Austro-German victory in Galicia was apparently due to the massing of extraordinary artillery power and the throwing of millions of shells into the enemy's lines. This indicates how the great battles are to be fought and explains the insatiable demand of the Allies for copper and spelter wherewith to make ammunition. Trenches have heretofore been considered well-nigh impregnable, but if one side can concentrate enough cannon to obliterate the opposite trenches, of course no troops can remain where the ground is being plowed up under their feet.

While the Allies are having to buy so much copper, what are the Germans and Austrians doing for their supply? Communications from our own correspondent in Germany do not indicate any panic over that matter. Reports from other well-informed quarters are to the effect, however, that trolley wires are now being taken down for the sake of their copper, iron being substituted. It ought to be noted moreover, that the huge purchases by the Allies are to a large extent of copper that they anticipate using in the future rather than being a measure of their current requirements.

We have just received the report of the Mansfeld company for 1914. In form and substance this is exactly like its reports for previous years. There are but slight references in it to the war, and to our great surprise the production of copper by this company in 1914 fell a little short of its output in 1913.

The entrance of Italy into the war will simplify the matter of copper shipments from this country by removing one of the neutral countries over which friction has arisen. Now only Sweden and Norway remain. Recent communications by our Scandinavian correspondent indicate that a lively business in smuggling copper into Germany from Sweden and Norway has been going on.

* * *

New High Levels for Spelter

The further rise in spelter this week has brought the ordinary brands of this metal almost to the level of electrolytic copper, something whereof no one dreamed six months ago, and maybe spelter will go higher still. High-grade and intermediate already sell for more than 23c. per lb. This surprising event is due to the military demand—which pays no attention to price. The huge premiums realized for the superior grades of spelter have led many smelters to produce them—by redistillation—and the supply of ordinary brands is diminished correspondingly. The consumption of spelter for peaceful purposes is becoming paralyzed, but has not yet been so checked as to halt the advance in price. It will be interesting to see what will happen when the military buying ceases.

* * *

New York's Mineral Law

In connection with the proposals of the engineers with respect to the drafting of the new constitution for New York a committee was received by Hon. Elihu Root, chairman of the Constitutional Convention. Mr. Root expressed warm sympathy with most of the measures advocated, but pointed out that many of them were properly subjects for legislative action rather than what ought to be incorporated in a constitution.

Among the engineers' proposals there was scarcely anything of direct concern to mining engineers, but Doctor Raymond, in a communication to the board of directors of the A. I. M. E., made an important suggestion, namely, that an effort should now be made to abolish the state's sovereignty in certain minerals, which may conceivably be a cloud upon a title to real estate, and let all mineral deposits belong to the owner of the land, just as they do in most of the other states where the Federal land laws do not prevail, Missouri, for example.

This matter is probably of no great consequence in New York, inasmuch as deposits of gold and silver ore are unlikely to be discovered here; but that is no reason why advantage should not be taken of a good opportunity to eradicate an ancient reservation that is contrary to American ideas.

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A New Step by the A. I. M. E.

A joint meeting of the New York sections of the A. I. M. E. and the M. M. S. A. was held a week ago to consider joining the other engineering societies in an effort to obtain the introduction in a new constitution for the State of New York, now being drafted at Albany, of features desired by engineers. While it was recognized that the program formulated by the other societies is good, the discussion was confined to the advisability of the mining societies joining them. It was recognized, moreover, that while the drafting of a New York constitution is primarily a local matter, it may properly be considered as one of national concern, inasmuch as other states may do the same thing, taking the New York constitution as a model.

The Mining and Metallurgical Society has not yet taken any action, being able to do so only as a whole, not through a section. The board of directors of the A. I. M. E. were in a position to take action by virtue of the recent amendments to the constitution of the Institute, but refused to do so and referred the question to the New York section with authority to act on its own account. Following a spirited debate, the New York section, by a vote of about 28 to 11, determined to go ahead.

This appears to have been a bungled business. The question itself was legitimate and the purpose was commendable. The Institute directors should have said "yes" or "no," we think. To evade the question and leave it to a section creates a bad precedent, which will be a plague hereafter. The right of action that was granted to the New York section will be claimed by other sections, and cannot fairly be refused; and sooner or later some section will take some action that will result in a schism in the Institute.

We surmise that the other big national societies will also have some things of a similar character to think about. If they are going to participate in public affairs they will have to arrange to do so in an orderly, deliberative way.

* * *

Specialization Overdone

So often have we been told that this age is one of specialization that we are beginning to believe it. In some ways we are sorry for it. There is, undoubtedly, such a thing as too much specialization. On the other hand, one may be so broadminded that by increasing the area too much the thickness may be reduced to the danger point. There is a happy medium to be sought in all things, and in nothing more than in mining engineering. Perennially we are regaled with the ancient admonition to skin our knuckles on the rocks and eschew yellow leggings and tall buildings. These advice-distributors fail to take into account the fact that the yellow legged, tall-building dwellers usually have already gained honor through field work, having formerly sufficiently skinned their knuckles and other parts of their bodies. It is not really necessary to maintain a permanently skinned condition to be efficient. The European war demonstrates that it is not necessary actually to point a gun by sight that the targets may be struck. A yellow-legged, unskinned mathematician in a tall building, many miles away, may efficiently direct the pointing of that gun, knowing the range and the carrying power of the explosive he is going to use. So may a mining engineer know many things without being on the spot—and being subject to skinning. Skinned knuckles do not signify the high-class mining engineer, any more than a "cauliflower ear" denotes a fistic champion. Either may be acquired without proficiency. Practice is, of course, an essential to success; but there are other essentials to which attention must also be given. The prospective mining engineer should strive to acquire a diversity of accomplishment. By dint of persistent effort he may even acquire the art of writing grammatically. We should certainly advise him to do so.

BY THE WAY

The grade of the Goldfield Consolidated ores, as shown in the annual reports by the average amount recovered per ton, has fallen from $34.72 for the year ended 1909 to $11.61 for the year 1914. During the same period the total operating costs have been reduced from $9.63 to $6.02. High-grade ore discovered the latter part of last year has raised the average grade of the ore reserve above the average of a year ago. The amount blocked out is about 150,000 tons.

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According to the New York *Evening Post,* N. Cushman, a mine owner, of San Diego, Calif., who returned May 6 on the steamship "Potsdam," said that when he was crossing the German boundary on his way to Rotterdam a search of his effects revealed two maps, which were confiscated. One was a map of Cripple Creek and the other of Hoboken, N. J. Mr. Cushman told the officer who took them that the Hoboken map might be useful, because that was where the German ships landed their passengers, but that he would not be likely to have use for the Cripple Creek map. To this the officer replied: "You never can tell."

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Herewith is a tale that comes vouched for by *Mine, Quarry and Derrick*: "It was on a ranch adjoining the site of the Dingman Well, just after that well had been spudded in and when public interest was becoming marked. At that time we were all optimists and every acre of land in the vicinity was looked upon as potential oil land. I was as keen as any. In discussing with the rancher the possibility of his land covering a huge lake of oil, I got this startling pronouncement from him: 'My G——! You fellas in Calgary is crazy. Why, I've been on this land this 20 years and I've plowed and harrowed every rood of it, and I never seen any signs of oil.'" We rise to remark that we have seen statements much worse than this in alleged "reports" and prospectuses.

⁂

A subscriber to the JOURNAL requests that we publish weekly the quotations for manganese ore. We regret that it is impracticable so to do. The business in manganese ore is done almost entirely in long-time contracts, and what the terms will be cannot be determined until the contract has been negotiated. The negotiations of such contracts occur at rather infrequent intervals, and the terms are generally kept pretty close by the parties concerned. The business in many commodities more important than manganese ore—sulphuric acid, for example—is done in that way. It is impossible for any newspaper to give accurate wholesale quotations on them from week to week. The conditions are totally different from those obtaining in the market for the major metals, wherein there are transactions being made by a great many persons all the time.

⁂

The first requisite of any Safety-First operation is thinking capacity, and the more rapid and efficient the "thinks" are the better will be the results. According to the Cripple Creek *Times-Record,* John Laughlin's quick wit saved his life in the face of an explosion of 86 sticks of dynamite within 20 ft. of him. He lay flat on his stomach and hung his head and shoulders down a winze while the 19 holes went off.

Miners working on the same level of the C. K. & N., where the accident occurred, rushed to Laughlin's rescue when the smoke had cleared away. They were surprised to find him pawing his way out of the mass of rock that almost completely buried him. He walked unassisted to the shaft, rang for the cage and went to the surface. One of his shoes was blown off, the blast having severed his shoe laces.

⁂

Reported in New York

The stockholders of the Anaconda Copper Mining Co. have decided to reduce the number of shares in that company to one-half, the par value of the shares being increased correspondingly. This is a preliminary to the dissolution of the Amalgamated Copper Co., the stockholders of which are to receive Anaconda shares in exchange for their Amalgamated.

⁂

The extraordinary demand for high-grade and intermediate spelters for military purposes has inspired the inquiry whether such spelters are not being required for purposes for which superior grades are not really necessary. Of course the ammunition contractors who buy the spelter know nothing respecting this. They simply comply with the military specifications.

⁂

The evidence in the case of the Minerals Separation vs. Miami Copper Co. over the alleged infringement of flotation patents by the latter was fully presented during the week ended May 15, and last week the case was argued. Everybody is now awaiting the decision of the court with great interest. The evidence submitted in this case is understood to be the most exhaustive of any there has yet been presented in the litigation of the flotation patents.

⁂

The New York Trust Co. brought suit May 21 in the Federal District Court against the Canadian Venezuelan Ore Co., Ltd., and G. Fred Pearson, liquidator, to foreclose the $1,000,000 mortgage which the company had to secure its first-mortgage 15-year 6 per cent. bonds. Interest on the bonds, the complaint states, was defaulted on Jan. 1, 1914, and Jan. 1, 1915, and on Apr. 13 last $911,000 bonds were presented for payment unsuccessfully. The amount of the principal and interest now owing, it is claimed, is $1,118,314.

PERSONALS

R. B. Brinsmade spent April in touring Oaxaca, Mexico, looking for smelting ore.

Paul W. Gaebelein has been made superintendent of the new mill of the Baker Mines Co., of Cornucopia, Oregon.

Thomas Cantley, vice-president and general manager of Nova Scotia Steel Co., is on his way to Petrograd on business for the company.

Kirby Thomas is making examination of the South Lorrain district in the Cobalt region of Ontario; also of properties at Porcupine.

L. E. Plummer, a prominent Ottawa financier, is in Porcupine, Ont., looking over a group of claims in Tisdale township with a view to investment.

Noble W. Pirrie, assayer, of Vancouver, B. C., left that city Apr. 23 to take up a commission as a lieutenant of artillery, for active service in Europe.

C. W. Drysdale, of the Geological Survey of Canada, is expected to spend the field-work season of 1915 in British Columbia, probably in the Lillooet district.

Bradley Stoughton, secretary of the American Institute of Mining Engineers, was present May 21 at the meeting of the Southern California Section in Los Angeles.

E. M. Hamilton arrived from London May, 16, and left New York for San Francisco on the following day. His address will be Room 908, 625 Market St., San Francisco.

Ed. Dedolph, who was engaged in 1913 and 1914 in connection with the electric zinc smelting experiments carried on at McGill University, Montreal, and at Nelson, B. C., has arranged to open an assay office at Kaslo.

Walter W. Barnett, graduate of Colorado School of Mines, 1911, and recently assayer for the Wellington Mines Co., Breckenridge, Colo., has undertaken the duties of engineer and assayer for the Ellamar Mining Co., Ellamar, Alaska.

Myron T. Herrick, ex-governor of Ohio and former ambassador to France, has been in Colorado to attend annual meeting of Yak Mining, Milling & Tunnel Co., of which he is president. He addressed the Denver Chamber of Commerce.

S. Le Fevre, formerly general manager and mining engineer with Witherbee Sherman & Co., Inc., Mineville, N. Y., announces that his services are available as consulting and mining engineer. Permanent address, Forest Glen, Ulster Co., N. Y.; interviews by appointment in New York City.

A. L. Queneau, who has been serving with the Royal Engineers of the British Expeditionary Force since last December, wrote from the front, May 10, that he had just been through three weeks of the severest fighting of the war, but escaped unscathed though many times he thought that the next minute would be his last. Mr. Queneau was in the gas battle, when the French colonial troops suffered so badly and the day was saved by the Canadians. His opinion is that the gas used by the Germans was chlorine.

OBITUARY

Alfred Pels, of the firm of Siegfried Pels, of Hamburg, died on Apr. 2 after a short illness.

George Kopp, who entered the employ of the Quincy Copper Mining Co. when 12 years of age died at Hancock, Mich. last week, aged 52. He was mining captain in charge of work at No. 6 shaft of the Quincy.

John G. Morony died at Butte, Mont., May 23, aged 45 years. He was born in Montana and was interested in many banking and power companies. For several years he was managing director of the Amalgamated Copper Co. He was president of the Daly Trust Co., of Butte.

Andrew J. Reilly, Jr., died at Birmingham, Ala., May 18, aged 56 years. He was well known as a civil and mining engineer in Pennsylvania and Alabama. For a number of years he represented Birmingham in the Alabama State Legislature, where he was particularly active in securing the passage of the child labor bill.

John T. O'Brian, who died at New Orleans, Mar. 10, while on his way to South America, was an engineer and miner in California, but was best known for more than 15 years past in Colombia, where he developed some important mining enterprises. He made extensive explorations in that country and Venezuela, and was widely known and highly respected there.

Pierre Martin died in Paris, France, [illegible]. He was born in France and educated both practically and theoretically as a metallurgist, becoming a member of the firm of Martin Brothers. He devised the method of refining iron and making steel in the openhearth furnace [illegible] the Siemens regenerative gas furnaces. The openhearth process is generally known in Europe as the Siemens-Martin steel process, in contrast to the bessemer or acid converter, and the Thomas-Gilchrist or basic converter process.

Erik Johan Ljungberg, for years past a leader of the Swedish iron industry, died Apr. 5, aged 72 years. Born in the province of Västmanland he learned his profession by work at various iron plants and at the bergschule of Filipstad. He was engaged at various works and in 1875 entered the service of the Stora Kopparbergs Bergslag Aktiebolag, with which he had remained ever since. He rose gradually to have charge of the Domnavfet works; in 1888 he became a director of the company and since 1896 had been managing director. He was instrumental in introducing the concentration of iron ores and the use of the openhearth furnace in Sweden. He was looked up to as the foremost expert in the industry.

SOCIETIES

Colorado School of Mines commencement will occur Friday, May 28, at Golden. Dr. Lucien I. Blake, of Boston, will deliver the main address, having chosen for his subject "Epochs in Science." Following the graduation exercises there will be the usual reception at the Integral Club, a baseball game, and the very formal "Junior Prom."

American Institute of Mining Engineers—The Utah section of the Institute will hold a meeting at Tintic, July 15. To facilitate the work of the Tintic committee, an expression as to what the individual members wish to see has been asked for. It is aimed to procure admission to any of the mines, for any or all members, or to show them the camp in general in automobiles. If members are interested in any particular feature or in any particular mine, they are requested to communicate with J. H. McChrystal, Eureka, Utah, in order to facilitate matters. Walter Fitch is chairman of the committee.

American Mining Congress—The Utah chapter is working to increase its membership, and letters have ben sent to those likely to be interested. Attention is called to the fact that mining is the most important business in Utah. When the mines are active all other kinds of business share in the prosperity; when the mines are shut down or have curtailed their production, or when prospecting and development work are at a standstill, the whole state suffers depression. The Utah chapter has been organized to promote the welfare of mining, and to encourage the development of new properties. It is self governing, and will look after all local matters. The chapter's headquarters are 306 Boston Building, Salt Lake City.

American Institute of Chemical Engineers—This society will hold its annual meeting at San Francisco, Aug. 25 to 28, inclusive. An extensive program has been prepared. According to a tentative schedule the members will leave New York on Aug. 6 and arrive at Los Angeles on the 16, after stopping for several days at Chicago and the Grand Cañon. At Los Angeles there will be excursions and a joint session with the Southern California Section of the American Chemical Society. The party will leave Los Angeles Aug. 19 for San Francisco, taking side trips to points of interest along the route. Aug. 31 the members will leave San Francisco and travel to Portland by steamer, thence to Seattle, Butte and Anaconda. The return to New York includes a visit to Yellowstone Park and a four-day lake trip.

University of Kansas—A professional fraternity "Sigma Gamma Epsilon," devoted to the allied interests of mining, geology and metallurgy has been founded at the University of Kansas. It is proposed to establish chapters in the departments of Geology, Mining and Metallurgy in the leading universities and scientific schools of the United States and Canada. At present there is no such society extant. It is hoped the organization of such a professional fraternity among undergraduate students will promote a greater interest in the broad field of these allied sciences. The social as well as the scientific advancement of its members is provided for. The charter members of the society are: Dr. E. Haworth, State Geologist, Dr. W. E. Twenhofel, Associate Professor of Geology and Paleontology, R. A. Reynolds, H. [illegible] Crum, H. R. Brown, W. E. Rohrer, C. B. Carpenter, G. L. [illegible], S. F. Kelly and G. B. Sammons.

Editorial Correspondence

SAN FRANCISCO—May 21

Iliamna Volcano and an unidentified peak on the west coast of Cook Inlet, Alaska, are in eruption, according to reports brought by the steamer "Alamada" from Seward. Dense clouds of smoke were rolling up from the crater. Four slight earthquakes, accompanied by noise, have been felt at Seward during the last three months, but no shock was felt when the craters became active. Iliamna volcano, on the west coast of Cook Inlet, a peak 12,066 ft. high, has been known as an active volcano since the earliest records of the Spanish and American explorers, but its eruptions never have been violent. The district around Iliamna is virtually uninhabited.

Mount Lassen, the California Volcano, is again in eruption and has emitted such a flood of thick mud that many persons have had narrow escapes from death, and many farmers have virtually been ruined because their lands, formerly fertile, have been covered with from 4 to 6 ft. of "mud." Persistent reports are arriving of a red glow being visible on Lassen at night. The volcano is sending forth volumes of smoke and strong sulphuric fumes. No lava and no ashes are being thrown up, just unending mud. Incandescent ejecta rolling down the mountainside can be observed from Volta, 10 miles from Lassen Peak. The latest eruption means that the explosions are getting down into very hot mass and that the activity is more completely volcanic. Heretofore the ejected fragments blown out by the steam explosions were rarely red-hot.

First-Aid Applied to a case of serious accident at South Eureka mine, in Amador County, recently demonstrated the value of the training received by the class under the tutelage of the U. S. Bureau of Mines about a year ago. The foreman of the mine, T. J. Donovan, was making his rounds through the mine, coming up from the 2300 to the 2000 level, where he pointed out work to be done. His arm came in contact with a live electric wire. Donovan fell to the ground. The power was cut off and an Austrian miner, Mike Radovich, one of the first-aid class, set immediately to apply remedies. His assistants considered the case hopeless, but the Austrian, who had the added experience of army service, persisted, and Donovan's life was saved. Two years ago a like accident occurred at this mine, when scientific first-aid was not practiced, and the victim died from the injury. The teaching of the U. S. Bureau of Mines has been quite generally accepted at the larger mines in California.

DENVER—May 21

Consolidation of the Former Jack Pot and Doctor mining properties years ago brought about litigation of which a remnant has just shown up in a recent decision of the Colorado Supreme Court in reversing a decree of a district court in 1903. In this case, Josiah Winchester sued to recover $50,000 upon a bond executed by Herman Warne, H. L. Shepherd, W. F. Rock and J. Weicher. It is a very complicated case, involving title to 430,000 shares of stock in the Doctor-Jack Pot Mining Co.

Creation of Denver Headquarters for Prospectors in proposed by Theodore F. Van Wagenen, old-time, well-known mining engineer of Denver. Such an office would be supervised by an experienced mining man, familiar with Colorado and willing to devote reasonable investigation to every reported discovery. According to this proposal, professional mining engineers, donating their services and receiving only their cash expenditures, will render preliminary reports on each new prospect, and all properties thus found worthy will be offered to investors with the backing of this quasi clearing house.

Merger of Cripple Creek Mines is common talk. Scarcely had people become familiar with the recent consolidation of the Vindicator and Golden Cycle mining properties and the simultaneous merging of all other Milliken interests with holdings of the United Gold Mines Co., until they were informed that A. E. Carlton, leading factor in both the above deals, has now gone further and is endeavoring to effect a greater merger that will include the Vindicator, Golden Cycle, Cresson, Elkton, United Gold, Findlay and Trail mines and possibly one or two sampling works. At this writing, it is too early to report outcome of negotiations in progress.

Tungsten Purchasers' recent announcement of a substantial rise in the price of ore and concentrate has stimulated search for this metal of interesting physical properties. Among the concerns bidding for these materials are Wolf Tongue Mining Co., Primos Chemical Co., Boulder Tungsten Production Co., Colorado Tungsten Production Co., D. H. Smith, Eugene Stevens, Albert Lee Tungsten Mining Co. and S. D. Furlong. The present price of $8 for 60% WO_3 concentrate is expected to give way to an advance. The Wolf Tongue company carries classified "ads" in mining-camp newspapers offering 2-year leases on blocks of tungsten ground and it has also undertaken development work on company account.

Assessment of Metal-Mining Properties for taxation purpose is subject of criticism by county assessors holding state convention in Denver. Until this year, assessments have been upon a basis that worked injustice to metal miners by favoring agriculturists. It is possible that, in an effort to adjust the taxation burdens fairly, the law-makers in the last legislature went too far in favoring mining; but the probability is strong that this new disturbance was started by the farmers. At any rate, accusation is made that the new law permits the owner of a large, idle group of claims to pay no greater tax than is demanded of a prospector working a single claim. That there may be something really wrong in the law is indicated in the attitude of Assessor Ferril of Teller County (Cripple Creek district) who points out that the assessable valuation in his county has been reduced from $7,000,000 to $3,000,000, a basis that is insufficient to meet revenue demands. Assessors Hicks, of Dolores County, and Culley, of Clear Creek County, both primarily metal-mining regions, also claim shortcomings in the new law.

SALT LAKE CITY—May 21

Dividends Aggregating $394,500 were paid during April by three Park City mines, the Daly-Judge, Silver King Consolidated, and Silver King Coalition, and the Iron Blossom of Tintic.

The Salt Lake Stock & Mining Exchange during April traded in 2,040,603 shares of stock of a value of $463,655, as compared to 1,890,690 shares in March, of a value of $303,051. This is an increase of $160,000.

The Uranium Camps in Dry Valley will be active this summer. The Kearns company will spend $200,000 developing its holdings it is reported. The claims will be patented, and the ore being taken out will be stored until the marketing situation is more satisfactory. A concentrating mill will be installed by the company, probably this summer. H. H. Redd, who is interested in the company, has filed on a number of springs in Dry Valley. The water will be used for the concentration of uranium ores.

A New Producer has been added to the southwestern part of the camp of Bingham, in the Utah Metal & Tunnel Co. This company, which a short time ago completed its tunnel between Bingham and the Tooele side of the range, has produced in a small way from surface workings and through leases. The new ore, which is likely to prove of importance, was found in a raise from the tunnel near the Bingham end. It is a bedded deposit which has been opened for 30 ft. in thickness, with the extent on the strike and dip not determined, all faces being in ore. A car of ore is being shipped daily from material taken out in development. The ore averages 30% lead, 1.5% copper, 11 oz. silver, and 0.25 oz. gold, bringing net smelter returns in excess of $20 a ton. So far 18 cars, or about 900 tons, have been shipped. There is more gold than is usual in Bingham ores, resembling in this respect some of the ore from the adjoining Highland Boy, and Bingham-New Haven properties in this section. The gold is associated with the pyrite, and the ore is entirely sulphide. New assay office equipment has been sent to the property.

SEATTLE—May 20

The First Cleanup of 1915 in the Fairbanks District was brought into that city Apr. 30 from Eva Creek, where it was sluiced out on the Alfred Hendrickson property. Eva Creek is a tributary of Ester Creek. This is a much-sought distinction in the district each year, and Hendrickson was hailed with delight when he brought in his poke. This is only a forerunner of the hundreds of others which will soon begin to "throw gold" and will soon be keeping the assay office furnaces going overtime to melt the first shipment for the outside, which is expected to be made up much earlier this year than last on account of the early breakup on the creeks. The placer mining season in this district is just 23 days ahead of last year, and because of the early start there is not an operator in the Fairbanks country who does not predict a larger production this season than in 1914. More ground is being worked, and while much of the new ground has not been proved up, early returns from the different discoveries indicate that new ground will go a long way to swelling the total. The Tolovana is expected to prove one of the biggest producers of the really new ground. This creek has shown more in the first few months since its discovery than the whole Fairbanks district produced in its first year. Sluicing is general in this district from Hot Springs, Tenderfoot and Circle. On Cleary Creek and Wolf Creek there are seven outfits sluicing and others are expected to start in a few days. On Ester Creek, Hendrickson & Dahl, Webber & Co., Leedy & Stay, George Roy, Sullivan & Olson and a few others are sluicing. On Pedro Creek it is expected two or three outfits will be sluicing within a few days. On Fairbanks Creek a number of small outfits are sluicing now. Old-timers report that with the new ground discovered and being worked and old properties showing up so well, prospects for a prosperous season were never more surely indicated.

ISHPEMING, MICH.—May 22

The Bill Repealing the Holland Law, which provided for separate taxation of mineral rights and reservations, apart from the fee has been signed by Governor Ferris. The bill not only repeals the taxing measure but it provides that the auditor general shall return all sums paid to the state on the enforced sales. The suits brought by Michigan mining companies to secure a determination as to the constitutionality of the old law, and to restrain the state from collecting the taxes on mineral reservations, will be dropped. Taxes that were paid in voluntarily, however, will remain in the state treasury. The state is saved money by the bill as it would cost in the neighborhood of $100,000 for the abstracts required in the auditor general's office. The taxes produced no additional revenue for the state as the valuation of the mineral right was deducted from the previous assessments, when both fee and mineral rights were lumped as the elements of value.

Foreclosure Suit against the Lake Superior Iron & Chemical Co. has been won by the Union Trust Co. of Chicago, and the defendant company must pay the sum of $7,462,851.53 on a specified date, with interest at 6%, in default of which the holdings of the company are to be sold by the special master in chancery appointed. The company was bonded by the Union Trust Co. for $6,000,000 several years ago, and the foreclosure suit was commenced in the fall of 1913. Codefendants with the Lake Superior Iron & Chemical Co. are the Continental & Commercial Trust & Savings bank and Frank H. Jones. The case was not contested by the defendants. The decree provides that any of the parties of the suit may become the purchaser, or purchasers, of the company's property. All bids for the purchase of the property must be accompanied by a certified check for $100,000. The Lake Superior Iron & Chemical Co. has extensive holdings in Michigan and Wisconsin. It has blast furnaces at Newberry, Chocolay and Manistique, in the upper peninsula, Boyne City and Elk Rapids, in the lower peninsula, and at Ashland, in Wisconsin. In addition to the furnaces, the company has large timber holdings in the two states, and an interest in the Yale mine on the Gogebic range. The Boyne City and Newberry plants are the only ones in operation at the present time.

BRAINERD, MINN.—May 22

The 1915 Season on the Cuyuna Range is characterized by activity in stripping at those portions of the range with shallow overburden, and, contrawise, the underground mines with few exceptions are idle, or nearly so. Stripping operations are under way at the Thompson, Armour No. 1, Hill Crest, Rowe, Pennington and Mahnomen properties. Underground development work is going forward at the Croft, Iron Mountain and Brainerd-Cuyuna, while the following properties are shipping: Armour No. 2, Kennedy, Wilcox and Thompson. The idle list includes Cuyuna-Duluth, Cuyuna-Mille Lacs, Adams, Duluth-Brainerd, Barrows and Meacham.

DULUTH—May 22

A New Loading Record was made at the Duluth, Missabe & Northern docks this week. Ten boats were loaded in one 10-hr. shift. The amount of ore which left the pockets totaled 86,000 tons. During the same time 1213 cars were unloaded into the ore pockets. Shipping is quite brisk from the Mesabi range and it is believed that the May shipments will be ahead of last year.

SAN ANTONIO—May 20

American Mine Owners Having Properties in Mexico have been much disturbed over the prospects of practical confiscation through the threatened enforcement [illegible] issued recently, by General Francisco Villa which imposed requirements upon them with which they are unable to comply. Congressman James L. Slayden of San Antonio interested himself, on behalf of a number of his constituents who own mines in that country, to have the decree abrogated or modified. He took the matter up with the Department of State at Washington and is just in receipt of a letter from Robert Lansing, counselor of the Department of State in which he says: "Under date of Apr. 14, 1915, Mr. George C. Carothers, a special representative of the Department of State, was telegraphically instructed to protest against the application of the provisions of this decree to American mine owners. A telegraphic reply has been received from Mr. Carothers saying that he is informed that it is not the intention of the authorities who promulgated this decree to injure legitimate mining industries, but to prevent the purchase of dormant mining property by speculators for profit. Mr. Carothers added that it was his intention to proceed to Chihuahua as soon as possible and discuss with the appropriate authorities the matter of changing or modifying the decree, and he recommended that American mine owners make immediate representations to the Minister of Fomento, in Chihuahua, and procure exemption if justified, as provided in the decree."

TORONTO—May 24

The Establishment of a Copper Refinery in Canada is likely in view of the great demand for shells caused by the war, the orders for which to date given to Canadian manufacturers amount to $154,000,000. Owing to the prevailing high prices for the copper, brass and zinc, all of which required for shell-making purposes have to be imported, the Canadian Government has been considering the question as to whether the manufacture of these metals in Canada would be economically expedient. An expert of the Internal Revenue Department and a professor of McGill University, who were commissioned to go to British Columbia and study the problem, have reported that a bounty of 2c. per lb. on copper would enable a copper-refining plant to be successfully established, and that the cost would speedily be made up by the saving in the price of materials for war orders.

CHRISTIANIA—May 1

Norwegian Nickel Mines at Skjaekerdalen are, it is stated, being unwatered with a view to reopening. They were shut down about 20 yr. ago.

Iron Ore Find in Sweden—A Swedish engineer, Wilh. G. Thisel, has registered a large iron-ore area between Vittangi River and Kunsivaara, probably a continuation of the Svappavara deposit. The ore does not outcrop and the claims are stated to be based solely on magnetometric measurement.

Underground Miners' Restaurant—In the Karl Johan shaft of the Swedish iron mines at Grängesberg, and at a depth of 170 yd., a saloon is being constructed for the sale of refreshments to the men as well as for meals during the usual intervals. The room, which will be about 17 yd. in length by 6½ yd. in breadth, will be lighted and, presumably, warmed by electricity.

An Embargo has been placed by the German military authorities upon certain of the rarer metals, such as tungsten, chrome, vanadium, molybdenum and manganese, used in the manufacture of implements of war. Owners of and dealers in such metals have to give notice to the War Office of their supplies in hand up to Mar. 16 and every three months thereafter under penalty of imprisonment for one year for each contravention.

Christianssand Nickel Refinery—On Jan. 2, 1914, the Christianssand Nickel Refinery, Norway, substituted basic converters for the Garherd and flame furnaces hitherto used. During the year there were smelted 28,521 tons of ore from the Flaadt mine, 2053 tons from the Faerö mine and 1991 tons from Greece. There were produced 955,675 tons matte, refined to 181,353 kg. nickel and 276,798 kg. copper.

No Want of Old Metal—In response to its admonition for economy in saving up scrap metal from which the valuable parts might be extracted for the exigencies of war, the German War Office has been overwhelmed with offers of household implements and even of church bells usable for such purposes. Acknowledging the patriotic interest evinced by all classes of the people, the Minister of War publishes his thanks through the press, at the same time notifying that there will be no lack of old material to draw.

The Mining News

ALASKA

HOT SPRINGS DISTRICT will employ 500 or 600 men this summer and expects to produce more than a million, thereby breaking all previous records.

OUTLOOK IN KOYUKUK is brighter since recent discovery of rich pay by several operators. On No. 4 Below, Hammond River, Nelson & Smith obtained $1632 in single pan of gravel. Their "pickings" for six days averaged more than $1000 per day. Kelly & Grogan, on nearby claim, picked up $4000 in six days. Hastings & Hoosier, on Hoosier Association claim, have found many $100 pans. Wool & Co. on No. 5 Nolan Creek, picked up $500 in one day, and Hansen & Christensen on same creek $600 in one day. The Koyukuk is noted for irregularity of pay and exceeding richness of some spots; it often happens in taking out winter dumps that half of total yield is recovered as nuggets and rich pans before sluicing.

CANYON CREEK (Fairbanks)—E. Canyon has found $1.50 ground at depth of 87 ft. on Cañon Creek, tributary of Healy River.

KENAI RIVER has been decided by government officials to be navigable stream, which means that all people can now mine within 60 ft. of high-water mark, same as on beach.

KNIK QUARTZ MINES, which produced nearly $300,000 in 1914, expect to increase their output this year. Alaska Free Gold produced $153,000 last year, Independence $18,000, and Gold Bullion $125,000.

FAIRBANKS TELEPHONE CO. (Fairbanks)—Fairbanks Telephone Co. plans to extend its line to newly discovered Tolovana district. Line will follow summer trail. Total distance from Fairbanks is 55 miles.

ALASKA GOLD (Juneau)—During April broke 106,986 tons ore and trammed 61,912 tons to oreways. Railroad handled 57,000 tons which mill treated. Construction and equipment of other sections of mill being aggressively pushed.

NO. 2 ABOVE DISCOVERY (Dome Creek, Fairbanks)—New pay running $2 per sq.ft. reported discovered recently by Nerland Bros. on claim No. 2 Above, Dome Creek. Johnson & Co. have also found pay on 6 Below, right-limit bench.

STEVENS-O'CONNOR (Fairbanks)—Stephens, Kleinschmidt & Boyd are mining 16 tons of ore per day from their lease on Stevens-O'Connor property on right limit of Fairbanks Creek. Vein is 12 ft. wide. Ore will be milled at Heilig custom mill.

ELK CREEK (Ruby)—Considerable excitement caused at Ruby by recent strike on Elk Creek, in Lone Mountain district, 27 miles southwest of Poorman. Ground is 50 to 75 ft. to bedrock; O'Connor & O'Melia have obtained pans carrying from 40 to 75c. at bottom of their shaft.

NO. 1 ABOVE (Ester Creek, Fairbanks)—Sluicing in Fairbanks district started by Webber & Co. on No. 1 above Discovery, Ester Creek, on Apr. 11, probably earliest in history of camp. Barker & Hendrickson, on Eva, who started sluicing about same time, made first cleanup of season.

ARIZONA

Cochise County

COPPER QUEEN (Bisbee)—Increased price of copper gained for 6000 employees at mines and smeltery at Douglas average wage increase of 8%.

CALUMET & ARIZONA (Bisbee)—Organization of railway company to connect with New Cornelia completed. Officials include Calumet & Arizona and E. P. & S. W. and Rock Island people. Survey completed. Charles Briggs, president of Calumet & Arizona, is president of new railway company. Bids are asked for construction of railroad 38 miles in length from the railroad at Gila Bend south to point near Ajo. All bids to be in office of general manager John C. Greenway, at Warren, by noon, June 10. Plans, profiles and specifications can be had by applying to R. H. Jones, chief engineer, Gila Bend, Ariz.

Gila County

CHAMPION (Globe)—Col. J. A. Flemming has taken 3-year lease on Champion mine 15 miles from Globe. Property was producer in early days.

INTERNATIONAL SMELTERY (Miami)—No. 1 reverberatory was filled with calcines morning of May 17. In anticipation of matte two stands of converters and one of the two casting receivers are being warmed up.

COLE-GOODWIN (Miami)—Development work shows better results daily. With advent of better equipment and larger working force for which management is now arranging, will probably show up well among copper prospects of this district.

PATRICK P. SULLIVAN, one of well-known mining men in Globe and Miami districts, and his coöwners in group of 22 claims that adjoin Inspiration and Warrior properties are contemplating churn-drilling their ground. They expect to tap Black Warrior ore dipping west.

WARRIOR COPPER (Black Warrior)—Title to property of Warrior Copper cleared and directors of that corporation, together with reorganization committee of old Black Warrior Copper Co., vindicated of all charges of fraud in Superior Court at Globe. Case before courts since early in 1909. Final settlement expected to aid in resumption of activities at Warrior. Property being worked at present under lease to Fisk, Snell & Wilson.

Greenlee County

TWIN PEAKS (Duncan)—E. A. Wayne of El Paso has purchased Twin Peaks property 25 miles northeast of Duncan. David Gough of El Paso is associated with Mr. Wayne. The Gold Strike which adjoins the Twin Peaks is included in transaction.

Maricopa County

PITTSBURGH TUNGSTEN (Cave Creek)—Active development continues on this property north of Cave Creek. Concentrator installation contemplated.

GEORGE U. YOUNG (Phoenix)—Plans to build new reduction mill at his mine, situated 16 miles north of Mesa. Mine is low-grade gold proposition. Present mill and cyanide plant upon property has capacity of 40 tons daily.

Pinal County

A. B. C. (Wooley)—Property being examined for Eastern capitalists who expect to start work in June.

Yavapai County

GRIJALVA (Wickenburg)—Property being sampled. Owing to nature of ore 4-ton samples are being taken.

UNITED VERDE (Clarksville)—Blowing in of new smeltery took place few days ago. Former Senator W. A. Clark, of Montana, was present.

COPPER CHIEF (Jerome)—Has started work on 125-ton cyanide plant, consisting of crushers, ball mill, tube mill, Dorr agitators and thickeners, Oliver filters and Merrill press. Will treat 175,000 tons leached surface ore assaying $10 gold and practically no copper. Plant expected to be in operation in September.

Yuma County

BIG DIPPER (Mohawk)—George W. Norton, who has a bond on the Big Dipper, recently opened up high-grade gold ore.

CALIFORNIA

Amador County

ORIGINAL AMADOR (Amador City)—About 50 property (townsite) owners have been made parties defendant in suit to quiet title. Property is covered by mining locations known as Eclipse, Eclipse Extension and Last Chance quartz mines. Company contends that its mining titles are paramount to townsite titles, but has offered deeds to surface rights which townsite holders are reported to have accepted. So there may be no serious legal contention, residents of the town will remain undisturbed and mining company be enabled to develop and mine orebodies extending beneath town.

ARGONAUT (Jackson)—Preparations being made for deepening shaft to 6000-ft. point. Station has been cut on 3900 level for installation of electric hoist. Shaft is now down 4200-ft. on incline and is deepest inclined excavation on Mother Lode. Coincident with hoist installation, removal and enlargement of 40-stamp mill will be in progress. These improvements were contemplated some time ago, but have been delayed by apex litigation brought by Kennedy Extension. Although case has been appealed to Supreme Court from lower court's decision in favor of Argonaut there is prospect that the matter will be adjusted out of court and save possibility of retrial.

Calaveras County

PIONEER CHIEF (San Andreas)—Preparations being made for installation of machinery and reopening this mine formerly known as Thorn. J. E. King is superintendent.

FINNEGAN EXTENSION & FINNEGAN (Carson Hill)—Both properties taken over by Carson-Calaveras Mining Co. Will add 10 stamps to 10-stamp mill and install cyanide plant. R. H. Toll, superintendent.

Nevada County

UNION HILL (Grass Valley)—Rich shoot of ore encountered in the raise from 800 level. Quartz is 15 in. wide. Second shot broke into volume of water and pumps necessary to clear level before resuming work in raise. This shoot of ore extends from winze in 600 level. Shaft will be deepened to 1200 ft. Expected mill will start at early date.

Shasta County

BRIGHT STAR (Stella)—Sinking shaft to 170-ft. point is in progress. Installation of stamp mill this summer is contemplated.

DELTA CONSOLIDATED (Redding)—Installation of modern stamp mill contemplated at this property on Dog Creek. S. D. Furber is secretary.

OSWALD (Knob)—Andrew Oswald, for many years superintendent of Midas mine in Harrison gulch, has resumed development of property adjoining Midas, located on same vein system.

MOUNTAIN COPPER (Keswick)—Shipment of ores and concentrates to smeltery at Martinez delayed by damage from heavy rains. Bridges, trestles and other surface equipment washed out. Reported that more than 100 in. of rain fell in 36 hours. Storm did great damage in various parts of copper belt.

COLORADO

Boulder County

KEYSTONE (Boulder)—C. A. Staley is reopening this pioneer mine after its inactivity for 12 years by sinking new shaft through old stopes to 400 level and thence through new ground to 600 level.

Dolores County

HIAWATHA (Rico)—Hays & Herron, leasing through Group adit, have opened 10-in. vein assaying 30% lead, 5 oz. gold and 900 oz. silver. First shipment just made to Durango smeltery.

PRO PATRIA (Rico)—Leasers Shelhamer & Batchlor make semiweekly express shipments to Durango of 100 to 200 lb., running about $15 per lb. exclusively in free gold. They save ore from which this stuff is selected and will soon ship carload.

Lake County

ST. LOUIS (Leadville)—During April shipments amounted to 75 tons averaging about $20 per ton.

PENROSE (Leadville)—Water has been lowered 70 ft. in shaft past week by new electric pumps after they were overhauled and somewhat altered to remedy defects that developed in initial runs. Pumps are suspended in separate compartments and are run intermittently, each pump being shut down while its column is lengthened.

Ouray County

CAMP BIRD (Ouray)—During March mine produced 2290 tons ore. Net profit was $36,000 or $15.72 per ton.

San Juan County

KITTIMAC MILL (Eureka)—Several carloads machinery for new mill arrived at Silverton. Will be freighted to mill site as soon as weather conditions permit.

WILFLEY MEARS (Silverton)—Tailings enterprise again under way. Flume which gave them so much trouble last fall in cutting out quickly is to be lined with vitrified tile. This is expected to overcome excessive wear of tailings transported.

AMERICAN OIL FLOTATION CO. (Silverton)—Silver Lake mill, recently leased, is being remodeled under direction of D. L. Thomas to suit oil-flotation process. At Champion mine, on Sultan Mountain, this company is placing property in shape to supply 50 tons of sulphide ore per day to mill.

San Miguel County

TELLURIDE SHIPMENTS OF ORE AND CONCENTRATE during April established a record. Concentrate was shipped from four largest mines in carload lots as follows: Liberty Bell, 11; Tomboy, 50; Smuggler Union, 25; Black Bear, 20. Approximately half the valuable metals in the ores from these mines is recovered by plate amalgamation before concentration.

Teller County

DEAD PINE (Altman)—Dump leasers Powell & Lee, marketing $12-stuff, will install washers.

GOLD DOLLAR (Cripple Creek)—A. J. Campbell, managing Beacon Leasing Co., has opened 4-ft. vein at foot of 127-ft. winze sunk from 1300 level of Mabel M. shaft, on Beacon Hill.

MARY McKINNEY (Anaconda)—Mine is shut down 10 days during installation of new electric-driven compressor that will provide for larger operations. Main shaft will be sunk 200 ft.

BLUE BIRD (Altman)—In Franklin lease, 1500 level, extremely rich sylvanite ore has been found in raise 600 ft. south of main shaft. There are three parallel vuggy streaks in a 5-ft. vein.

AJAX (Victor)—On 400 level, leasers Worthington & Downer have developed 100 ft. along high-grade shoot in supposed hanging wall. Are shipping 10-oz. ore. Shoot is 9 ft. thick. Similar ore also found in 1200 level.

ECONOMIC (Victor)—Tramway and 100-ton orehouse for handling dump at mouth of old Gold Coin adit to railroad point are completed. Estimated that 100,000 tons will be shipped and cyanided.

LAST DOLLAR (Victor)—On 1200 level, leasers Gibbons & Crumby opened 4½ ft. of 3-oz. ore. Hereafter compressed air for drilling in this mine will be piped from Logan mine plant. Main shaft will be sunk from its present depth of 1400 ft.

GOLDEN CYCLE-VINDICATOR (Goldfield)—In both mines leasers are producing heavily. E. Soran is washing a Vindicator dump and marketing fines running 3 to 4 oz. per ton. Company will soon begin erection of $10,000 boarding and club house for employes and officials.

ELKTON (Elkton)—John Sharp maintains shipments of 1-oz. ore from mine dump. Regular 2% quarterly dividend paid on May 24, 1915 distributions of profits amounting to $100,000. To date mine has paid to stockholders $3,547,460. All ore now goes to Golden Cycle mill, Colorado City, for treatment.

IDAHO

Bonner County

KEYSTONE MINES CORPORATION (Sagle)—Three-fourths interest in the Keystone group having 43 patented and unpatented mining claims, acquired by V. D. Williamson, of Spokane. Mine is developed and ore blocked out to 800 level. Large tonnage now available for shipment and milling. Is installing compressor and electric-light plants. Will sink from 800 level, and Brown tunnel now in 1600 ft. will be continued 2000 ft. to intersect vein at point 1600 ft. below apex. When this work is completed company intends to erect concentrator. Sagle camp is situated about six miles north of Blacktail, on Lake Pend Oreille.

KANSAS

J. C. CAMERON (Galena)—Has leased 40 north of Panama mines to Marshall, Moss & Kirkpatrick, who will open up ground and lease it out to miners and do custom work in mill located on land. They expect to run tailings until ground is ready for miners.

PANAMA (Galena)—Is busy on Connor land east of Galena. Has installed pump and will [illegible] boiler and outfit on 40-acre lease on Connor land in [illegible]. There are number of shafts already in ore and company expects to commence taking out ore as soon as [illegible].

OLD CYCLONE (Galena)—Transfer[illegible] & Co. through agency of J. Franklin Smith. [illegible] have been in operation for some time and have been [illegible] best producers in district. New owners will [illegible] plant and install some modern machinery and operate [illegible] on larger scale.

SUFFER LOSS BY CAVE-IN—Much damage was done by a large cave-in on the Land and Arthur [illegible] Front St. and Galena Ave. Two companies lost heavily and were forced to cease operations. The Silver Coin Mining Co. lost nearly all its machinery, which went down with the dirt and waste. The Rohrbough Bros. were more fortunate. They saved their machinery and part of their shaft.

MICHIGAN

Copper

WINONA (Winona)—Will be working full crew and full blast by June 1. Underwatering proceeding rapidly.

SOUTH LAKE (Houghton)—Houghton shareholders are very much opposed to proposed consolidation with Algomah.

ALLOUEZ—(Allouez)—Will not show any loss in month's total copper output because of small accident last week. Rock tonnage is now above normal, making up for this difficulty.

ONONDAGA (Houghton)—Has resumed diamond drill explorations, following satisfactory results secured soon after organization of company. Drilling is in zone of formation which White Pine is operating.

ISLE ROYALE—(Houghton)—Is now furnishing rock for four heads, one at Franklin, one at Tamarack's little mill, and two at Point Mills plant. One head at rebuilding Isle Royale mill will be ready for operation about June 15.

OSCEOLA CONSOLIDATED (Osceola)—Cave-in of ground from surface to fifth levels between Shafts 1 and 2, South Kearsarge branch, did absolutely no underground damage. It was a fall of ground worked in early days of mine and had long been expected.

CALUMET & HECLA (Calumet)—Despite efforts of Manager MacNaughton miners at Calumet & Hecla continue to go ahead with plans for big Calumet celebration of "Dividend Day" June 12. That day concludes week's meeting of state encampment of the Knights Templars of Michigan. MacNaughton is most popular man in state today.

WHITE PINE (Outonegan)—Vein is widening at lower levels and mining problem is not as difficult as formerly. Shafts now are below 1100 ft. point on incline. At beginning shaft went down at an angle of 18° but later was straightened to 38°. It may be some time before there is another shipment of mineral, because of great difficulty in teaming from mine to loading dock. There have been long-continued rains and ordinarily difficult clay-mud road is almost impassable at this season.

Iron

CHAPIN (Iron Mountain)—This now valued at $2,574,602. Ore in stock is estimated to be worth $425,398. Cut in value of real property is considerable.

RICHMOND (Palmer)—Night force has been added here. Regular shipments are now being made from pit. Ore is being shipped by M. A. Hanna Co.

CASTILE (Bessemer)—Preparations being made to mine extension of Anvil orebody found in Eureka mine some months ago. Large electric-driven compressor and other machinery to be purchased. Anvil belongs to Newport Mining Co.

IMPERIAL (Michigamme)—Two No. 6 crushers have been removed from crusher house here. One is being installed at Lake mine at Ishpeming and other at Negaunee at Negaunee. Cleveland-Cliffs Iron Co. has decided to crush almost all of its ore. It is then more in demand by furnaces.

PEWABIC (Iron Mountain)—Part of force here has been laid off and working hours reduced. Most of good ore is exhausted, only low-grade material is now being mined. At one time the Pewabic was the richest mine on the Menominee range. Valuation of mine was reduced this week by state tax commission to $102,129, and stock pile to $134,760.

MONTANA

Deer Lodge County

WASHOE PLANT (Anaconda)—New acid plant put in commission May 17 and will start manufacture of sulphuric acid for use in leaching process. Construction work completed to point where operations can proceed, though not all Gay Lussac towers have been finished. Capacity of the plant is 100 tons of acid per day. Acid will be carried to leaching plant on hill in special tank cars.

Lewis & Clark County

BARNES KING—New mill of company's Piegan Gloster property near Marysville had power turned on May 16 for purpose of trying out new line. Not much can be done until shaft is unwatered which will be done with aid of electric pumps.

Missoula County

MAMMOTH MINING CO.—This company just incorporated at Wallace Idaho, has acquired Lead King group of mines consisting of six claims, located 8 miles northeast of Bonita and 4 miles west of the well known Copper Cliff property in same mineral zone as Garnet and Clinton districts. Development consists of three shafts and several tunnels and open cuts. Orebodies average 25% lead and from 2 to 12 oz. in silver. Vein has been opened distance of 2000 ft.

Park County

BUFFALO-MONTANA (Cooke City)—Planning to ship 100 tons of ore per day during summer. Fifteen auto trucks and trailers have been ordered for hauling ore from Cooke to Gardiner on railroad. Company is taking advantage of recent permission of government to haul ore in autos through Yellowstone park, distance of 63 miles.

Silver Bow County

CORBIN COPPER (Butte)—Owner of Gambrinus claim is trying to sell. Gambrinus is favorably located and carries extension of several of Anaconda company veins, but it is undeveloped and it requires great deal of money to open property.

KING COPPER M. & R.—This Salt Lake corporation has acquired Isele lode mining claim in Summit Valley mining district and has filed its articles of corporation for $50,000, to do a general mining, milling and reduction business. Incorporators are P. S. Keogh et al. of Salt Lake, Utah.

EAST BUTTE (Butte)—Both mine and smeltery now in operation at normal capacity. During suspension one of furnaces was entirely rebuilt and capacity nearly doubled. About 500 men are employed in mine and smeltery. Considerable ore from several independent producers in Butte district being treated.

TIMBER BUTTE MILLING (Butte)—Mill partially closed down for two weeks started again at full capacity. During shut-down which was necessitated by temporary interruption in ore supply from Elm Orlu mine, all machinery in mill was overhauled and necessary repairs made so that plant is again in first-class condition.

BUTTE CENTRAL (Butte)—In suit against this company brought by members of the International Underwriters' Co., report favorable to defendants has been filed in supreme judicial court of Boston, Mass. Property in question is old Ophir mine in southern section of Butte district which in years past has yielded considerable quantities of high-grade silver ore.

BULLWHACKER COPPER (Butte)—Started operations on May 3 after long shut-down; has increased output of mine since opening of Pittsmont smeltery of East Butte mine. Car of ore per day is sent there in addition to from two to three cars a day which go to Washoe smeltery. In view of present high price of copper company decided on mining and shipping ore now and not to wait upon further experiments with leaching process installed at plant.

NEVADA

Esmeralda County

BLUE BULL-NEW GOLDFIELD SIMERONE (Goldfield)—Side-line agreement signed recently. Latter company has three-year lease on block of ground adjoining Simerone, owned by Blue Bull. New Goldfield Simerone gives Blue Bull privilege of working through its shaft, which is to be sunk to 400 level. Oreshoot 100 ft. long, assaying $60 to $100 per ton opened. Much development work on 250 level will be done.

ATLANTA (Goldfield)—Rumor that Merger company will not permit Atlanta company to operate through Merger shaft not taken seriously as Atlanta paid for sinking of shaft from 1330 to 1750 level and installed pumping plant. If necessary, however, Atlanta will install supplementary hoist at winze from 1400 level and work through Grizzly Bear shaft.

MERGER MINES CO. (Goldfield)—Demand by minority stockholders of 200,000 shares Jumbo Extension stock to withdraw suit and cease attack on validity of Velvet claim sale refused. Later report from Seattle states federal court has authorized receiver Johansen to institute suit in any United States court against Geo. Wingfield, Atlanta, Goldfield Consolidated, Jumbo Extension and Clark interests for recovery of Velvet claim, value of ores extracted and damages.

Eureka County

UNION MINES (Union)—Large tonnage zinc-lead-silver ore developed and milling plant will be built, according to statement of general manager Thatcher.

Humboldt County

MOREY vs. STAR PEAK MINING & LEASING CO. and WHITE (Winnemucca)—Suit for recovery of 100,250 shares Star Peak stock instituted.

NEW STRIKES AT WILLARD MADE RECENTLY, extending bounds of known mineralized area. On Sheepherder's Dream claim, one mile north of original Honey Bee strike, shoot 5 ft. wide, assaying $15 in gold opened. Rich strike made by Shea and Pitman south of Shepherder claim. Strikes also made on Trinidad, Enterprise and Ruth claims. Development of ore on Oddie lease continues; on Finlander group, vein opened by cuts every 40 ft. for length of 300 ft.; assays show $22 to $72 per ton.

Mineral County

THORNDYKE-BLEY (Sunland)—Mine and mill sold at sheriff's sale to Walter Trent, of Reno. Large tonnage ore developed in mine and on dumps. Property in Buena Vista mining district.

AURORA (Aurora)—First shipment of cyanide precipitate made recently by parcel post. Total value estimated at $58,000; representing mill run of less than one month. Precipitate will be refined at Goldfield Consolidated plant, Goldfield.

Nye County

TONOPAH SCHOOL OF MINES formally opened Monday, May 2, by Prof. E. R. Bennett. Enrollment of 20 already made. Classes will be held temporarily in old high-school building.

TONOPAH ORE PRODUCTION for week ended May 15 was 10,617 tons, estimated value $217,066 compared with 9871 tons week previous. Producers were Tonopah Belmont, 3537; Tonopah Mining, 3050, Tonopah Extension, 1780, West End, 783, Jim Butler, 1050, Tonopah Merger, 258; North Star, 52; and Halifax, 107 tons.

TONOPAH EXTENSION (Tonopah)—New 10-leaf addition to filter presses being installed; mill capacity will be increased to 275 tons per day. Murray vein stope on 1170 level is 35 ft. wide and good grade.

Storey County

UNITED COMSTOCK PUMPING ASSOCIATION (Virginia)—Reidler pumps at C & C shaft in steady operation.

OVERMAN (Virginia)—On 1200 level the raise from east crosscut carried up 8 ft. to 50-ft point. Top in quartz and porphyry.

SIERRA NEVADA (Virginia)—Jointly with Union Con. continued to alter and retimber winze station on south boundary line and prepare for installation of hoist.

UNION CON. (Virginia)—West crosscut on 2650 level extended 10 ft. making total length 645 ft. Face in porphyry, clay and quartz. Six tons ore sampling $10.26 per ton extracted.

MEXICAN (Virginia City) Broke ore (and stored it) in north drift 123 ft. from northeast drift, 2300 level. Completed installation of ladders, platform, blower pipe and guides in winze from 2500 to 2700 level. Water cleared on 2700 level.

NEW MEXICO

Socorro County

TRI-BULLION SMELTING & DEVELOPMENT (Kelly)—Has succeeded in closing contract for resumption of operations with its immediate neighbor, Ozark Smelting & Mining Co., owned and operated by Sherwin-Williams Co., one of largest and strongest international paint manufacturing companies. Contract covers period of three years, and resumption of operations at properties, New Mexico, whereby above company is to both mine and treat ores upon royalty based upon current prices for spelter. Work was commenced on May 1.

UTAH

Beaver County

IN THE FORTUNA GOLD DISTRICT seven properties are doing work, the Fortuna, Gold Queen, Paymal, Golconda, Fortuna Gold, Mother Lode and Homestead. The Beaver Gold, on the east side of the valley, is to continue its 100-ft. shaft to the 300 level

HORN SILVER (Frisco)—Survey shows new strike to be 180 ft. from King David lines, on two claims of which Horn Silver has taken lease, vein striking in that direction. Frank Clayton lease, expired Apr. 1, is stated to have netted between $10,000 and $15,000.

MOSCOW (Milford)—Electric hoist to be installed to replace one at present using distillate. Electrically driven compressor is in operation, furnishing air for old workings over ridge from new shaft. Hoisting is being done here at present by compressed air instead of by steam.

Juab County

TINTIC ORE SHIPMENTS for week ended May 14 totaled 147 cars, estimated 7350 tons valued at $180,000, compared with 149 cars week previous, heaviest weekly output in many months.

WEST TINTIC MINING (Tintic Junction)—This company has recently been incorporated to develop group of claims near the Scotia.

GEMINI (Eureka)—Electrically driven pumping plant to be overhauled, to permit of unwatering workings below 1600, present water level.

CHIEF CONSOLIDATED (Eureka)—Has located 18 claims in North Tintic, where it is proposed to do exploration work. Vacant ground also acquired in East Tintic where work will be done. Diamond drills will be used.

Salt Lake County

UTAH COPPER (Bingham)—One new unit is working on flotation at Magna mill.

UTAH APEX (Bingham)—Net profits for quarter ended Mar. 31 were $51,106. New body of shipping ore has recently been opened on 700 level. The bonded indebtedness has been reduced to $49,000.

COLUMBUS EXTENSION (Alta)—Stringer of ore carrying gray copper has been opened from raise above tunnel level in what is thought to be Flagstaff fissure. Main tunnel is being driven ahead for Toledo fissure, two shifts working with machine drills, but progress is slow, owing to necessity of timbering.

SECRET MINING & MILLING (Alta)—Owning claims in upper part of Little Cottonwood has increased capitalization from 300,000 to 600,000 shares. Arrangements have been made for a 20-yr. right-of-way through Albion tunnel, 3500 ft. long. Crosscut from this tunnel will enter Secret ground, after 800 ft. of work, and give depth of 1500 ft. Development will be started shortly.

WASATCH MINES (Alta)—Work to be started shortly on new drainage tunnel, which will be driven about 4000 ft. to drain Columbus Consolidated section of this property, 100 ft. below deepest workings. Tunnel will start in southwestern part of former Superior Alta ground, now belonging to Wasatch Mines. Timbering is being done in Flagstaff ground, where recent strike of 5 ft. of silver-lead ore was made. Drifting on oreshoot will be continued. Is thought to be continuation of faulted No. 5 orebody.

Summit County

SILVER KING COALITION (Park City)—A flotation plant is proposed in addition to present mill equipment.

CHILE

BRADEN (Rancagua)—During March, mill treated 80,304 tons of ore averaging 2.01% copper, producing 7043 tons of 15.66% concentrates from which 1261 tons of copper were realized.

AFRICA

Transvaal

GOLD OUTPUT IN APRIL is reported at 744,080 oz. fine, of which 717,225 oz. were from Witwatersrand and 26,855 oz. from outside districts. Total is 9855 oz. less than in March, but 60,203 oz. more than in April, 1914. For four months ended Apr. 30 total production was 2,648,692 oz. in 1914 and 2,889,220 oz. in 1915; an increase of 240,528 oz. this year. Total number of negro laborers employed in Transvaal mines at the end of April was 195,359, an increase of 1904 over March.

The Market Report

Metal Markets

NEW YORK—May 26

Copper was dull and weak, but at the close there seemed to be a good prospect of renewed demand. Tin was dull, uninteresting and stationary. Lead became decidedly stronger, and the leading producer advanced its price. Spelter experienced the craziest week that has ever been recorded up to this time.

Copper, Tin, Lead and Zinc

Copper—The lull in demand continued. The principal producers steadily maintained their asking price from 18¾@19c., regular terms. During the early part of our week of record, when copper was offered from several quarters at material concessions in price, no business was reported done among the principal offices. On Monday and Tuesday some sales, relatively small, were made at 18½c., regular terms. On Wednesday morning some sales were made at the same price, but later a new inquiry developed and the market was quoted stronger, although no business was reported consumated.

The Calumet & Hecla company is reported to be very well sold ahead at 23c. per pound.

Certain domestic consumers who have never used anything heretofore but Lake copper are now said to be considering the use of electrolytic.

Copper Exports from the United States for the week ended May 15 are reported by the Department of Commerce at 11,501,528 lb.; the chief items being 4,539,932 lb. to France, 3,569,890 lb. to England and 3,209,768 lb. to Italy. Imports for the week were 3,704,514 lb. metal and 8,866,485 lb. in ore and matte; 12,570,999 lb. in all, the larger part from Cuba.

Copper Sheets base price 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire, 20c. per lb. at mill, carload lots.

Visible Stocks of Copper in Europe May 15 were: Great Britain, 19.291; France, 2263; afloat from Chile, 1875; afloat from Australia, 4000; total, 27,429 long tons, an increase of 1065 tons over the Apr. 30 report.

Articles of dissolution have been filed with the Secretary of State at Trenton, N. J., by the United Metals Selling Co., which now exists only as a subsidiary of the Anaconda Copper Mining Co.

Tin—Practically nothing was done in this market. The price remains stationary. The deliveries both on the Atlantic and Pacific coasts are large this month, which naturally detracts from interest in the spot market.

Lead—A good inquiry developed from ammunition manufacturers, and on May 25 the A. S. & R. Co. advanced its price to 4.30c., New York. This took most of the other producers by surprise, relatively cheap lead having been offered in considerable tonnages in the St. Louis market right up to the eve of the advance. In the New York market, however, some comparatively small sales had previously been made at 4.25 and 4.30c.

Spelter—The spelter market during the last week of record was the craziest in the history of the metal. Transactions in ordinary brands, of which we had reports, aggregated 14,150 tons, besides which there were large transactions in the superior grades. The buying was mostly by ammunition manufacturers. These manufacturers have extraordinarily lucrative contracts, the profit from which renders the price paid for spelter almost immaterial. The chief thing in their minds appears to be to contract for all the spelter they are going to require in filling their ammunition orders. This has been reflected in the spelter markets of recent weeks, the bulk of the business having been done in contracts for delivery running from August to the end of the year. This condition was more pronounced during the last week of record than in any previous time. The producers have been for a long time well sold ahead, but as each month comes to an end their safety reserve becomes released and available for prompt delivery. Such supplies are peddled out at large premiums, and during the last week upward of 18½c. per lb. was realized for such in the latter part. However, the business for such deliveries was absolutely trifling in comparison with the bulk of the business. It is noteworthy that one large contract running into 1916 was made.

With the crazy market that we had last week, it may almost go without saying that prices were erratic. There were wide variations between sales from the same office, and among sales by different producers, who found it impossible to keep closely posted as to conditions. On Wednesday the business became much less in volume.

Toward the end of the week, sales of brass special spelter for June-July delivery were made at 22c. The price for intermediate spelter was 23@25c., according to grade and time of delivery. High-grade spelter was reported sold at 25c. and upward.

Many of the galvanizers are urging their customers to discontinue the use of galvanized steel. Two or three galvanizers have intimated that they were going to draw the spelter from their pots, and have asked for bids on the same.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
May	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
20	4.7850	49¾	*18.40 @18.50	38	4.20 @4.25	4.10 @4.15	13.75 @15.25
21	4.7806	49¾	*18.30 @18.40	38	4.20 @4.25	4.10 @4.15	14.00 @15.50
22	4.7844	49¾	*18.25 @18.35	38	4.20 @4.30	4.12½ @4.17½	14.00 @16.00
24	4.7850	49¾	18.25 @18.35	38	4.20 @4.30	4.12½ @4.17½	15.50 @17.50
25	4.7844	49⅞	18.25 @18.35	38	4.30	4.17½ @4.22½	17.00 @18.50
26	4.7838	49¾	18.35 @18.55	38	4.30 @4.37½	4.17½ @4.22½	17.50 @19.00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
May	Silver	£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
20	23 9/16	75⅞	16.48	76⅞		160¾	160¾	20 1/16	4.36	70	15.21
21	23 9/16	75¼	16.35	76¼		162¼	162	20 1/16	4.36	71	15.4
22	23 9/16										
24											
25	23⅝	76	16.51	77		164	163¾	20 1/16	4.36	73	15.86
26	23 9/16	76¾	16.67	77¾		162	161½	20¼	4.40	73	15.86

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver, which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound, the following approximate ratios are given, reckoning exchange at $4.86: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.86c. Variations, £1 = 0.21½c.

This will not add greatly to the supply of spelter, but it is a straw showing how the present conditions are annihilating the galvanizing industry.

Zinc Sheets, base price $24 per 100 lb., f.o.b. Peru, Ill, less 8% discount. Usual extras charged.

Exports from Baltimore for the past week included 224,098 lb. spelter and 677,280 lb. zinc dross, all to Liverpool.

METAL EXPORTS AND IMPORTS

Exports and Imports of Metals other than iron and steel in the United States, three months ended Mar. 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons	113,726	81,096	42,293	25,322
Tin, long tons	172	185	11,845	8,787
Lead, short tons	1,775	24,554	5,147	19,129
Zinc, short tons	421	41,681	250	241
Nickel, lb	7,444,694	8,077,564	10,995,349	10,376,456
Antimony, lb	....	109,296	3,724,804	4,554,802
Aluminum, lb	....	17,555	3,982,572	2,618,992
Quicksilver, lb	2,886	103,303	....	....
Platinum, oz	5,293		19,939	4,216

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Exports include reëxports of foreign material. Imports of zinc ore for the three months this year were 14,909 tons, estimated to contain 10,619,466 lb. zinc. No exports of domestic ore were reported. Exports of aluminum in manufactured forms were valued at $275,927 in 1914, and $1,127,337 this year.

Other Metals

NEW YORK—May 26

Aluminum has suddenly developed new activity and a sharp advance in price. Spot lots have been in demand and are now quoted at 24@26c. per lb. for No. 1 ingots. The stock of imported metal here is small. The chief producer is selling on contract as usual, but is not quoting on outside business just now—**Antimony** is very dull. In the absence of business quotations are largely nominal at 34@35c. per lb. for ordinary brands and 40c. per lb. for Cookson's.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is firm, and supplies are only moderate. The Italian Government has placed an embargo on all exports from Italy. New York price is $74 per flask of 75 lb. for large lots, with smaller orders $75@80 per flask. San Francisco price is telegraphed at $65@67.50 per flask, with some dealers holding at $75, supplies being short. London price £11 15s. per flask, with £11 23s. 6d. named from second hands.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there.—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20, per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots. Exports from Baltimore for the past week included 1592 lb. selenium to Rotterdam.

Gold, Silver and Platinum

NEW YORK—May 26

Gold imports in Great Britain four months ended Apr. 30 were £4,280,780; exports, £3,135,461; excess of imports, £1,145,319, against £2,841,656 last year.

Silver the past week has remained almost stationary, the price being for the most time 23$\frac{9}{16}$d. There are some accumulations of silver, sellers feeling that the price is too low and that any large inquiry ought to advance the price materially.

Shipments of silver from London to the East Jan. 1 to May 13, as reported by Messrs Pixley & Abell:

	1914	1915	Decrease
India	£2,772,000	£2,171,000	£601,000
China	40,000	5,000	35,000
Total	£2,812,000	£2,176,000	£636,000

China banks have been selling some silver in Bombay, and are said to be ready to sell more.

Silver imports into Great Britain four months ended Apr. 30 are valued at £3,382,534; exports, £3,175,124; excess of imports, £207,410, which compares with an excess of exports of £1,294,023 last year.

Platinum here remains quiet with little doing and no change in prices. Dealers quote $38@39 per oz. for refined platinum; $42@46 per oz. for hard metal, according to grade.

Late advices from Russia put the total production of platinum in that country in 1914 at 156,775 oz., which is a decrease of 16,867 oz. from 1913. It is understood that about 46,000 oz of crude metal is held by the banks at Ekaterinburg nad Petrograd, on which advances have been made to the producers. Notwithstanding the embargo there is little difficulty in securing permits for export to friendly countries.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 22

Blende, high price, $79; assay base per ton 60% zinc, premium ore $75.50; medium grades $73@70; lower grades down to $62. Calamine, base per ton 40% zinc, $50@44; average, all grades of zinc, $68.94 per ton. Lead, high price $54.50, base $51@52 per ton of 80% metal content; average, all grades of lead, $50.36 per ton.

SHIPMENTS WEEK ENDED MAY 22

	Blende	Calamine	Lead	Values
Totals this week	10,959,220	713,630	2,063,540	$454,320
Totals this year	224,295,430	19,854,320	33,539,410	8,099,690

Blende value, the week, $386,370; 21 weeks, $6,915,790.

Calamine value, the week, $16,000; 21 weeks, $364,810.

Lead value, the week, $51,950; 21 weeks, $819,090.

First shipments were made this week to the Cherokee Zinc Co., at Bruce, Kan., for the firing of four blocks by June 1. Also the Kirk plant at Iola. The name of the company operating the North Pittsburg smeltery is the Joplin Ore & Spelter Co. Buyers worked industriously and quietly all week purchasing ore, and it is estimated over 8000 tons were bought for next week's delivery.

PLATTEVILLE, WIS.—May 22

The base price paid this week for 60% zinc ore was $64@66 per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS WEEK ENDED MAY 22

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,569,760	372,750	767,500
Year	72,204,860	2,718,740	8,919,450

Shipped during week to separating plants, 2,952,190 lb. zinc ore.

Iron Trade Review

NEW YORK—May 26

The iron and steel trades continue to show improvement. The foreign orders received, while somewhat exaggerated by general rumor, are still very considerable, while domestic business is manifestly increasing. An encouraging lift has been given by the orders placed by the Pennsylvania R.R., and other railroads are likely to follow suit.

Structural steel business improves slowly as large building projects seem to hold back. There is, however, a good demand for smaller building material and jobbers report an encouraging demand for bars, nails and other small material. Operation of the mills generally is pretty well up to 75% of capacity and is increasing rather than diminishing.

Pig iron is quiet, but fairly firm, and the rate of production is increasing. Sales of foundry iron have been rather light, but the demand for basic is increasing.

Exports from Baltimore for the week included 384,366 lb. bars, 1,821,108 lb. wire rods, 108,510 lb. skelp steel and 4,316,150 lb. steel billets, all to Liverpool.

Imports at Baltimore for the week included 2250 tons ferromanganese from Great Britain and 3550 tons manganese ore from Brazil.

United States Foreign Trade in Iron and Steel and manufactures thereof, three months ended Mar. 31, as valued by the Department of Commerce:

	1914	1915	Changes
Exports	$53,777,795	$55,509,677	I. $1,731,882
Imports	7,412,747	4,538,047	D. 2,874,700
Excess, exports	$46,365,048	$50,971,630	I. $4,606,582

The larger increases in exports this year were in billets, bars and wire.

PITTSBURGH—May 25

The iron and steel situation shows no material change, except in detail. Steel bookings are about the same as formerly, but a larger proportion is furnished by the export demand, both direct and indirect. The demand for steel rounds for shrapnel and rifles to be made in this country is very heavy. Export barb wire is in less demand, but rods, plain wire and nails show an increase more than making up the difference.

The steel mills have received scarcely any actual orders as yet from car builders for use on the 14,000 freight cars lately ordered by the Pennsylvania, many details as to equipment having to be settled before the formal contracts are placed.

Italy's entrance into the war will probably be followed by increased demand for coal, pig iron and scrap for that country, and there may be demand for war munitions. Italian emigration on a large scale would not materially affect the supply of labor for coke works, blast furnaces or steel works, but might possibly affect the labor supply for construction work, which consumes steel.

Steel prices are being well held in the main. Merchant bars are strong, while shapes are steady and plates continue weak. Wire products are on the basis of 1.55c. for nails, with some shading. Galvanized sheets are advancing sharply, owing to the spelter famine. The leading interest is selling in a limited way on the basis of 3.60c. for 28 gage, but several independents are quoting 4.00c., and still higher prices are predicted. Substitutes are being much discussed, but it is well to recall that in 1901, during the Amalgamated Association's strike against the Steel Corporation, galvanized sheets sold at 5.20c. for 28 gage.

Pig Iron—The market continues rather quiet, but with a firmer undertone. Prices can scarcely go lower, while they could easily advance sharply if once the start were made, as this would undoubtedly bring buyers into the market with a rush. We quote: Bessemer, $13.60; basic, $12.50@12.65; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The English makers recently withdrew their $88 price and now quote $100 at seaboard. Small prompt lots are bringing a trifle less. Consumers are well covered on contracts and are interested chiefly in deliveries, which are gradually increasing.

Steel—Billet and sheet bar deliveries are heavy and demand is considered good, but consumers are so well covered by contracts that market transactions are exceptional. We quote billets at $18.50@19 and sheet bars at $19@19.50, f.o.b. maker's mill, Youngstown, and 50c. higher at maker's mill, Pittsburgh. Rods are $25, Pittsburgh, and firm at that price on account of the continued export demand.

FOREIGN IRON NOTES

The German Iron & Steel Union reports steel production in March at 1,098,273 metric tons, being 152,080 tons more than in February. For the three months ended Mar. 31 the total make of steel was, in metric tons:

	Basic	Acid	Total
Converter	1,525,434	35,716	1,561,150
Openhearth	1,237,571	48,003	1,285,574
Direct castings	84,802	25,890	110,692
Crucible		25,222	25,222
Electric		25,616	25,616
Total	2,847,807	160,447	3,008,254
Total, 1914	4,557,407	189,155	4,746,552

The total decrease from 1914 was 1,738,198 tons, or 38.1%. There were 233 steel works in operation this year.

IRON ORE

Imports and exports of iron ore in the United States three months ended Mar. 31, in long tons:

	1914	1915	Changes
Imports	282,927	242,461	D. 40,466
Exports	14,255	6,521	D. 7,734

Of the imports this year 159,875 tons were from Cuba, 31,043 tons from Sweden and 5193 tons from Spain. Exports were chiefly to Canada.

Imports of manganese ore for the three months were 58,147 tons in 1914, and 10,274 in 1915; decrease, 47,873 tons.

The Interstate Commerce Commission has filed its decision in the application of the Newport Mining Co. and others, who complained of the rate charged from mines on the Marquette, Menominee and Gogebic ranges to the Lake ports of Ashland, Marquette and Escanaba. The rate was formerly 40c. per ton for ore placed on board vessels. In January, 1913, the carriers filed supplementary tariffs separating their charge on ore traffic and applying a 5c. per gross ton additional charge for dock service, but keeping in effect the old rate of 40c. which then applied only for the service of assembling and line haul up to the dockyard. The effect was practically to increase the rate to 45c. The Interstate Commission holds that the rate of 45c. is not excessive and can stand. It is further held that the system of grouping all the mines on one range under a blanket rate to the nearest port does not constitute a discrimination.

British Iron Ore Imports four months ended Apr. 30 were 2,070,224 long tons in 1914, and 1,881,449 in 1915; decrease this year 188,775 tons.

Statistics gathered by the "Marine Review" from the Lake Erie ports show that the amount of ore on Lake Erie docks on May 1 was 6,092,303 gross tons, against 5,920,157 tons in 1914, an increase of 172,146 tons. The total rail shipments from Lake Erie ports to furnaces during the winter season (Dec. 1 to May 1) aggregate 2,315,602 tons. Adding these winter shipments to 22,914,887 tons, the amount shipped to furnaces during the navigation season of 1914, gives 25,230,489 tons as the entire consumption of [illegible] Lake Erie ports during the year ended May 1, [illegible] tons for the previous year.

Of the Lake ore shipments in April only 136,224 tons, or 27%, went to Lake Erie ports.

SAULT STE. MARIE CANAL

The total tonnage passing through the Sault Ste. Marie canals in April was: East bound, 1,090,077; west bound, 344,658; total, 1,434,735 short tons, which compares with 774,520 tons in April, 1914 and 1,905,555 tons in 1913. The number of vessel passages this year was 634, showing an average cargo of 2263 tons. The mineral freights included in the total were: Anthracite, 130,111 tons; bituminous coal, 149,455; iron ore, 111,845; manufactured iron, 8580; copper, 5749 tons; salt, 50,637 bbl. The American canal opened Apr. 17; the Canadian canal Apr. 13, four days earlier.

COKE

Connellsville—The furnace coke market continues very dull. Prompt is $1.50, contract to July 1 about $1.60 and contract to Jan. 1 about $1.75, with scarcely any negotiating. Foundry coke is more active, both for prompt and for contract. Prompt brings $2@2.40 according to grade. Contracts are usually for the twelvemonth beginning July 1, the regular price for recognized standard brands being $2.40, with less-known brands bringing somewhat less.

Coal and Coke Tonnage of Pennsylvania R.R. lines East of Pittsburgh and Erie four months ended April 30, in short tons:

	1914	1915	Changes
Anthracite	3,705,800	3,607,419	D. 98,381
Bituminous	14,967,184	13,203,746	D. 1,763,438
Coke	3,593,030	3,136,262	D. 456,768
Total	22,266,014	19,947,427	D. 2,318,587

The total decrease this year was 10.4%. April was the best month in 1915, the total decrease being only 80,786 tons, or 1.5%, as compared with April last year.

Foreign Fuel Trade of the United States three months ended Mar. 31, as reported by the Department of Commerce in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	567,659	495,734	123	18
Bituminous	2,708,681	1,910,887	350,302	377,476
Coke	206,868	161,457	22,328	11,627
Bunker coal	1,787,123	1,609,894		
Total	5,270,331	4,177,972	372,753	389,121

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The greater part of the trade, both imports and exports is with Canada.

Chemicals

NEW YORK—May 23

The general market is moderately active, and less disturbed than it has been for some time.

Arsenic—The market continues slow but generally steady. Quotations continue around $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is fair and prices are steady. Quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

The Nichols Chemical Co. gives notice that from June 1 the sale of sulphate of copper manufactured by the company will be handled exclusively by the General Chemical Co., as sole selling agent for North America. All inquiries and orders should be directed to the nearest office of the General Chemical Co. from that date.

Nitrate of Soda—Business is good but still a little irregular. Prices are firm and quotations continue about 2.30c. per lb. for all positions this year.

Imports and Exports of Chemicals in the United States, three months ended Mar. 31, in pounds, except for other soda salts of which only values are given.

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	1,299,300	1,538,763		660
Bleach	12,178,005	9,507,579	8,011	132
Potash salts	9,765,710	11,480,543	258,872	19,098
Acetate of lime			14,310,4[illegible]	1,811,267
Copper sulphate			9,494,191	10,564,148
Sodium cyanide		3,580,488		1,161,339
[illegible]	$79,427	$232,922	[illegible]	$9,085

Exports include reexports of foreign merchandise. Potash salts do not include the crude salts used in fertilizer manufacture.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	May [illegible]	June [illegible]	[illegible]
Argenta, Ida.	May 10	June [illegible]	0.001
Belcher, Nev.	May 1	June 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Caledonia, Nev	May 1	June 1	0.05
Cash Boy, Nev.	May 17	June 17	0.01
Cedar Creek, Ida.	[illegible]	[illegible]	0.005
Contact Copper, Mich	May 15		0.50
Crown Point, Nev., post	June 16	July 8	0.15
Diam'field Black Butte, Nev	Ap[illegible]	[illegible]	0.01
Duluth, Ida.	June [illegible]	[illegible] 8	0.001
Emerald, Utah (three insta		[illegible]	0.01
Exchequer, Nev	May 11	[illegible] 1	0.03
Hancock Cons., Mich	[illegible]		1.00
Hancock Cons., Mich	[illegible]		1.00
Houghton, Mich.			1.00
Idaho-Nevada, Ida	[illegible]	June 5	0.002
Idora, Ida	[illegible]	July 2	0.005
Laclede, Ida.	May 24	June 14	0.003
Majestic-Idel Nev	Dec. 1	July 20	0.005
Moonlight, Ida		June 5	0.005
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich	Dec. 1		0.50
New Hope, Ida	May 5	June 2	0.002
North Lake, Mich		June 15	1.00
O. K. Silver, Utah	May 3	June 5	0.0025
Ophir, Nev	June 4	June 25	0.05
Overman, Nev.	May 19	June 8	0.05
Raymond-Illinois, Utah	May 24	June 9	0.005
Raven, Ida.	May 15	June 14	0.0006
Royal, Ida	June 1	July 6	0.0015
Samson, Ida (post.)		June 3	0.002
Selma, Utah	May 29	June 16	0.005
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida.	May 15	June 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Tarbox, Ida	Apr. 26	May 28	0.0025
Tintic Standard, Utah		June 1	0.005
Treasure, Calif			0.05
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Wisconsin, Ida	May 15	June 15	0.003
Yellow Jacket, Nev., (post	June 14	July 8	0.15

Stock Quotations

Sales at auction on Wednesday, May 19, in New York, included: 160 shares Silver Link Mining Co., $10 lot; 7500 shares Horn Silver Mining Co., $475 lot.

COLO SPRINGS May 25 Name of Comp.	Bid	SALT LAKE May 25 Name of Comp.	Bid
Acacia	04⅛	Beck Tunnel	04
Cripple Cr'k Con	01¼	Black Jack	06¼
C. K. & N.	03½	Colorado Mining	10
Doctor Jack Pot.	10¼	Crown Point	01
Elkton Con	.42	Daly-Judge	5.25
El Paso	1.03	Gold Chain	10
Findlay	.04	Grand Central	50
Gold Dollar	.02½	Iron Blossom	71
Gold Sovereign	04½	Little Bell	15
Golden Cycle	1.70	Lower Mammoth	04
Isabella	18¼	Mason Valley	2.00
Jack Pot	06¼	May Day	15¼
Jennie Sample	‡ 02	Opohongo	01
Jerry Johnson	04	Prince Con	40¼
Lexington	‡ 008	Seven Troughs	01½
Mary McKinney	37	Silver King Coal'n	3.05
Pharmacist	01¼	Silver King Con	1.87½
Portland	1.40	Sioux Con	02
Raven B. H.	03	Uncle Sam	04½
Vindicator	1.64	Yankee	02

TORONTO			May 25
Bailey	02	Dome Exten	08½
Coniagas	‡ 01½	Foley O'Brien	30
Peterson Lake	24	Hollinger	25.00
Right of Way	03½	Imperial	06¼
Seneca Superior	1.25	Jupiter	10
Silver Queen	01	McIntyre	42
T. & Hudson Bay	0.00	Pearl Lake	01
Timiskaming	34	Porcu. Crown	80
Wettlaufer-Lor	04	Preston E. D.	02
Big Dome	4.25	Rea	‡ 10

SAN FRANCISCO			May 25
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡ 04	Belmont	4.30
Andes	05	Jim Butler	81
Belcher	‡ 13	Lone Star	07
Best & Belcher	05	MacNamara	03
Caledonia	20	Midway	16
Challenge Con	‡ 06	Mont.-Tonopah	33
Confidence	08	North Star	16
Con. Virginia	10	Rescue Eula	11
Gould & Curry	02	West End Con	71
Hale & Norcross	03	Atlanta	4
Julia	‡ 01	Booth	[illegible]
Mexican	2	C. O. D. Con	4
Occidental	[illegible]	Comb. Frac.	[illegible]
Ophir	07	[illegible] Extension	1 [illegible]
Overman	07	Pitts. Silver Peak	[illegible]
Potosi	‡ 01	Round Mountain	44
Savage	02	Sandstorm Kendall	[illegible]
Sierra Nevada	08	Silver Pick	08
Union Con	16	Central Eureka	14
Yellow Jacket	30	So. Eureka	‡2.[illegible]

N. Y. EXCH. May 25 Name of Comp.	Clg.
Amalgamated	65⅞
Am. Sm. & Ref., com	65⅛
Am. Sm. & Ref., pf	102¼
Am. Sm. Sec., pf. B.	‡80
Anaconda	31⅞
Batopilas Min	1¼
Bethlehem Steel	139
Bethlehem Steel, pf	112
Chino	44¼
Colo. Fuel & Iron	30
Federal M. & S., pf	28½
Great Nor., ore., ctf	31½
Guggen. Exp.	59⅜
Homestake	117¼
Inspiration Con.	29½
Mex. Petroleum	69
Miami Copper	25
Nat'l Lead, com.	60⅜
National Lead, pf.	108¼
Nev. Consol.	14⅜
Ontario Min	3
Quicksilver, pf.	.75
Ray Con.	23½
Republic I&S, com	28¼
Republic I&S, pf.	84½
SlossShefff'd, com	33
Tennessee Copper	33¼
Utah Copper	65
U. S. Steel, com.	54⅛
U. S. Steel, pf.	106⅛

N. Y. CURB May 25 Name of Comp.	Clg.
Alaska Juneau, w.i.	13½
Alta Con	88
Beaver Con	35
Big Four	07
Blue Bell	03
Braden Copper	7¼
Buffalo Mines	⅞
Can. Cop. Corpn.	‡1 15/16
Can. G. & S.	.03½
Caribou	.48
Cashboy	.09
Chambers Ferland	.17
Con. Ariz. Sm.	.75
Con. Coppermines	‡1¾
Davis-Daly	.99
Diam'field-Daisy	.07
Dia. Black B.	.04
Florence	.54
Goldfield Con	1½
Goldfield Merger	.25
Greene Cananea	28
Kerr Lake	4⅜
La Rose	.56
McKinley-Dar-Sa	28
Mines of Am	2⅜
Nevada Hills	23
New Utah Bingham	2
Nipissing Mines	5¼
Ohio Copper	2[illegible]
Oro	08½
South Utah	‡⅜
Stand'd Oil of N.J.	396
Standard S. L.	1½
Stewart	1¾
Tonopah	7⅛
Tonopah Ex.	3⅜
Tonopah Merger	.38
Tribullion	⅜
Tularosa	.18¼
West End Ex	04
Yukon Gold	2¼

LONDON			May 14
Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	15	3
Camp Bird	0	6	3
El Oro	0	8	0
Esperanza	0	8	3
Mexico Mines	3	17	6
Oroville	0	12	3
Santa Gert'dis	0	7	6
Tomboy	1	4	3
Tough Oakes	0	14	6

BOSTON EXCH May 25 Name of Comp.	Clg.
Adventure	3
Ahmeek	280
Alaska Gold M	35
Algomah	3
Allouez	54½
Am. Zinc	46⅞
Ariz. Com., ctfs	7⅜
Bonanza	35
Butte-Balaklava	3
Butte & Superior	70¼
Calumet & Ariz	67
Calumet & Hecla	585
Centennial	18½
Cliff	1½
Copper Range	51½
Daly West	3
East Butte	11½
Franklin	10
Granby	81
Hancock	21½
Hedley	28
Helvetia	70
Indiana	6½
Island Cr'k, com.	43
Island Cr'k, pfd.	88
Isle Royale	27½
Keweenaw	2¼
Lake	13½
La Salle	6
Mass	14
Mayflower	5
Michigan	1
Mohawk	72¼
New Arcadian	9½
North Butte	31¾
North Lake	2¼
Ojibway	2¼
Old Colony	4½
Old Dominion	53¼
Osceola	80¼
Quincy	87¼
Santa Fe	2¼
Shannon	8¼
Shattuck-Ariz.	26½
Superior	29
Superior & Bost.	3¼
Tamarack	35
Trinity	5¼
Tuolumne	40
U. S. Smelting	37
U. S. Smelt'g, pf.	45
Utah Apex	2¼
Utah Con	12
Victoria	3
Winona	4
Wolverine	57
Wyandot	1¼

BOSTON CURB May 25 Name of Comp.	Bid
Alvarado	[illegible]
Bingham Mines	6
Boston Ely	32
Butte & Lon'n Dev	.17
Calaveras	1⅛
Calumet-Corbin	10
Chief Con	.78
Corbin	.90
Cortez	20
Crown Reserve	75
Eagle & Blue Bell	1 1/16
First Nat. Cop	2 3/16
Houghton Copper	4
Iron Cap Cop., pf	5
Majestic	53
Mexican Metals	15
Nevada-Douglas	65
New Baltic	4
Oneco	1½
Raven Copper	10
Smokey Dev.	30
So. Lake	6½
Tonopah Victor	31
Trethewey	14
United Verde Ext	4

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1913	New York 1914	New York 1915	London 1913	London 1914	London 1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175		27.825	26.704	
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290	...	27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1914	New York Electrolytic 1915	London Standard 1914	London Standard 1915	London Best Selected 1914	London Best Selected 1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99		63.182		67.786	.....
June	13.603		61.336		66.274	....
July	13.223		60.540		64.955	....
August	*		‡		‡	.....
September	*		‡		‡	.....
October	*		‡		‡	....
November	11.739		53.227		*	....
December	12.801		56.841		*	....
Year						

TIN

Month	New York 1914	New York 1915	London 1914	London 1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360		150.702	......
June	30.577		138.321	......
July	31.707		142.517	......
August	*		‡	......
September	32.675		‡	......
October	30.284		‡	......
November	33.304		139.391	......
December	33.601		147.102	....
Av. year	34.301			

LEAD

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900		3.808		18.503	.....
June	3.900		3.810		19.411	.....
July	3.891		3.738		19.051	.....
August	3.875		3.715		‡	.....
September	3.828		3.658	...	‡	.....
October	3.528		3.384		‡	.....
November	3.683		3.585		18.500	.....
December	3.800		3.662		19.097	....
Year	3.862		3.737			

SPELTER

Month	New York 1914	New York 1915	St. Louis 1914	St. Louis 1915	London 1914	London 1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.9[illegible]	9.837	21.569	49.888
May	5.074	.....	4.924	.....	21.393	....
June	5.000	.....	4.850	......	21.345	....
July	4.920	...	4.770	....	21.568	....
August	5.568	...	5.418		‡	...
September	5.380	..	5.230		‡	....
October	4.909	...	4.750		‡	....
November	5.112	...	4.962		25.016	....
December	5.592	...	5.430		27.369	...
Year	5.213	......	5.061			....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer 1914	Bessemer 1915	Basic 1914	Basic 1915	No. 2 Foundry 1914	No. 2 Foundry 1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.9[illegible]	13.45	14.13	13.95
May	14.90		13.90		14.27	...
June	14.90		13.90		13.96	....
July	14.90		13.90		13.90	....
August	14.90		13.90		14.08	....
September	14.90		13.90		14.03	....
October	14.84		13.75		13.97	...
November	14.59		13.43		13.83	.
December	14.70		13.45		13.83	...
Year	$14.88		$13.78	......	$14.01	.....

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Concentrating Plant of the Moose Mountain, Ltd.

By B. B. Hood*

SYNOPSIS—A description of the milling methods at what is probably the largest known magnetic-iron deposit. The ores are tough and some difficulties are encountered in crushing them. Belt conveyors are used to minimize transportation costs. Magnetic separators of the Ball-Norton type are used. The mill is operated by electric power purchased under contract.

Because of the decreasing supply of high-grade hematite more attention is being paid to magnetite as a source of supply for blast furnaces. There are a number of magnetic iron-ore deposits in the world, but in all probability the Moose Mountain, Ltd., operating at Sellwood, Ont., is mining the largest one known. Sellwood is at the end of a 5-mile spur from the main line of the Canadian Northern R.R., and is 35 miles nearly due north of Sudbury, Ont. It is about 80 miles by railroad from Key Harbor, on Georgian Bay, from which point the ore is carried in lake steamers. From magnetometric surveys conducted by the Canadian Government it has been computed that a reserve of more than 150,000,000 tons of magnetic iron ore has been outlined.

Division of Ore Classes

There are two classes of ore, locally known as types No. 1 and No. 2. The No. 1 ores consist of coarse-grained magnetite, associated, but not intimately mixed, with epidote, hornblende and pyroxene. The No. 2 ores have a fine texture, and the magnetite is intimately associated with silica. The banded structure of these ores suggests sedimentary origin.

The No. 2 ores are far more plentiful than the No. 1, but their preparation for market on a commercial basis is a problem, so that a relatively small amount has been shipped to the furnaces. The No. 1 ores are rather easily concentrated and have been on the market since 1909. While conditions vary, the No. 1 plant may be said to concentrate three tons of ore into two tons of salable product. The accompanying analysis is typical of the concentrates when ready for shipment. They have been crushed to pass the equivalent of 1¼-in. screens and have been passed over 8-mesh screens, the product meeting blast-furnace requirements. They are classed with the nonbessemer Mesabi iron ores.

The No. 1 mill has a maximum capacity of about 1500 long tons of ore per 24 hr. It is near the shaft from which most of the No. 1 ore has been taken. This deposit is nearly vertical and has been mined on such a scale that there is now an open pit about 100 ft. deep, 60 ft. wide and 250 ft. long. The ore is broken from benches into three mill holes, trammed underground to the shaft and hoisted to the mine-ore bins. The accompanying diagram shows a flow sheet of the mill as it was being operated in June, 1914, while testing on

Concentrating Plant of the Moose Mountain, Ltd., Sellwood, Ont.

ANALYSIS OF CONCENTRATES

	Per Cent		Per Cent
Fe	[illegible]	MgO	2.61
SiO_2	13.94	CaO	[illegible]
Al_2O_3	1.90	S	[illegible]
[illegible]	0.06	P	[illegible]

Ore Tough and Hard to Crush

Milling this ore is practically a crushing proposition and the "pyramid" system has been adopted after numerous changes. The ore is tough and hard and has a pronounced tendency to break into slabs. The [illegible] screen readily, so are returned as oversize, tending to overload the oversize-handling part of the mill.

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*Former superintendent, Moose Mountain concentrating plant, Sellwood, Ont.

The accompanying photograph shows the mill and town of Sellwood. In front of the mill is the headframe over the shaft. The openpit is just to the right of the picture. Near the center is an old boiler plant, which has since been dismantled, and to the right and back of this are the rock, middlings, dust, and ore bins. The latter are used during the shipping season. A double-track spur runs between them. A conveyor running back toward the town was used at one time for rock, but is now idle. The outer end of the stockpile conveyor is a temporary structure built upon the pile to facilitate the necessary extensions. It was moved about 20 ft. at a time. It shows the effect of settling due to melting of snow in the pile.

The No. 8 Austin crusher referred to in Fig. 1 is not satisfactory for the work, and is only run when it is necessary to make repairs on the Farrel crusher. The first difficulty is that the three openings into the No. 8 crusher will not admit the larger pieces of ore sent up from the mine, while the 36x24-in. machine will take most of them. In addition it is hard to get manganese-steel mantles that will stand the heavy crushing strains. Two of them split before they were worn. The nut holding them down on the shaft was too light and stripped its thread a number of times. It was also caught by large pieces of ore, so that it had to be closely watched to prevent loosening.

Both this crusher and the Farrel machine are belted from a jackshaft which is driven by a 150-hp. motor. Only one crusher is run at a time, the belts of the other being thrown off. The jaw crusher is more satisfactory and gives little trouble. Running at a speed of 250 r.p.m. causes the pitman bearing to overheat unless a spray of water is kept playing upon it. Decreasing the speed to 180 r.p.m., or else supporting the weight of the pitman by a spring, would be as effective as the water spray. Before shutting down the mill in June, which was done on account of the poor iron market, a spring was ordered, but was not installed. If the crusher is adjusted with less than a 4-in. opening at the bottom of the jaws the angle of nip becomes too large; so the opening is usually left a little larger.

Belt-Conveyor Systems

After going through these crushers the ore is fed to a 36-in. belt conveyor running on an incline of approximately 20°. This conveyor carries it to the top of the mill building. A 36-in. Balata belt was tried on this conveyor, but did not prove as satisfactory as the rubber belts. The latter have a $\frac{3}{16}$-in. rubber facing on the top side and $\frac{1}{16}$-in. on the under side. It discharges either into one of two bins or upon a cross-conveyor, which discharges into either of two other bins. These bins hold about 150 tons each, are of wooden construction and discharge into the crushers below through short chutes.

The daily capacity of the mill is limited by the capacity of the No. 5 Austin and three No. 4 McCully crushers, which are set up as closely as possible. They may be said to be doing well when crushing 25 tons of ore per hr. It is usually necessary to be repairing one of these crushers, so that it is safe to count on only three of the four being available at any time. The McCully crushers are driven by [illegible]-hp. motors, and the Austin by a 50-hp. motor. The crushers handle the tough ore well, but trouble is caused by pieces of steel from the mine getting into them. No satisfactory way has been found to utilize magnets to pick these pieces of steel from the ore; consequently the men feeding the crushers have to be on the lookout for them. It is possible that the crushers are a little large for the screens which follow them, which are all revolving, 46 in. in diameter by 6 ft. long, $\frac{1}{4}$-in. steel plate perforated with $1\frac{3}{8}$-in. round holes. The oversize from the screens is about 50% of the discharge from the crushers when they are set up as closely as possible. Sometimes conditions are such that the screens return considerably more than 50% in oversize.

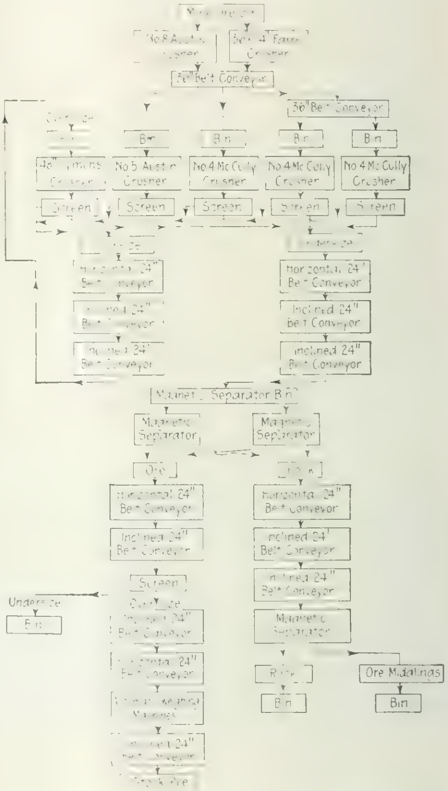

FIG. 1. FLOW SHEET OF MOOSE MOUNTAIN MILL

Rolls Gave Unsatisfactory Service

For a while the oversize from these screens was elevated by a chain bucket elevator to a set of 36x14-in. spring rolls. This did not prove satisfactory, as the rolls would give entirely too much oversize on a $1\frac{3}{8}$-in. screen when set to nip the largest piece that would come through the crushers. If the rolls were set closer, these pieces would not be nipped and would soon block the feed. At the time of shutting down the mill last June preparations were being made to screen the oversize again over a revolving screen having 2-in. holes. The undersize was to be fed to the rolls, while the oversize was to go to the Symons crusher. This would allow the rolls to be adjusted so that a large percentage of their product would go through the 1⅜-in. screen.

After the use of rolls was discontinued, the oversize was elevated on belt conveyors running on slopes of about 20°. With the exception of the 36-in. belts previously referred to, all conveyor belts in the mill are 24 in. wide and have a ⅛-in. rubber facing on the wearing side. The oversize is discharged into a bin feeding the 48-in. Symons disk crusher. This crusher is driven by two motors—a 30-hp. and a 50-hp. which have not sufficient torque to start the crusher in cold weather; but after it is once going they prove satisfactory. This crusher will handle 50 tons of oversize per hr. without any trouble when the disks are set 7/16 in. apart at the closest place. The screen following it is similar to the others and will return about 25% oversize to the crusher. This crusher withstands remarkably well the destructive action of the steel that gets into it. Never has any part of importance been broken, since the crusher will come to a standstill with the motor fuses blown before breaking. I saw a 2-in. hexagonal nut, fed in with the ore, that had been flattened into wedge shape, with the thinnest part only ⅝ in. thick. When steel does get into this crusher it is usually wedged so tightly that it requires hard work to get it out. It is customary to keep a man watching the feed to pick out steel. The wear and repairs on the crusher were small. It makes not over 15% more dust than the gyratory crushers.

THE MAGNETIC SEPARATORS

The undersize from the revolving screens is sent to the separator bins. Each of the magnetic separators has a capacity of 60 tons of ore per 24 hr. They are a modification of the Ball-Norton type, as illustrated in Fig. 2. A base drum revolves about a series of fixed magnets and carries a 24-in. rubber-belt conveyor on which the ore is fed. Each of the magnets extends parallel to the axes and across the face of the drum. They are so wound that opposite poles are adjacent to one another. The nonmagnetic rock is quickly discharged from the belt, while the ore containing magnetite adheres and is carried over as concentrates. The alternate polarity of adjacent magnets causes the magnetic particles to roll over and over when they pass the alternate poles, thus allowing rock which may have been buried under pieces of magnetite to be freed. Twenty-one amperes at 120 volts is the current required to energize each of the separators. A belted motor-generator set is used to supply the necessary direct current. A man stationed at these separators keeps the feed regulated to a uniform depth of about 1½ in. on the belts. The whole concentration is satisfactorily made here in one step by a simple machine. On ore finer than ¼ in. these machines do not separate as cleanly as those of the Wetherill type.

The blast furnaces demand that the dust be taken out of the concentrates; so they are elevated on a belt to a revolving screen of 8-mesh wire cloth, the oversize of which is the salable product. This screen gives considerable trouble in wet weather, since it will readily clog up. Even under dry conditions it is impossible to screen all of the dust from the ore, as the particles attract one another magnetically. From this screen the concentrates are conveyed to an automatic weighing machine.

AUTOMATIC WEIGHING MACHINE

This weighing machine consists of four receptacles, into one of which the ore is discharged. These are counterbalanced on a lever arm. When about 600 lb. of ore has been discharged into one receptacle, the counterbalancing effect is overcome, allowing the receptacle to drop and another one to take its place while it is discharging. A revolution counter is connected to the lever and records the number of dumps. This machine forms a good check on the milling operation. The daily weights of ore for figuring costs are obtained from the number of skips of ore treated. The principal source of error of the weighing machine lies in the fact that it takes nearly ½ sec. to move and place the next receptacle in position. The ore that comes during this ½ sec. goes into the full receptacle. As the machine is calibrated occasionally by weighing successive dumps, this surcharging causes no trouble when the rate of ore coming to the machine remains constant. However, if the rate is increased, more ore gets into each receptacle and the machine will record too low.

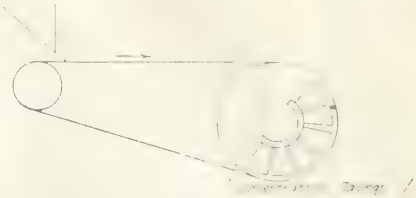

FIG. 2. MODIFICATION OF THE BALL-NORTON SEPARATOR

During the winter months, until the opening of navigation, the concentrates are taken from the weigher to the stockpile by means of a conveyor belt. Temporary supports for this conveyor rest on the stockpile and the conveyor is lengthened as the pile increases in length. Concentrates from the stockpile in the past have been loaded into cars by means of a magnetic crane, but recently timber drifts were built, on which the pile is accumulated. It is the plan to run belt conveyors in these drifts and load the cars much more rapidly than was possible with the magnetic crane.

USE FOR ROCK TAILINGS

The rock discarded from the magnetic separators goes over another similar separator equipped with heavier magnetic fields. This picks out a middlings product which is taken to the No. 2 plant for future treatment. The rock goes to a bin and is hauled away in railroad cars. A market has been developed for this crushed rock, since it is ideal for concrete and road-making purposes. The railroad uses all that is given to it for ballasting its tracks. The dust from the 8-mesh screen is also sent to the No. 2 plant.

The mill is supplied with alternating-current electric power at 550 volts from a transformer house near by. There are 15 motors with a total rating of [illegible] hp. Power is furnished to the transformer station at 23,000 volts from a hydroelectric plant 35 miles distant. By the provisions of a contract the power bill for a month is the same as for the previous month, irrespective of how much current has been used, provided that no 20-min. peak is made higher than the highest 20-min. peak of any previous month. If such a peak is made during the month, an increased bill is rendered based on the higher peak, and is rendered for the same amount each month thereafter until the record is again broken. The actual cost for current for May, 1914, was a little under ½c. per kw.-hr. on the switchboard at Sellwood. The power bill is divided among the various accounts at Sellwood in proportion to their full-load motor ratings.

The mill building is a wooden structure, and no heat is provided for the cold winter months. The principal trouble in operating when the temperature is 20° or 30° below zero is in the inefficiency of the workingmen, due to their extra clothing, and the stiffening of both the conveyor and transmission belts. When extremely cold, motor bearings will start to cut before the oil warms up enough to lubricate them. The greatest operating trouble due to temperature, however, is experienced in the spring and fall when the thermometer stands at about the freezing point. Then the fines of the wet ore will freeze to everything in the mill. The dustiness in warm weather is overcome to a large extent by using a spray of water as the ore is fed to the crushers. A little water is enough, and if this quantity is exceeded the efficiency of the crushers is impaired. This decrease in efficiency is more noticeable on the Symons than on the gyratory crusher.

DAILY COST SHEET OF MILL OPERATIONS, JUNE 12, 1914

(896 Tons of Ore Milled)

Article	Cost	Cost	Cost per Ton
Blacksmith shop	$0.15	....	.....
Machine shop	2.43	....	.....
Manganese parts	....	$13.44	$0.015
Other parts	....	13.44	.015
Conveyor belting	....	26.88	.03
Transmission belting	....	8.96	.01
Power	....	19.00	.....
1½ tons coal	....	7.50	.....
3 ¼x⅜ bushing	....	.06	.....
5 gal. red oil	....	1.35	.....
1 five-gal. oil can	....	.50	.....
2 thirty-two-in. sledge handles	....	.30	.....
160 F. fastener bolts	....	4.80	.....
5 lb. 5-in. nails	....	.15	.....
1 bbl. crusher oil, 40 gal	....	9.60	.....
5 lb. resin	....	.30	.....
Warehouse expense	....	3.76	.....
	$2.58	$110.04	
		2.58	
Cost today	$2.58	$112.62	.1257
Cost for month to date	14.44	954.45	
Total cost to date	$17.02	$1067.07	

Total tonnage for month to date, 8187 + 896 = 9083
Average cost of supplies, 1067.07 ÷ 9083 = $0.1175

LABOR

	Hours	Pay	Cost per Ton
Millmen	168½	$44.81	$0.0500
Railroad operation for mill	14	5.56	.....
	1	.22	.....
	2	.45	.....
Various belt conveyors	16	4.00	.....
	2	.45	.....
	2	.45	.....
	2	.50	.....
Stockpile belt	2	.45	.....
Belt from screen	2	.45	.....
Shaft, driving belts and pulleys	2	.50	.....
Chutes	2	.50	.....
Mill general	4	1.05	.....
Railroad	1	.25	.....
Mill general M/S	4	.80	.....
Symons crusher	11	3.12	.....
Crusher	1	.20	.....
Motors	16½	4.77	.0265
Labor	213	$68.53	$0.0765
Stores	...	112.62	.1257
Total		$181.15	$0.2022

Tons milled, 896

FOR CURRENT MONTH

Total tonnage, 8187 + 896 = 9083
Average labor cost, $661.57 + $68.53 = $730.10, $0.0803 per ton
Average total cost, $1615.00 + $181.15 = $1796.15, $0.1977 per ton

The engineer worked 14 hr. and the brakeman 14 hr. There were 298 ore dumps at the weighing machine and 10 cars of rock.

Mill Operation and Cost

The operating force consists of a mill superintendent, a mill foreman, two shift bosses, four men on the repair crew, four, and sometimes five, men per shift feeding the crushers, one man tending the separators and four men on each shift tending belts and cleaning up. An electrician makes a daily inspection of the motors and the lighting system. The men work 10-hr. shifts. Except during a busy shipping season the mill stops an hour between each shift and at noon and midnight.

⁂

Heat Developed in Crushing

An interesting discussion relating to the amount of heat developed in crushing ores has been instituted by James Cook in a paper on the subject in *Bulletin 124* of the Institution of Mining and Metallurgy, Jan. 14, 1914. Mr. Cook was making some experiments in connection with the various methods of calculating the relative energy required to reduce ore to various degrees of fineness, and it occurred to him to ascertain whether the heat evolved could indicate the energy utilized. The accompanying table shows the data accumulated from these tests. Taking the figures in the order tabulated, the following notes show the precautions which were taken to determine the figures as accurately as possible and also to point out the limitations of accuracy.

The weight of the stamps was calculated within a few pounds of the figure used. No deduction was made for their loss in weight during the experiments, which covered a portion of three successive days. The drops per minute were ascertained frequently during the test, but the average height of the drop, which could not be determined continuously, is only approximate. The electrical horsepower put into the motor—the battery being electrically driven—was continually read and the average taken. The "actual" horsepower is merely the product of the estimated weight of stamp and the number and height of drops converted into horsepower. Its accuracy is limited by the difficulty in reading the height of the drop already referred to. The aperture of the commercial screen cloth used was accurately known. The commercial mesh is given first, followed by that of the nearest I.M.M. screening of practically similar orifices. Various meshes were used in order to show whether the heat evolved varied appreciably with the mesh. In the example shown two widely different meshes were selected.

The weight of the water used and the ore crushed was found by two methods—first, by gaging the water feed and the proportion of solid in the pulp sample; and, second, by running all pulp into a measured tank for a certain time, afterward ascertaining the amount of water and solids. Absolute accuracy could only be obtained by having a sufficiently large tank to contain the entire pulp obtained during the test.

The average temperature of the ore feed was ascertained at intervals by burying the thermometer in the ore chute supplying the automatic feeder. This temperature was practically constant. The average temperature of the water feed was found by frequent tests. After numerous experiments it was found that the best method of ascertaining the pulp temperature was to take large samples from the entire pulp stream into which a thermometer could be inserted and examined undisturbed. The temperature of the building was not sufficiently above that of the pulp or feed to affect the temperature during the time of reading. The same thermometer was used to take all temperatures. This, though somewhat inconvenient, avoided any instrumental error. The thermometer was a sensitive one, divided into tenths of degrees Centigrade, and could be estimated easily to further subdivisions by means of a magnifying glass. The specific heat of the ore was calculated from an analysis to be 0.251, which was confirmed by a rough test in the laboratory.

The product of the pounds of ore crushed per minute, the specific heat, and the rise in temperature in degrees Centigrade, together with the product of the number of pounds of water per minute, its specific heat and the rise in degrees of Centigrade, give the total heat units evolved per minute. This is multiplied by 1390, the number of foot-pounds in 1 pound-calorie[1], divided by 33,000 gives the total horsepower per minute represented by this rise in temperature.

DATA OF EXPERIMENTS ON HEAT DEVELOPMENT

Experiment No.		5	6	7	Average
Battery		5 Stamps	5 Stamps	5 Stamps	
Weight of stamps in lb.		1300	1300	1300	1300
Drops per minute		103.5	106	103.3	104.27
Average height of drop		7.8 in.	7 in.	7.5 in.	7.43 in.
Hp. at motor		17.12	16.2	16.92	16.75
Hp.—"Actual" from weight × drop × drops per min.		13.25	12.18	12.72	12.72
Percentage actual of motor hp.		77.3%	75.2%	75.17%	75.9%
Screen used		12 = 8 I.M.M.	30 = 22 I.M.M.	30 = 22 I.M.M.	
Lb. ore crushed per minute		44.7	33.8	31.04	36.51
Lb. water used per minute		471	472	405	450
Average temp. C. of ore, feed		22.15	24.2	22.0	22.783
Average temp. C. of water, feed		27.07	27.96	26.51	27.180
Average temp. C. of pulp, discharge		27.483	28.372	27.00	27.618
Diff. temp. ore, feed and discharge		5.333	4.172	5.00	4.835
Diff. temp. water, feed and discharge		0.413	0.412	0.490	0.438
Heat units from ore, S.H. = 0.251		44.7 × 0.251 × 5.333 = 59.83	33.8 × 0.251 × 4.172 = 35.39	31.04 × 0.251 × 5.00 = 38.95	36.51 × 0.251 × 4.835 = 44.49
Heat units from water, S.H. = 1.		474 × 1 × 0.413 = 195.76	472 × 1 × 0.412 = 194.46	405 × 1 × 0.490 = 198.45	450 × 1 × 0.438 = 197.10
Total increase in heat units per minute		255.59	229.85	237.40	241.59
Hp. represented by heat units H.U. × 1390 as — 33,000		255.59 × 1390 / 33,000 = 10.76 hp.	229.85 × 1390 / 33,000 = 9.68 hp.	237.4 × 1390 / 33,000 = 9.999 hp.	241.59 × 1390 / 33,000 10.170
Percentage motor hp. returned as heat		62.84%	59.7%	59.09%	60.7%
Percentage actual hp. returned as heat		81.2%	79.5%	78.6%	79.95%
Size of ore before milling		— 2 in. + ¾ in. ring	— 2 in. + ¾ in.	2 in. + ¾ in.	
I.M.M. mesh after milling	8 - 0	36.12			
	22 - 0		5.09	5.02	
	30 - 40	6.61	9.11	9.24	
	40 - 60	7.87	12.77	14.32	
	— 60 + 100.	2.42	13.15	14.95	
	— 100 + 120.	5.07	5.08	3.97	
	— 120	41.91	54.80	52.59	

For the original experiments the pulp was graded through I.M.M. screens, as shown in the examples given. Of the electrical horsepower supplied to the motor, it will be seen that only 76% is apparently stored in the raised stamp. The ore crushed will be seen to have been raised an average of 4.8° C., while the water used was raised an average of 0.438° C. The difference is due to the smaller ore feed being at a lower temperature than the water feed. Of the actual electrical horsepower put into the motor, practically 61% is returned as heat in the pulp. Of the energy which reached and was stored in the lifted stamp, practically 80% was returned as heat in the escaping pulp.

Twenty per cent. of energy in the falling stamps unaccounted for as heat may be allotted as follows: A small percentage lost in friction on the guides; a small percentage in sound and vibration; a small loss in radiated heat; and a large amount, possibly the remainder, accounted for by the energy with which the pulp is delivered through the screen. It was found that the screen had at some points a perceptibly higher temperature than the pulp, showing the energy of bombardment to which it was subjected by the particles which were partly returned or passed through. It is a question whether or not the energy used in tearing the ore particles apart is entirely returned as heat. We know that it is so in the agitation of water, and the question has probably been decided by physicists with regard to solids, but it has not been possible to find any definite pronouncement on the subject. Possibly some electrical phenomena may exist.

It will be seen that in the case of the two meshes used a difference in percentage of heat energy of about 3% is given. From other experiments made it appears that this may be regarded as an experimental error within the limitations outlined.

These experiments were not carried to their logical conclusions, due to circumstances which required the author's change to another mine, where no similar crushing appliances existed. A chilean mill was experimented on and no perceptible temperature rise took place while run without ore. This would naturally not be the case with a stamp battery. The ore experimented on was a gold-bearing conglomerate or "banket," but not very similar to the Rand banket in appearance or composition.

In discussing this paper H. Stadler, in *Bulletin 126*, I. M. M., said that it was rather curious that the roughest and clumsiest of all our crushing appliances is the one from which these results have been obtained. The hot pulp discharged by tube mills when working with a low percentage of moisture was for many engineers a temptation to execute similar investigations. Notwithstanding the high-temperature difference between feed and discharge, the experiments were not so successful as those carried out by Mr. Cook with stamps, where conditions are proved to be unexpectedly favorable for such an investigation—first, on account of the close contact of water with the crushing part of the appliance in a comparatively narrow and more or less inclosed box, and, secondly, because the bulk of the mechanical loss is liquidated when the potential energy of the lifted stamp is released, after which comparatively small further mechanical loss takes place.

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[1] The heat necessary to raise the temperature of 1 lb. of water 1° C., usually taken from 10° to 11° C. The figure 1390 is based on the older determinations of the mechanical equivalent of heat. The figure usually given now is 1402, but this alters the calculated values in the text less than 1%.—EDITOR.

Of the causes mentioned in Mr. Cook's paper to account for the 20% of heat loss which was not definitely accounted for in the rise of pulp temperature, the first was the portion lost in friction with the guides. The frequent breakages of stems in older, carelessly run mills is proof of the [illegible] stresses produced in guides and stems by hard lateral thrust at the moment of impact, particularly if the guides are unevenly worn and the clearance of the guides is greater than is absolutely necessary. A regular wear of shoes and dies, as claimed by single stamps, is a good recommendation for a mill design; but the millman can do almost as much on his part by turning the dies from time to time. The idea would be to have short stems now; but it is a question whether conditions could not be improved by more elastic, hollow stems. The reduced weight could be made up by lead cast into high stamp heads.

Loss by Heat Radiation

Stadler believes that the conversion of energy into waves and oscillations is reponsible for the greatest portion of the energy not accounted for as heat. If no ore were fed into the mill a much smaller percentage of heat would be recovered in water; but a correspondingly higher efficiency of the stamps as producers of sound and vibration would result. Mortar boxes with heavy bottoms and in close contact with solid foundations are the natural remedy for such losses. Though not readily perceptible, the radiation of heat is in general one of the principal causes of loss. It is most probable that for this reason the comparatively small amount of heat developed in the adhesive friction of wheels of the empty-running chilean type did not show any appreciable rise in the temperature of water. As the author elsewhere states that the temperature of the building was not sufficiently above that of the pulp or feed, a radiation of heat would, in the case under consideration, rather have acted in the direction of a gain of heat. On the other hand, a correction of the readings to allow for the cooling effect of the water evaporated in the mortar box might have slightly lowered the results. The energy accounted for by the throwing of the pulp through the screen has probably been overestimated and should not even have been mentioned among the losses unaccounted for as heat. The violent agitation of the water here, possibly to its full amount, was converted into heat and accounted for.

Accepting the law of conservation of energy, according to which energy can neither be generated nor destroyed, as an axiomatic truth, it follows that for each heat unit recovered in the pulp, a corresponding equivalent of kinetic energy of the stamp must have been destroyed by the resistance which the ore offered to its elastic and plastic deformation, of which latter rupture is the final stage. The immediate effect of the consumption of energy is the breaking of the ore and the reappearance of the equivalent of this energy in the form of heat. The amount of heat recovered cannot, unfortunately, be taken as a criterion of the useful work done in crushing, because it also includes the heat equivalent of the wasted energy. In includes the head produced by the agitation of the pulp, the friction among the particles, the deformation of the ore within the limits of elasticity, and the energy lost by the rebound of the stamp, which, though accounted for as heat, is lost for the purpose of crushing. The two extreme cases of inefficient working conditions, namely, empty running stamps and a cushioned ore bed, would respectively have just an opposite effect on the rise of temperature. In the first case a smaller and in the second a larger percentage of energy spent would be recovered as heat—in both cases with a reciprocal loss in sound and vibration.

The only essential difference in the working conditions of tests 5 and 6 is the coarser battery mesh used in test 5. The water ratio at 12.3 : 1 is in all three tests unusually high. Mr. Cook's figures show only a slight difference (1.8%) in the percentage of actual horsepower returned as heat, the difference being in favor of the coarse-crushing stamp. The higher efficiency obtained by calculation from the measurement of the screened product forced out at 9.8%, which figure is in better accord with the experience that the efficiency of stamps increases considerably with the coarseness of the battery mesh. It must here again, however, be remembered that this increase of efficiency refers to grinding to the 200-mesh only, and it would therefore be more correct to say that the inefficiency of stamps increases with the percentage of overdone slime produced within the —200-mesh grade.

Use of Heat Energy

The recovered heat energy is, of course, still further capable of doing useful work. This is actually done, since the rise in temperature has a beneficial effect on chemical affinity and on the rate of settlement of slime. For the realization of these advantages mill pulps are sometimes purposely heated, though generally only when cheap waste heat is available. If direct heating had to be resorted to, as in the case of at least one mine on the Rand—where in consideration of the short life of the mine the capacity of the slimes plant had to be increased without capital expenditure for extension—the money value of the coal required for the production of the 255.6 heat units would be net gain.

R. T. Hancock, in discussing the matter, called attention to the fact that finely powdered dry sand exhibits an appreciable rise in temperature when wetted. It would be a bold man who asserted that the heat thus manifested was part of the energy originally applied in crushing. It is more likely that the phase sand-air possesses more surface energy than the phase sand-water, and it is on these differences according to phase that flotation is based. The phenomenon suggests a possible means of ascertaining the relative fineness of samples of slimes which defy screening analysis. Even without a knowledge of the physical properties involved, comparison might be possible between the slimes produced by two different crushers on the same ore.

⁂

Nevada Consolidated Copper Co.

The report of the Nevada Consolidated Copper Co. for the first quarter of 1915 shows a production of 10,815,680 lb. of copper—3,069,919 lb. in January, 3,210,569 lb.

in February and 1,535,192 lb. in March. During the quarter 564,834 dry tons of Nevada Consolidated ore, averaging 1.49% copper, was milled, in addition to 22,483 tons of Giroux ore.

The cost of copper produced, including Steptoe plant depreciation and all charges except ore extinguishment, and crediting all miscellaneous earnings, was 8.97c. per lb. Earnings are computed on the basis of 14.646c. per lb. as the selling price for copper.

There was a surplus of $201,870 for the quarter, after payment on Mar. 31 of the 21st dividend of 25c. per share. There were set aside $100,273 for plant and equipment depreciation and $56,523 for ore extinguishment, leaving a net credit to earned surplus for the quarter of $48,073 and a balance of $2,338,700 in earned surplus. Operating costs were charged with $118,921 for stripping.

⁂

New Iron Ranges in Northern Wisconsin

It has been believed for many years that much iron ore would eventually be discovered in northern Wisconsin. The last legislature had sufficient faith in this possibility to provide funds for a survey to ascertain the facts. As a result of the work, the State Geological Survey will soon receive from the state printer the first report, covering a territory of over 2,000,000 acres.

This area is bounded approximately by a line connecting the following towns in the order given: Cameron, Spooner, Hayward, Cable, Morse, Park Falls, Minocqua, Prentice, Phillips, Winter, Ladysmith and Halcombe. Many of the 90 townships surveyed show strong indications of the presence of iron formation—the rock in which iron ore is found—and there will undoubtedly be a large amount of drilling done in this area in the near future, on the basis of the information contained in this report.

Each of the 90 townships is described in plain terms, and definite statements are made as to just which lands show the best indications and which lands are not worth exploring. Each township description is accompanied by a detailed map, about 8 in. square, of that township. This map shows all the railroads, roads, houses, streams, swamps and other features of an ordinary map; and in addition gives the magnetic lines indicating the presence of iron formation, the rock outcrops, and all the detailed readings taken with the dial compass and dip needle.

The report comprises about [illegible] pages and 91 maps and is sent free to persons forwarding the [illegible] necessary to pay for mailing. Address requests to the State Geologist, Madison, Wis.

⁂

Electromagnetic Zinc-Ore Treatment by the Campbell Process

By L. E. Ives

As is well known, the zinc ores of the Platteville district, Wisconsin, are readily amenable to treatment by roasting, followed by separation on electromagnetic separators. With this process it is common in that district to make a clean zinc concentrate acceptable to the smelter and an iron-sulphide product. The roasting is usually done in a kiln, the sulphur in the ore furnishing most of the fuel, and the iron sulphide is made magnetic. The product of the kiln is crushed and the electromagnetic separators pick out the magnetic iron sulphide, leaving a clean zinc concentrate, which is shipped to the smelter.

If the ore is given a hot, heavy roast, the result is that the iron product is too low in sulphur to be of value for the sulphur. Its principal use as such would be in the manufacture of sulphuric acid. Moreover, such a hot roast not only magnetizes the iron, but is apt to magnetize some of the zinc, with the result that some of the latter is picked up by the magnets on the separating machines and finds its way to the waste dump.

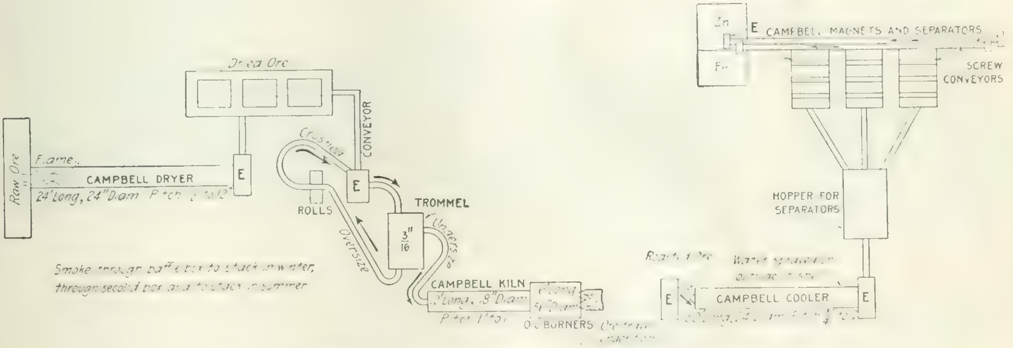

Fig. 1. Campbell Magnetic Blende Concentrator, Linden, Wis.

Within the last few years two plants using the so-called Campbell process and designed to overcome these objections have been erected in the district, at Cuba City and Linden, Wis. The rights and patents to the process and machines involved are controlled by the Campbell Magnetic Separating Co., Boston, Mass.

In the Linden plant the ore is first dried in a revolving sheet-iron drier 24 ft. long and 24 in. in diameter, pitching 1½ in. in 1 ft. toward the discharge end, in which oil fuel, introduced at the feed end, furnishes most of the heat. The dried ore is then crushed to pass a $\frac{3}{16}$-in. trommel. From here it enters a revolving kiln, also sheet iron, 12 ft. long and 12 in. in diameter. In this, however, the oil flame, which furnishes the heat, is from the discharge end of the kiln, which is enlarged to 36 in. in diameter for a length of 6 ft. This kiln pitches 1 in. in [illegible] ft. toward the discharge end.

The roasted ore discharges into a cylindrical, revolving cooler, 30 ft. long and 24 in. diameter pitching 3/4 in. in 1 ft. toward the discharge end. The cooling is done by spraying cold water on the outside of this shell. The cooled and roasted ore is elevated to a hopper, from which it feeds by gravity to a battery of electromagnetic separating machines.

The separators have three magnetic fields of different intensities, or, in other words, three magnets. These magnets are transverse to and at regular intervals reach entirely across the surface of the table. The top of the latter is an aluminum plate, pitching rather steeply from head to tail end. Revolving canvas belts pass under each magnet and at a slight distance—a fraction of an inch—from the top of the table. These belts pick up the iron and discharge it at the side of table. The zinc continues to the bottom of the table. Each product is collected in separate bins by screw conveyors traveling under the floor at the foot of the separators. Fig. 1 shows a flow sheet of the plant at Linden, Wis., which is under lease to the Linden Zinc Co. The Cuba City plant is under lease to the Wisconsin Zinc Co.

It is claimed that by the Campbell process—which uses a light roast with the temperature at all times under absolute control due to the oil flame—a high recovery of zinc is obtained, from 92 to 95%; also, that the recovery of the total contents of the ore, zinc, sulphur and iron, is higher, 85 to 90%. Other advantages claimed are great general efficiency, low cost per ton, and a nearly automatic process.

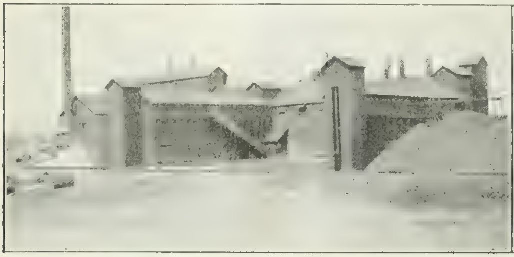

FIG. 2. REAR VIEW, CUBA CITY PLANT

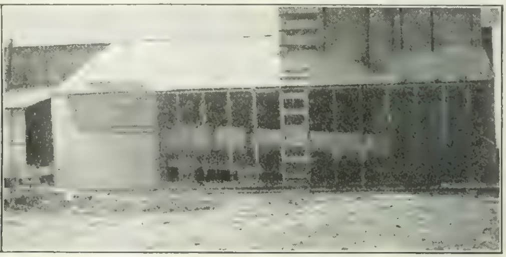

FIG. 3. DRIER FOR RAW ORE

As supporting these claims the figures given in the table may be of interest. They are taken from the books of the Linden plant and show the results of operations during 1914 and for January, 1915.

MAGNETIC CONCENTRATION OF ZINC ORE, LINDEN, WIS.

Month	Raw % Zn	Finished % Zn	Tonnage Raw	Tonnage Finished	Operating Cost per Ton Exclusive of Freight
January, 1914	[illegible]	60.41	512.5	[illegible]	$2.48
February, 1914	33.1	61.01	600	[illegible]	1.52
March, 1914	26.62	59.54	619.32	278.05	1.72
April, 1914	[illegible]	59.15	381	134.31	
May, 1914	[illegible]	59.00	330.6	[illegible]	
June, 1914	[illegible]	58.26	231	[illegible]	
July, 1914*	[illegible]	[illegible]	205	[illegible]	
August, 1914*	[illegible]	[illegible]	311	117.2	
September, 1914	[illegible]	62.80	161.5	69.8	
October, 1914	[illegible]	[illegible]	311.8	176.25	
November, 1914	[illegible]	[illegible]	[illegible]	86	
December, 1914	20.94	59.11	258.25	90.75	
January, 1915	28.76	60.00	[illegible]	251.5	

*Unusually low-grade ores containing lime sludge.

The labor necessary to operate the Linden plant consists of one man per 12 hr. shift, who unloads the raw ore and loads the finished ore. Between these two points the operation of the plant is automatic.

Additions to the Randfontein Plant

A large amount of construction work was done at the Randfontein Central last year, according to the report of C. A. Ferguson, general manager, an abstract of which appears in the *Financial Times*, London, May 5, 1915. At the Porges section an electric hoist of 600 hp. was erected at level 17 to replace the 100-hp. hoist which, as the depth of the shaft increased, became too small in capacity to cope with the work. Two 3400-gal. pumps were installed, one on the 20 and the other on the 21 level. One 3400-gal. pump was also installed on level 19 of the south section and one 8000-gal. pump on level 20. At the north section a 600-hp. electric hoist was erected and the following pumps installed: One 6000-gal. pump on level 15, two 12,000-gal. on level 16, one 22,000-gal. on level 17 and one 22,000-gal. on level 18. At the Robinson section the electrification of the waste-rock elevator was effected and one 22,000-gal. pump and four 12,000-gal. pumps were installed. At the Stubbs section a Fraser & Chalmers 800-hp. Ward-Leonard controlled electric hoist has been installed on the surface in place of the Robey steam hoist and one 12,000-gal. and one 6000-gal. Glenfield & Kennedy pump have been erected on No. 8 level. At the block A section two 12,000-gal. Glenfield & Kennedy pumps have been installed on level 4 and 5-in. Sulzer pumps have been placed on levels 10, 11 and 12.

The capacity of the shaft at this section has been increased by installing larger skips. Four 5-ton skips with Morcom tip and square-tip carriage have been made, and two are in use in the rock-hoist compartments, and, it is stated, are giving satisfactory results. At the Mynpacht section one 12,000-gal. Glenfield & Kennedy pump has been installed at level 8 and a 5-in. Sulzer pump at No. 9 level. Three temporary hoists have been installed for work in the auxiliary shaft: one 35-hp. Holman hoist on No. 7 level, one 30-hp. Holman hoist on No. 8 level and a 6-in. and 7-in. by 12-in. Hornsby hoist on No. 8 level. At the Johnstone section one 12,000-gal. Glenfield & Kennedy pump has been installed on No. 9 level and also one 5-in. Sulzer pump on the same level. At the East Reef section one 6000-gal. Glenfield & Kennedy pump has been installed at level 5. An average of 883 stamps ran 293.921 days last year and crushed 2,493,984 tons of ore. The sand and slime treated amounted to 2,493,924 tons. Working costs averaged 16s. 7d. per ton milled and the yield 23s. 1d. per ton. At the central mill the tube mills have been fitted with Schmidt pebble feeders.

Pressure Ventilating System Used in Cripple Creek Mines

By S. A. Worcester*

SYNOPSIS—Comparison of pressure ventilation with natural draft, blowers and exhauster systems. Explanation of unexpected effectiveness of low-pressure ventilation. Obstacles and difficulties encountered and overcome. Details of construction.

The pressure system of ventilation which I described in the Journal, Jan. 17, 1914, is, in essence, simply the method of sealing or bulkheading the mine practically air-tight and forcing in air under what pressure is necessary to expel mine gas through a fissured formation.

The sectional diagram (Fig. 1) illustrates the inefficiency of natural-draft ventilation in workings reached through deep shafts, as are most of the important mines in the Cripple Creek district. If the gas is not too heavy—that is, if it does not contain too much carbon dioxide—a natural draft will usually occur, as shown by the arrows in Fig. 1, in cold weather, and in the reverse direction in hot weather; but, alas for natural ventilation! when the temperature is the same outside as in the mine, there is no draft, and in gassy mines the men lay off and hope for a change of weather. Where, as in the Conundrum, Midget and some of the other mines, the gas in lower levels contains 10% carbon dioxide, it stops all circulation in these levels even in good weather; and even though there may be enough air at the bottom of the shaft to support life, the levels and stopes may be full of gas. As a general rule it is unsafe to work in air too poor in oxygen to support a candle flame, although this rule is too often disregarded, and often with fatal results. Fig. 2 shows by comparison with Fig. 1 how well the pressure method distributes air to all parts of the mine which would normally exude gas. *B* is a stationary bulkhead, *EB* an entrance bulkhead and *BL* a blower.

Entire Mine under Slightly Increased Pressure

I am calling this a pressure system, as opposed to blower or exhauster systems, because it puts the entire mine air under a nearly uniform pressure. A gage applied to the most distant bulkhead at any time shows the same pressure as at the mine entrance. Experience with blower systems has shown that, as a rule, where much gas was present, air forced in by a blower simply passed through the gas without effectively moving it, much as it would pass through water. While exhausters of good capacity have been more successful than blowers, they have the same fault of requiring complete pipe systems, which must be maintained and extended as fast as the mine is enlarged. Success with the pressure system requires some knowledge of its principles and reasonable correctness in details of construction and operation. A preliminary knowledge of the nature of the formation, of the extent and character of the workings, and perhaps of the adjoining territory and workings, is important to success.

A highly interesting feature in the success of this scheme has been the remarkably low pressure which proved efficient in practice in a large number of mines. The pressure has varied from $\frac{1}{4}$ to 5 in. of water gage, a maximum of less than 3 oz. per sq.in. It is easy to assume—as I did in my first estimate, made for the Moose mine—that mine gas will issue from fissures with a pressure equal to that indicated by the variation of the barometer. This assumption did not take into account any possible outlets on the vein which would give relief and enable a low pressure to expel gas from the mine—hence my first estimate, including two pairs of steel doors, making

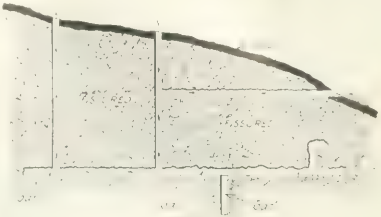

FIG 1

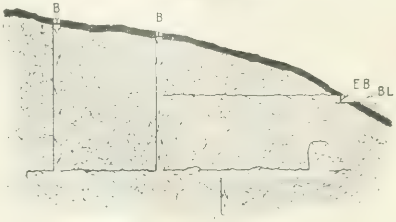

FIG 2

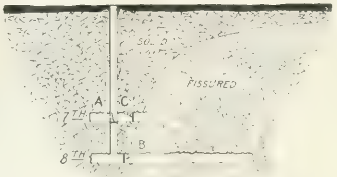

FIG 3

FIGS. 1 TO 3. MINE SECTIONS SHOWING NATURAL AND PRESSURE VENTILATION

an airlock, with equipment for maintaining a pressure of 1 lb. per sq.in. if necessary. A vital fact is, however, that this district is one great volcanic crater, with innumerable fissures generally connected, and with hundreds of shafts, tunnels, pits and cave-ins giving vent to the atmosphere above. Thus it is that the pressure necessary to ventilate any particular mine is that which will displace the gas, or overcome its specific gravity, without compressing it to any considerable degree. In the Conundrum and Work mines vugs are found as large as the rooms of an ordinary dwelling, and the ventilating current passing out through these places into the crevices is strong enough to blow out a candle. In places in the

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*Mechanical engineer, Victor, Colo

Moose, Midget and other mines the basalt dike is similar to gas coke, and a pick or candlestick can be easily pushed into it. All of the mines having any large quantities of gas have, as a rule, this fissured or porous formation, which is well adapted to assist ventilation by the pressure system. While the highest pressure I personally have used was 3½ in., I was told that at times a 5-in. pressure was used at the plant which I placed in the Empire State mine of the Isabella Mines Co. This is explained by the minute fissures and the lack of any nearby outlet on the vein.

Fissured Formation Essential and an Outlet Desirable

The two essentials to success with this method seem to be, first, a fissured or porous vein formation, and, second, some form of restricted outlet, connecting the vein fissures with the atmosphere, at a distance not too great to give the proper vent. The existence of the first has thus far always implied the existence of the second. The principal outlet, in most cases, has been one or more abandoned shafts in nearby ground. Displacement in the mine being ventilated has the effect of raising the gas higher in the adjoining workings. When the pressure system became effective in the Conundrum mine the adjoining Midget was put out of action, the gas at times being forced out of the mouth of the Midget shaft, while the ventilation at the bottom level of the Conundrum, about 1000 ft. below, was perfect. The Midget management had refused to consider the pressure system, although the lower levels, having good ore, had been abandoned for several years on account of gas. Both the Midget and the Conundrum now use the pressure system, and several nearby abandoned shafts, as a result of the pressure maintained in these two mines, are filled with gas to the surface during working hours.

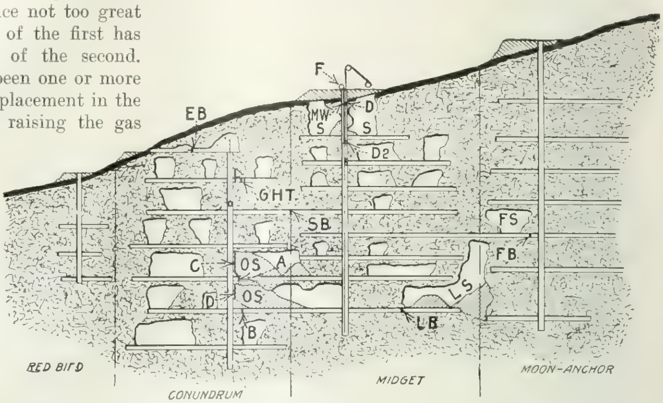

Fig. 4. Section Showing Pressure Ventilation in Several Connected Mines

Difficulties Encountered

It may be helpful to those who are considering the adoption of this method to know what my troubles have been. In most cases I have necessarily depended on my clients for much of my information as to the extent and character of the workings to be ventilated, and this information has too often proved incomplete or misleading. At my first installation, at the Poorman shaft, Anaconda, Colo., I was told that no mine gas had even been known at the seventh level (see Fig. 3), or at the eighth level until it had been extended at least 50 ft. from the shaft. I therefore placed a temporary bulkhead at *A* just below the seventh level while installing the permanent concrete bulkhead *B*, with swing door, on the eighth level. A short time after first applying pressure at *A* the shaft and lower level were free from gas; but gas was soon noticed coming from the seventh and accumulating above the bulkhead in dangerous quantity, showing that the seventh was connected with the fissured and gassy ground. It was necessary to place another bulkhead at *C* before the work at *B* could be continued. After *B* was completed, *A* was removed, leaving the shaft clear for hoisting. After this arrangement had been working nicely for several weeks a machine man neglected to fasten the door open when firing his round. The result was that the first concussion blew the door shut and the second blew it into splinters, and a new door was installed with some difficulty. While the exhaust air from one piston drill would give ample pressure for preventing the entrance of mine gas during working hours, the compressor was a wasteful means of furnishing air when the drill was idle, and I deprecated its use, although the management preferred not to provide the simple and much more economical arrangement advised.

A somewhat similar experience with gas from unexpected places befell the manager of the Little Nell mine some months later. Having little or no gas at the 400-ft. level, but the shaft being full of gas for 150 ft. below, he placed a bulkhead at the 400, with doors allowing the bucket to pass, and with an air-jet injector, through which he forced air under the bulkhead. Going below after a short time, he found all clear at first, but soon began to smell gas, as some experienced miners can do. On coming through the bulkhead he observed that gas was being forced up on the 400 through the fissured vein, so that instead of furnishing fresh air the jet was principally circulating gas through the fissured vein and back through the jet. I was absent from the district at that time, and after having a narrow escape from the gas the manager abandoned further work until my return, when I placed a new shaft bulkhead, with doors, about 15 ft. below the shaft collar. I placed a 5000-ft. fan at the surface, with a wind trunk 20 in. square in section, carrying the air down the manway and through the bulkhead. The fan was driven by a 3-hp. induction motor. Current cost $15 per month when running one shift and $22 when running two shifts. The vein is so loose and fissured and the fan so effective at this mine that 1500 ft. or so of workings is completely cleared of gas in about 10 minutes, although the gas may be pouring out of the shaft, as it often does, when the fan is started. The pressure maintained is less than ½ oz. per sq.in.

At the Conundrum mine a short drift connecting the main shaft with the Gold Hill tunnel, *GHT* (Fig. 4), seemed to offer a convenient situation for the steel plate fan and its motor. I was told that no gas was ever found at this point, and the draft of fresh air from the tunnel portal was unfailing. After the fan had been running effectively at this place for several months the mine air became poor occasionally, so that in very bad weather candles would hardly burn. Gas was found to be issuing from the Gold Hill tunnel and mixing with the air furnished by the fan. Fortunately enough fresh air entered to support life, so that the mixture was not dangerous. This condition was later remedied by cutting a chamber in the Conundrum adit at the entrance bulkhead *EB* (Fig. 4) and moving the fan to that place. The cost for power with a 15-hp. induction motor is from $45 to $60 per month, running about 8½ hr. daily. The fan is sometimes shut down an hour before the end of the shift, and with all doors closed and the check valve on the fan discharges, the gas returns to the mine slowly. The usual pressure is 2-in. water gage. An automatic 3-step starting device, crude but effective, brings the motor to speed in about 15 sec. It is started about one hour before tally, so that no gas is found in the mine when the shift goes down. The fan has a 56-in. blast wheel and its discharge opening is 30 in. square. Its speed is about 340 r.p.m. At the Midget mine the first set of doors tried in the vertical shaft was placed at *D* (Fig. 4), 20 ft. below the shaft mouth, and the manway *MW* was lined with 1-in. boards, which were battened with canton flannel soaked in P. & B. paint. This made a wind trunk extending from the blower through the doorframe bulkhead. On starting the fan very little pressure showed on the gage, and a careful search discovered a number of stopes, *SS,* behind the shaft timbers and connecting in places with the first level and reaching the surface above, but covered by the coarse waste dump to considerable depth. As these immense leaks could not be stopped without great expense, and this level was worked out, the easiest course was to move the doors to *D2,* just below the first level, and extend the wind trunk to this point. When this was done a good pressure was obtained. The fan *F* is a converted steel plate exhauster with one side inlet and is set directly over the manway. It has a 66-in. blast wheel, a discharge outlet 36 in. sq. and a speed of about 400 r.p.m. and is driven by a 20-hp. induction motor.

At the Prince Albert tunnel, about 1100 ft. in length, I was told there was no connected working and no air outlet except the portal. Acting on this hypothesis, I installed an entrance door and bulkhead about 50 ft. in from the portal, and when I commenced to blow with an air-jet injector no sensible pressure was produced. I had noticed a winze, perhaps 100 ft. in from the portal, with water showing about 20 ft. below the tunnel, but did not suspect that this connected with workings. On careful examination I found several hundred feet of drifts at a level about 15 ft. below the tunnel, extending in various directions from the winze, including one drift which extended into a dump of coarse waste at the surface. A muck pile in this drift reached within 2 ft. of the top. I had this piled against the top of the drift and covered with 3 or 4 in. of black soil tightly packed, brought from the surface. After this was done, blowing a few seconds with the air jet raised a pressure of 2½ in.

At the Conundrum mine (Fig. 4) two worked-out stopes, partly filled with fine rock, extend through some distance into the Midget property. The foreman was certain that this stope filling would be air-tight and that bulkheads at *A* and *B* would prevent leakage to the Midget at these levels. When the [illegible] started the air roared through the fine stope filling [illegible] a cyclone. The foreman advised calking with oakum between the round lagging at *C* and *D*. Again giving [illegible] the benefit of a doubt, I tried this, but found that while it absorbed immense quantities of the expensive P. & B. paint, it failed to stop leaks. I finally boarded over the entire front of these stopes at *C* and *D,* a distance of about 70 ft., with 1-in. dressed boards, fitting carefully to the foot and hanging walls and battening with canton flannel strips well soaked in P. & B. paint. This made them practically air-tight. Where a level connects directly from one mine to the other, as at *SB*, a permanent bulkhead of 1 in. lumber is built, with the dressed side toward the pressure and two 3x8-in. girts behind, securely wedged in hitches. All loose rock is cleared away at the top, sides, and bottom down to solid, and swept clean. Boards are nailed upright and trimmed so as to fit closely the irregular rock surface. The rocks and the board are painted, and the canton-flannel strip painted on both sides is stuck over the crack and again painted. Nothing else equals P. & B. paint for this purpose. A doorway 20x24 in. is cut about 18 in. above the level; a trap door, 23x27 in., covers this opening. It must not fit between strips edgewise, so that moisture might make it bind. It must lie flat against the bulkhead, with four thicknesses of canton flannel, nap side out, tacked on in strips 1½ in. wide around the edges where it rests on the bulkhead. A cheap door may be made without hinges and merely held by two buttons. This permits the passage of a man for the purpose of inspecting the bulkhead with a candle. A slight leak, when pressure is on, will give current enough to deflect a candle flame.

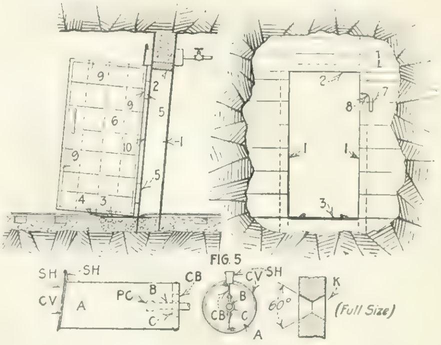

FIG. 5

FIG. 6

FIGS. 5 AND 6. DETAILS OF AIR-TIGHT DOOR IN DRIFT BULKHEAD

DETAILS OF CONSTRUCTION AND OPERATION

Where a worked out stope, *LS* (Fig. 4), partly filled with waste was found, passing from one property into the other, and [illegible] a bulkhead at the property line would be expensive, the stope, since it had no value, was simply shut off by placing a permanent bulkhead, *LB*, on the level. Leasers having ground which they desired to work in an adjoining mine, at *FS,* arranged with the Midget to ventilate their workings by placing a bulkhead at *FB*

They then had their product hoisted through the Midget shaft.

Tunnel Entrance Using Air Jet

Fig. 5 shows details of an entrance bulkhead for tunnels or drifts using an air-jet injector of crude form for supplying air. Select a place in solid ground, free from cracks or open fissures, and clean away all loose rock at bottom, down to the [illegible], [illegible]ing clean at the bottom, sides, and top. Then set the 3x10-in. door posts *1*, wedging them solidly [illegible], with the cap *2* spiked between them. Then nail 1-in. boards on the front and back of the posts to a height within ¼ in. of plate *3*. Then nail 1-in. boards horizontally on the front side of the posts and cap up to the top of the drift, trimming with a compass-saw the ends next to the rock to fit the rough surface closely, leaving no opening wider than ½ in. Make mortar of 1 cement to 5 sand by measure, with water enough to show on top after the mortar has settled a short time.

Then fill the bottom of the bulkhead to the height of plate *3*, which should be leveled, embedding many large clean rocks in the mortar, but taking care that they do not touch the form, as that causes voids. Embed the plate in wet mortar, tamping concrete under the edge at 4. The plate is usually 24x¼x36 in., and must fit closely between the posts. After the bottom is filled, nail 1-in. boards singly, smooth side out, on the inside of the frame, filling with mortar and rock as each piece is nailed, and making sure that no voids are left. As the height increases the pressure of mortar on the lower boards increases, and if the drift or tunnel is large, making these boards long, it will be necessary either to brace the unsupported ends or, better still, to run wires through from one side to the other, to prevent bulging. When approaching the top of the bulkhead, the mortar is made drier, and only small rocks, if any, are used, in order to make a good joint and prevent undue shrinkage in drying. The edges where the bulkhead joins the rock should be gone over with clear cement when the bulkhead has set four or five days and all shrinkage cracks closed, particularly around the top, where there is usually some settling. The door, *6*, is made of two thicknesses of 1-in. dressed boards. Two thicknesses of the heaviest canton flannel are placed between the boards and 2-in. nails are used close together and clinched on the pressure side. Clear pine is used. The boards next to the doorframe are horizontal. To prevent twisting, the door should be nailed together on leveled horses or supports.

How the Door Is Made Gas-Tight

Care must also be taken in setting the bulkhead posts to have them "out of wind." The door must not fit between strips or in the frame, but must lie flat on the bulkhead so that the pressure holds it shut and moisture will not affect its fitting. The door laps the opening 1½ in. at the top and sides, and a canton-flannel strip of four thicknesses, 1½ in. wide, is tacked around the door at *9*, where it closes against the frame—that is the 1-in. facing *10*. A 5-in. 4-thick strip is doubled around the bottom edge of the door and tacked on both sides. All of these strips are laid with the nap outward and fastened with carpet tacks spaced about 1 in. apart. The track rails are cut off and the ends tapered down and curved so as to form horns, which rest on the plate clearing the door and guide the wheels of the mine car. The bulkhead is inclined 1 in. per ft., so that the door swings clear of the plate and rails when opening. Ten-inch T-hinges are screwed to the door and to blocks *5*, which are of the same thickness as the door screwed to the bulkhead. The pressure gage *7*, a glass U-tube, is placed at a convenient height on the outside of the bulkhead and connected by a short rubber tube *8* with a nipple passing through the bulkhead. The glass tube is half filled with kerosene. If it is less than ¼ in. inside diameter capillarity will impede its action. It is well to keep this pressure gage in good order, because it indicates any failure of pressure, with the accompanying danger from gas.

The air jet or injector (Fig. 6) includes a short 8-in. galvanized pipe *A*, into which the 1-in. compressed-air pipe *B* projects a short distance. I usually have at hand three different pipe caps, *PC*, with orifices about $\frac{3}{32}$ in., $\frac{3}{16}$ in. and $\frac{5}{16}$ in. diameter. The smallest may be used for ventilating small workings or in good weather, and the others for heavier demands. The $\frac{3}{32}$-in. jet seems to use about as much air as one hammer drill. A check valve, *CV*, of light tin is held by the small strap hinge *SH*, and has four thicknesses of canton flannel held by its turned edge, making a good joint with the wired edge of the pipe *A*. The cross-bar *CB* and clamp *C* supporting the 1-in. pipe centrally are made of 1x$\frac{3}{16}$-in. bar, with $\frac{1}{4}$-in. stove bolts. The circular jet orifices are reamed as shown full size at *K*, giving a spreading discharge to the compressed air. Any tinner can make this air-jet outfit in a short time, and at small cost. This device is only recommended for temporary use or where compressed air is cheap.

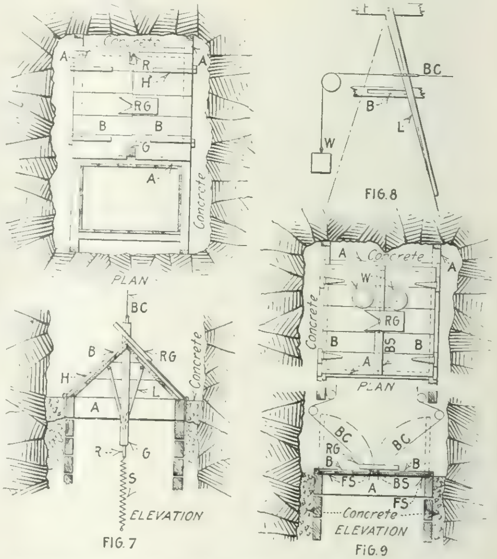

FIG. 7 FIG. 8 FIG. 9

Figs. 7 to 9. Details of Shaft Doors for Pressure Ventilation

A fan electrically driven is a more economical arrangement in most cases, especially where large volumes of air are needed. The check valve *CV* may be hung up, so as not to impede the air current during the shift, but is dropped to its seat when the jet is shut off and the door is left closed, with the effect of impeding appreciably the entrance of mine gas to the workings. The end of the pipe *A* is inclined so that the check valve shuts by gravity.

Type of Door for Skip Hoisting

The doors used at the Midget vertical shaft, where a skip is utilized for hoisting, are made of double 2-in. clear pine, with two thicknesses of canton flannel between, and have forged hinges. They are notched to clear the guides and have all seating or meeting edges stripped with four thicknesses of flannel, tacked closely, nap side out. The rod *R*, with links *L*, opens and closes the doors together. The spring *S* assists in starting the doors from the vertical position toward closing, and the steel bell-cord *BC* passes up the shaft, over a sheave to the lever *L* (Fig. 8) with fulcrum at *F*, and is placed within easy reach of the hoist engineer. The weight *W* nearly balances the doors and spring. The parts are held in the open or closed position by hooking the lever *L* over the stationary block *B*. The weight of these doors and connections is sufficient to resist the pressure used at this mine. The rope guide *RG* is bolted to the door and is easily renewable when worn. It directs the rope into the center groove when the doors are closed, preventing it from catching between the meeting edges.

Shaft Doors Used with Bucket Hoisting

When installing these doors (Fig. 9) as used at the Little Nell mine a place was chosen in solid rock 15 ft. below the shaft collar, and enough of the shaft timbering was removed to make room for the frame *A* and for swinging the doors *B* clear of the shaft. The rock was swept clean on all sides, to give a good joint for concrete. The sides of the frame *A* extend through the manway, giving sills for the bulkhead of 1-in. boards. The cracks are battened with the heaviest canton flannel, well soaked and stuck on the freshly painted surface with P. & B. paint, then painted on the back. The frame *A*, being firmly wedged in place and leveled, is concreted all around, using the mortar described in the foregoing. Many large clean rocks are embedded in the mortar, taking care to leave no voids and making the top about 2 in. of clear mortar, with no rocks. The doors *B* are made of 1-in. clear dressed boards, crossed, with two thicknesses of canton flannel between and 2-in. clinched nails spaced closely. They should be free from twist and lie flat on the frame. The frame should be dressed where the doors seat. Canton-flannel strips *FS*, about $1\frac{1}{2}$ in. wide, in four thicknesses, are tacked around the three edges of the doors where they rest on the frame and on the under side of the batten strip *BS*, using carpet tacks about 1 in. apart, with the nap of the flannel outside. The doors are notched at the center to fit the hoisting rope nicely, and the rope guide *RG*, of hard pine, is screwed to the door. The lower boards run lengthwise. Ten-inch tee hinges are used. The weights *WW*, in this case worn-out sheave-wheels, were determined by experiment after pressure on the door, and are bolted to the door. The batten strip is fast to the door having the rope guide, and this door must be opened first and closed last to prevent interference. Cotton bell-cords *BC* are fastened to stocks near the edges of the doors and are led by pulleys to handles with hooks within easy reach of the engineer. The doors must not fit edgewise but lie flat, or moisture will make them troublesome.

I have built many fixed bulkheads in shafts and raises by simply stulling and lagging the [illegible] and packing a few inches of black surface soil on top of the lagging. Ordinary mine rock, however fine, [illegible] to leak very much, but black surface soil makes a tight stopping when well packed.

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The Things We Ought Not To Have Done*

By David H. Browne

There are in the Irish language a great many witty proverbs, some of which you never hear in their English translation. One of these, relating to widows and old maids, will be appreciated. "It's a lonesome washing" says the proverb—"it's a lonesome washing that hasn't a man's shirt in it."

The two proverbs that have always appealed to me, however, are "'Come back to me,' says the half-done job"; and "Bought sense is the best sense."

These two are particularly applicable to scientific men—we are always impelled to go back to our half-done jobs. We cannot leave them unfinished. We realize in all our work that the things that really count are the things that we have been taught by experience.

Kipling's Mounted Infantry man sings:

> "I wish myself could talk to myself,
> As I knew 'im a year ago,
> I'd tell 'im a lot 'ud save 'im a lot,
> On the things he ought to know."

To this sentiment every one here will assent. Hindsight is always clearer than foresight. Anyone can see a mistake when it hits him in the shape of cast iron, but it takes a wise man to see that same mistake in a beautiful blueprint.

In looking back over our half-done jobs we are often struck with the way in which we overlooked some point which experience shows us was vital. Too often all our calculations were vitiated by lack of information, or by lack of realization of the importance of some point which at the time received scant attention.

Another thing that strikes us is the way one investigator will duplicate another's work—plodding along a path which some previous experimenter found to lead nowhere. All this lost endeavor is due, as Dr. Johnson said, to "pure ignorance, ma'am; pure ignorance."

It very often happens that success and failure are separated by a very small margin. I remember once our old friend Garnier, in the days of our innocence, was instructing us on the art of refining molten nickel. "You shall take," said he, "a great pole of ze fir tree, a green pole zat shall be perfectly dry, and you shall push him down in ze bath of melted nickel and ze nickel shall go [illegible] and ze air shall go through ze nickel and oxidize ze iron and purify ze nickel."

Very pretty in theory, but it did not work out in fact. A few weeks later Garnier returned to France and several of us accompanied him to the station to bid him farewell. With us was the furnace foreman, an Irishman with a hand like a ham and a heart like a child. "Before ye go, Mister Garnier," he said, "I'd like to tell ye something [illegible] don't mind that [illegible]

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*A paper read at the [illegible]

Misther Garnier, that ye told us to get a furr pole an' put it in the furnace. Now Misther Garnier, in the English language there is three words 'furr'—There is furr that's a furr three, an' there is furr that's furr on a cat, an' there is furr that's to go furr to do a thing. So it may be, Misther Garnier, that owin' to yer ignorance av' the English language we got howld av the wrong kind av a three."

Now the foreman's conclusions were erroneous, but he certainly had the right idea about the importance of little things in metallurgical work.

In all research we are seeking for the truth. We are trying to read the riddles of Nature. To every question there must be an answer, and the more answers we find to be wrong, the greater are the chances of our finding the true solution. I wish therefore to emphasize the importance of failures.

Every metallurgist can look back and recite his confession: "We have left undone those things that we ought to have done and we have done those things that we ought not to have done"; but he will not add, "And there is no health in us," for health in any business means the assimilation of what is suitable and the rejection of what is unfit. So the more we add to our store of information as to the unfit, the faster will be our progress.

Failures Are Not Advertised, Successes Are

The difficulty is, however, to get information about failures. Success stands in the limelight; failure hides behind the screen, and yet success is built on failures. Men as a rule do not publish their mistakes. Inquire about any discarded patent or process. You go to the place where the experiment was made and ask Jones: "Oh, that idea is no good. We tried it in '98. Robinson could tell you all about it." Robinson has moved away, and when you run him down he refers you to Smith, who is dead—information and all.

I suggested last year to the directors of one of the largest copper companies that all smelting plants should coöperate to establish a bureau of unpublished metallurgical research.

Such a mortuary, or metallurgical graveyard, would be a valuable asset. It would save much money uselessly expended. It would keep on file those ideas which, like Jairus' daughter, are not really dead but are waiting for their awakening.

The formation of such a bureau by smelting companies is, however, open to the objection that the data recorded there would not be available to the public, and that as inventions do not always originate with these smelting companies the information would not serve its full purpose.

It might be possible to have our engineering societies, such as the Canadian Mining Institute, the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, act as custodians of information regarding failures or regarding investigations which did not yield practical results.

Let us take an extreme case as an example of this. Some one conceives the idea that the metal contained in slag could be recovered by some process of water concentration or flotation. He does much work on this and obtains a lot of interesting data, but can find no process of which the cost bears a profitable relation to the recovery. He finds, we will say, that some of the metal is there as oxide and cannot be recovered. He gives up his investigation because the idea will not pay. Meanwhile some other man may have worked out a cheap method of converting copper oxide to sulphide, but sees no use in the reaction because the general trend of copper metallurgy is to convert sulphides into oxides and get rid of the sulphur. These two men, brought into mutual relation, are of value to the world. Their work fits together, but individually their labor is useless. Neither hears of the other because each has scored a failure, and failures remain unpublished.

If some scheme were adopted whereby our societies could become repositories of such data, A and B would both deposit their records with the society and the next bulletin would announce that we have received notes on these subjects, and if any one desired information concerning them a brief summary could be forwarded on receipt of a certain fee for stenographers' services. Thus A and B would hear of each other and pool their resources.

In the old days the cry was "Go West, young man, and grow wheat!" Today there are no homesteads to take up and the tide is setting back; the young man is advised to go East and take up an abandoned farm.

Abandoned Farms Exist in Metallurgy

It is just so in metallurgy. The more great advances are made, the less chance there is for such advances to be made. We are driven inward to look for abandoned farms —ideas that were good in themselves but failed because of lack of information or experience. These are the future fields for us to cultivate. The advances to be made in metallurgy today are to be made by intensive cultivation and not by extensive expansion.

Let us therefore formulate some scheme whereby our attention is directed toward these abandoned farms and see how we can make them profitable.

We are too prone to look upon past failures as closed incidents, and to forget the benefits derived in the shape of increased knowledge. We must learn to apply to each debit for failures a credit for experience.

Some years ago I moved into a house which had formerly been occupied by an old country doctor. In the attic I found his account books. In one of these was an account with a clergyman. The left-hand side was filled with items: "To visit, $1.00; to bolus, 25c.; to medicine, 50c.; to plaster, 25c., and so on. The column added up at the foot of the page: "Total, $52.50." On the credit side, under a date two years after, was the entry in red ink: "By Gospel preached to balance this account, $52.50.

The failures we make in metallurgy are debits on our ledgers. I wish to suggest a plan whereby we can cancel them—"by Gospel preached to balance this account."

Spitzbergen Coal Fields

Christiania Correspondence

Owing to the war, the Norwegian syndicate which had sold its rights in Spitzbergen to a Russo-German syndicate for 300,000 roubles ($154,500) and received the first installment of the purchase amount, has had to take over the claims, with a loss to the foreigners of the amount paid. The Stavanger syndicate has now, it is stated, disposed of its rights to a Russian company for a sum of 700,000 kroner ($187,600), but the first installment is not to be paid until after the war.

Details of Practical Mining

Steel and Concrete Mine Houses

The question of mining dwellings is a perennially perplexing one. A late addition to the list of possible types of construction is the Kahn Pressed Steel method as developed by the Trussed Concrete Steel Co., of Youngstown, Ohio. This method uses a pressed-steel frame, the members all fabricated to exact measure and capable of rapid and easy assembly, and correspond to the members used in wood construction. To this frame are fastened sections of Hy-Rib, a well-known type of concrete reinforcement, and on the Hy-Rib cement mortar is plastered for walls, partitions and floors.

The pressed-steel members resemble rolled sections in general, the most common being the channel and I-beam. The flanges are doubled back a short way to give additional stiffness. Little tags of steel are forced out of the flanges at regular intervals and are bradded down over the Hy-Rib to hold it in place. The Hy-Rib not only holds the mortar but also stiffens the frame transversely.

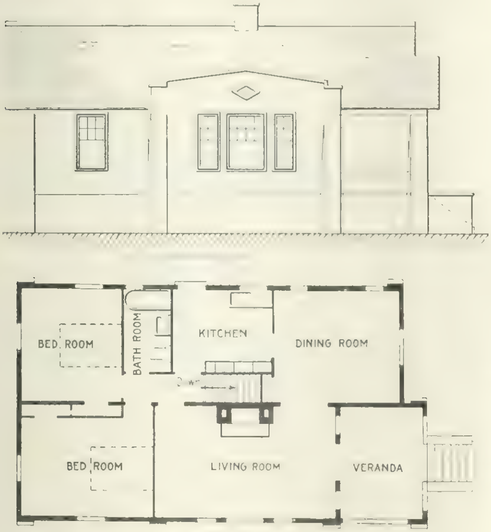


FIG. 1. CONCRETE MINERS' HOUSE

Joints are made by means of a wedge and a "tenon angle." A typical joint is shown in Fig. 2. This is a rapid method of assembly and is supposed to do away with the use of all tools but a hammer. Bolt holes are also provided if it is desired to use bolts.

When a wood floor is wanted, wood nailing strips are nailed along the center of the floorbeams, the latter being I-beams made by riveting two channels together, so that nails can penetrate between the halves. The space between the nailing strips is filled with mortar on Hy-Rib and the wood floor nailed to the strips. A solid concrete floor is not uncommon, and a cement-[illegible] floor on gravel or ashes is available under certain conditions. Steel window frames are recommended, although wood frames are often used. Instead of wood trim inside, cement and steel can be used.

For partitions carrying no weight, light channels are furnished to carry Hy-Rib, or Hy-Rib alone can be used, mortar being applied in the usual manner. These partitions can be made either double or single.

Some of the numerous advantages claimed by the manufacturer will probably occur to the reader. In the first place, houses thus fabricated can be made about as completely fireproof as is possible, and the importance of fireproof construction around the mine is becoming more and more widely recognized. In the second place, great permanency is obtained, and with the 300,000,000-ton-reserve mine growing increasingly common, permanent construction is becoming more desirable from the point of view of the mine operator. Again, field erection is extremely simple and rapid, and as it requires no expert labor it is relatively cheap. As with most concrete construction, protection against vermin and infection is simplified.

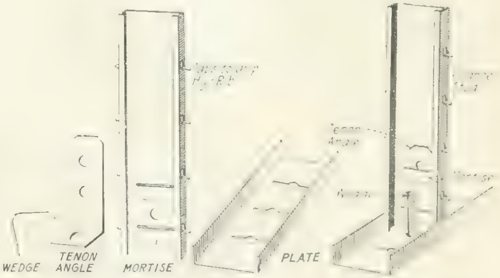


FIG. 2. JOINT FOR REINFORCED-CONCRETE HOUSES

It is perhaps questionable whether this type of construction would be as warm as that employing wood, lath and plaster, but for most mining districts no trouble should be had from this source.

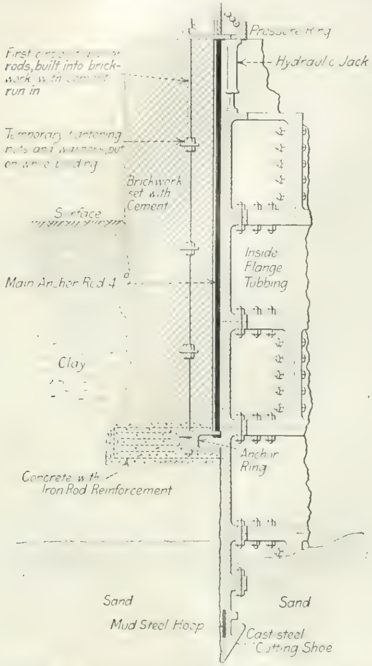
The question of cost is, of course, all-important, but this will vary with the locality to such an extent as to make general figures impossible. It is stated that usually this type will be found cheaper than wood. Specific figures may be of interest. For 10 houses of the design shown in Fig. 1, one of the more elaborate listed, a contractor in Ohio gave a price of $2400. This included a cement-floored basement under half the house, with hollow tile foundation walls under the entire building; hardwood floors in two rooms and the rest yellow [illegible]; hot-air furnace; complete plumbing, bathroom fixtures, kitchen fixtures and gas piping and appliances; painting, tinting, electric wiring, etc.

The material shipped from the factory for this design is 11,000 lb. of pressed steel and 15[illegible] lb. of Hy-Rib, cos-ing f.o.b. factory $663, subject to substantial discounts. This included all the frame, such as floorbeams, sill plates, channel studding, lintels, rafters, joint parts and Hy-Rib for inside and outside of walls and for partitions and ceilings.

⁂

Drop-Shaft Sinking

A method of drop-shaft sinking as applied by Haniel & Lueg at Düsseldorf, Germany, has been described and illustrated in "The Sinking of Shafts," by R. A. S. Redmayne, chief inspector of mines in Great Britain. This system of shaft-sinking is known in Düsseldorf as the sinking-drum process, and the scheme of operation is almost apparent from the illustration, taken from *Coal Age*, May 1, 1915.


Pressure Ring
First [illegible] rods, built into brickwork with cement run in
Hydraulic Jack
Temporary [illegible] rods and [illegible] put on [illegible]
Brickwork set with Cement
Surface
Inside Flange Tubbing
Main Anchor Rod
Clay
Anchor Ring
Concrete with Iron Rod Reinforcement
Sand
Sand
Mud Steel Hoop
Cast steel Cutting Shoe

HANIEL & LUEG'S SINKING-DRUM PROCESS OF ADVANCING SHAFT

The sand shown in the lower part of the illustration lies so near the surface that it is necessary to build up the shaft with brickwork set in cement so that there may be sufficient weight against which the hydraulic jacks may be braced in pressing down the cutting shoe into the water-logged sand. The sand is removed by hand or by a clamshell bucket.

⁂

Coke Blacksmiths' Fire

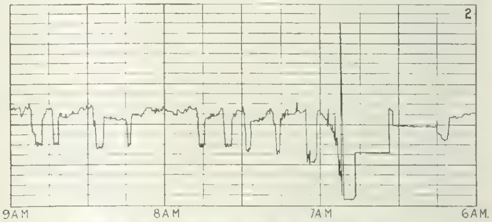
Few blacksmiths use coke in their forges, though it has many advantages over coal and almost no disadvantage after the fire is once ready for use, which does take a little longer than with coal. The coke should be banked up about 1 ft. high and 2 ft. wide, and when the mass is properly coked together, it should be carefully undermined, or scooped out, until it resembles the front of a muffle of an assay furnace. Into this opening six or eight drills can be put, and with the heated arch above them, they will come to proper heat without being buried in fuel. The heat from such a coke fire is more even than can be obtained from a coal fire and intermittent blast. The drills are always in sight and are cleaner, better heated, and more conveniently and expeditiously handled. Once the blacksmith learns this scheme, it is his only method of smithing.

⁂

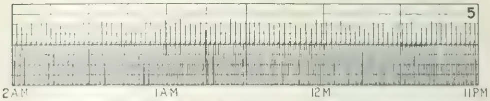
Hoist and Compressor Power Curves

By P. E. Barbour

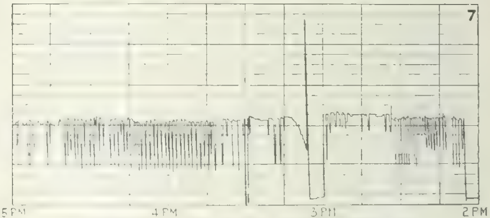
The poor load factor of mine hoists is emphasized in the reproduction of curves from recording wattmeters



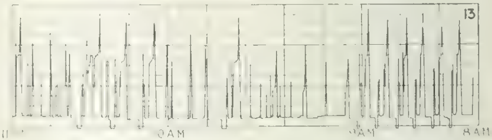
COMPRESSOR PLANT, NORDBERG COMPRESSOR AND MACHINE SHOP



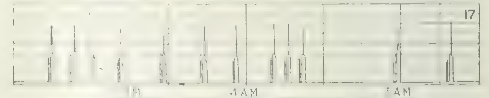
UNWATERING JUMBO MINE WITH SINGLE DRUM AND BUCKET



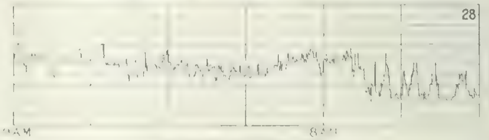
COMPRESSED AIR AND MACHINE COMPANY'S COMPRESSOR



MOHAWK HOIST WORKING SINGLE DRUM SHOWING INDUCTION MOTOR ACTING AS GENERATOR BY LOWERING CAGE WITH CONTROLLER ON 1ST NOTCH



SHAFT SINKING SHOWING POOR LOAD FACTOR



[illegible] TOTAL LOAD

HOIST AND COMPRESSOR POWER CURVES

used at the central station of Goldfield Consolidated. No. 17 shows the Jumbo hoist at work shaft-sinking. Besides the poor load factor shown by the curve, one gets a very good mental picture of the crew in the bottom of the shaft, which sends up one bucket every 15 min. With this record in hand the boss cannot be fooled very much by his night shift.

No. 13 shows the Mohawk hoist operating with cage. The hoist had a single drum driven by an induction motor, and the curve shows the motor acting at times as a generator, when the controller was left on the first notch while the cage was being lowered. This curve indicates plainly the starting torque, the period of acceleration, the drop to zero as the cage is stopped and dropped onto the landing dogs, the sudden demand for enough power to lift the cage from the chairs, and then the return of power to the line during the lowering, if the controller is left on the first notch.

No. 5 shows the Jumbo single-drum hoist unwatering the shaft with a bailing bucket. This curve illustrates the starting torque, acceleration, dropping the bucket on the discharging device, lifting the bucket to clear the discharging device and the lowering. It also shows that the engineer averaging one round trip every two minutes was earning his money.

Nos. 2 and 7 are compressor charts. No. 2 is from a compressor with corliss valve-gear, whereby the intake is throttled to suit the work to the demand. No. 7 is from a compressor of the blow-off type and shows the poor load curve in comparison with the other machine. It also shows the "jerky" load and more severe service on the motor. Both these curves show the starting of the compressor and the period required to bring it up to normal load.

The Consolidated originally had separate contracts for each unit, but by installing a substation of its own and doing its own distributing it raised its power factor to 80% and decreased its power costs from 4c. to 0.9c. per kw.-hr. No. 28 shows the receiving-line curve carrying mines and mills. These economies were effected under L. T. Merwin, electrical engineer for the company.

* * *

Carbon-Monoxide Poisoning

A peculiar accident due to gas poisoning in an iron mine was described by Kobrich[1], a translation of which is given in the *Transactions* of the North of England Institute of Mining and Mechanical Engineers for December, 1914. Four men were poisoned in June, 1913, at the Ober Rosbach vor-der Höhe manganese-ore mine in Hesse At a depth of about 236 ft. a communicating gallery had been driven between the two hoisting shafts of the mine at about 36 ft. above the working level, and the mine had subsequently been drowned out. The gallery was stopped up with mud and débris and had to be cleared. To do this a platform was constructed in one of the shafts at the height of the floor of the gallery, and the latter was cleared to a distance of about 16½ ft. The air in the dead end thus formed was vitiated, however, by fumes from the broken rock and from the wet wood. Fresh air was supplied through a temporary 2⅞-in. pipe by a hand ventilator above, and compressed oxygen in flasks was also supplied to the men below. The ventilation was to be further improved by heating the air, for which purpose the pipe was fixed to a barrel, open at the bottom, in which a stove was installed. The stove was fired with mine wood and shavings, and oxygen was supplied to it from an open flask. The ventilator was worked at intervals during the day, at first bringing up thick smoke. On the following day lights were lowered and continued to burn, and two men descended, but were overpowered by fumes. Two men followed them to see what had happened and met with a similar fate.

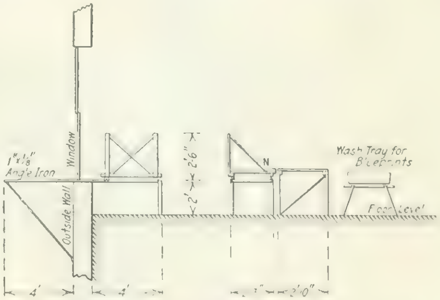
Later investigation showed that the stove had burned fiercely until the oxygen had become exhausted. In the bad air the fire had died down and smoldered at the bottom of the stove. Heavy carbonic acid in the pipe then sank back into the stove while the ventilator was not going, and was there changed into carbon monoxide. The fire had melted the solder attachment of the pipe to the barrel, and when the ventilator was turned again it drew air and black damp from outside, instead of through the stove. The gas thus allowed to accumulate had poisoned the men. A compressor driven by steam gave sufficient ventilation, and the air in the gallery was, on the following day, found to be good and pure.

* * *

Carriage for Blueprint Frame

By W. F. Boericke*

The accompanying sketch shows an easily constructed carriage for handling a heavy blueprint frame without assistance. When not in use the frame lies face downward on the wooden stand to the right of the carriage. In operation, the tracing and paper are first inserted, and the frame is then raised perpendicularly and allowed to settle back in the notch *N* of the carriage. Being now free from the stand, the carriage and frame may be run out on the tracks through the opened window. After exposure, the carriage is pulled in, the frame set back on the stand, and the prints transferred to the adjacent wash tray without delay. Angle iron, 1x1x$\frac{1}{8}$, is used for the track, though channels can be used if preferred. The expense of construction is small, and the labor can be done by any carpenter.



Details of Carriage for Blueprint Frame

* * *

A One-Eyed Man Has a Hard Time to convince others he can see as well as he ever did, says the Inland Steel Co.'s "Bulletin." Why not wear goggles for dangerous work?

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[1] "Zeit. f. B. H. u. Salinenw.," 1914, Vol. lxii, pp. 171-175

*Mineral Point Zinc Co., Galena, Ill

Details of Milling and Smelting

Influence of Impurities on Zinc

In discussing the production of zinc shavings for precipitation in cyanide plants, C. C. Freeman, in the *Monthly Journal* of the Chamber of Mines of West Australia, February, 1915, says that although in many parts of the world zinc dust is to a large extent replacing shavings as a precipitant for precious metals from cyanide solutions, the shavings are still almost universally used in Australia. In small mills the relatively low cost of the installation necessary for precipitation by zinc shavings would outweigh any advantages that would accrue from the use of zinc dust as the precipitant, and in the case of the larger plants which are already equipped with efficient units of the former type, it is a matter of experiment and calculation to determine if the advantages claimed for zinc-dust precipitation warrant an alteration to the latter system.

Most of the English zinc smelters aim at the production of spelter suitable for use in making a good quality of brass, for which purpose little lead is permissible, and such spelter cannot be conveniently rolled. On the other hand, many of the Continental works treat zinc ores and concentrates containing appreciable quantities of lead, and the resulting spelter, after refining, usually contains from 1% to 1½% of lead, which renders the product amenable to rolling.

The rolling qualities of spelter are affected to a marked degree by the impurities present. Moderate amounts of lead render zinc malleable and ductile, and quantities up to 1½% permit good rolling. With more than 1½% of lead, zinc becomes tender; and although when it contains 3% of lead it can be successfully rolled, the sheets are very tender and liable to crack.

Iron reduces the malleability of zinc and makes it harder and more brittle. Up to 0.125% of iron is not injurious, but above this the bad effects become apparent, and passing 0.2% of iron seriously interferes with rolling. Oxygen may occur as zinc oxide, due to imperfections in distilling. If much of this is present the spelter will become brittle and difficult to work. Other impurities may occasionally be present in spelter, and of these cadmium, up to 15%, does not interfere with rolling, while copper, tin and arsenic render zinc hard and brittle.

At ordinary temperatures zinc is quite brittle, and ingots can be easily broken. Between 100° and 150° C. it becomes malleable and ductile, but above the latter temperature it again becomes brittle, and at 200° can be reduced to a powder by pounding. The relatively coarse crystalline structure of cast zinc is destroyed by rolling or hammering, and the specific gravity of the wrought metal is about 7.25, compared with 7.05 when cast. Wrought zinc heated to between 100° and 150° C. retains its malleability and ductility after cooling.

Zinc shavings for precipitation were formerly produced from round disks, which were punched from sheet zinc and clamped together between two iron plates or flanges. This was turned down by a tool moving radially, but the method was responsible for a lot of waste, both from the sheet and from the butts of the disks. The disks cost about £9 per ton above the ruling market price of spelter. The shavings are now almost universally produced from sheets of zinc wrapped about a wooden mandrel, forming a cylinder about 3 ft. long and about 6 in. in diameter. This is cut with a tool with a lateral travel, and no zinc is wasted. The average price of sheet zinc, f.o.b. Antwerp, during 1913 was £3 14s. 6d. above that for spelter.

By the use of a special turning tool it has been proved that it is possible to produce a shaving direct from cast spelter; but the process is so slow that the cost of such turning is greater than that of shavings produced in the ordinary way. The shavings produced by this method are more brittle than those from the sheet metal, and would probably yield an excessive quantity of short zinc when used in the precipitation boxes. A zinc ribbon has recently been placed on the market as a substitute for ordinary zinc shavings. This is produced by fine streams of molten zinc falling on a rotating water-cooled drum, which has a peripheral speed of about 950 ft. per minute. The ribbon, although of about the same thickness, is much wider and more ductile than the ordinary shaving, and after being in contact with cyanide solution for a time it would probably have a tendency to pack in the boxes.

*

Newsom Placer Machine

The Newsom placer-mining machine, invented by John F. Newsom, of Palo Alto, Calif. (U. S. pat. 1,127,667), is in effect a traveling-belt concentrating machine, operating a good deal on the principle of the vanner.

The belt travels over cylinders or pulleys located at each end and is inclined at the proper angle to accomplish the desired results. On this belt there is a coco-matting cover which serves as a concentrating medium, entangling and holding the fine particles of gold and mineral. Over the whole there is a coarse mesh of wire which serves as riffles, while cross-bars with short baffles

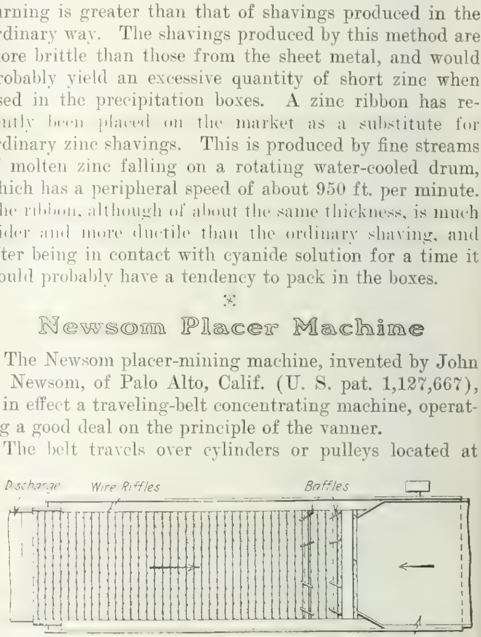


FIG 1

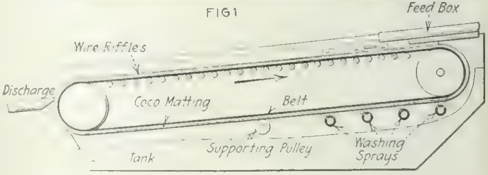


FIG 2

NEWSOM PLACER MACHINE

are placed at intervals to direct the pulp current onto the belt, instead of off at the edges. On the under, or return, side of the belt, there are a supporting pulley and, in addition, several cleansing jets. Just under the feed launder, clear water is admitted to give a final wash to the concentrates formed on the belt. The accompanying illustration shows the construction of the machine—the feed, traveling belt, tailings discharge and concentrates washers.

⁂

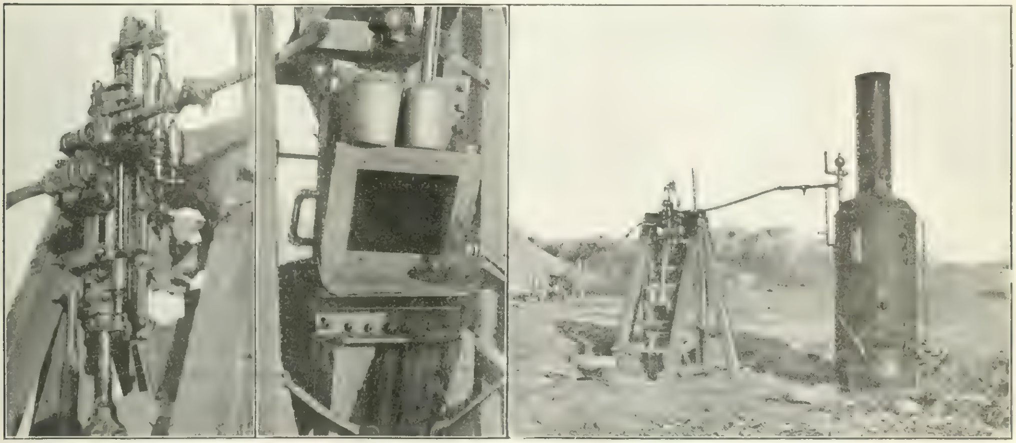
Flotation at Timber Butte Mill

Owing to the paucity of data on flotation operations, the information contributed[1] by Theodore Simons on the work of this department at the Timber Butte concentrator is of interest. This mill treats the ore of the Elm Orlu mine at Butte. The ore is complex, containing gold and silver free and combined with sulphides of lead, zinc, copper and other metals; the gangue is chiefly quartz, fluorite, rhodonite and rhodocrosite. The ore is first treated by table concentration, the tailings being reground in Hardinge mills to pass 60 mesh. The pulp going to the flotation department is thickened to a density of three parts of water to one of ore and is heated to 130° F. by the introduction of live steam. Sulphuric acid is mixed with the pulp in the ratio of 7 to 8 lb. of acid to every ton of original ore going through the mill. Oil is added in the proportion of 0.5 lb. to the ton.

The pulp for flotation goes to a standard 600-ton 11-cell Minerals Separation rougher unit which produces concentrates, middlings and clean tailings. These concentrates contain about [illegible].8% Zn and 11% of insoluble and are cleaned in a 200-ton 8-cell Minerals Separation finisher unit, being fed into the first and fifth cells. Concentrates, containing 52% Zn, 3.5% of insoluble and some lead, copper and iron sulphides, are taken from cells Nos. 1, 2, 3, 5, 6 and 7 of the finishing machine and passed to an Esperanza and then to a Richards hindered-settling classifier; the fine concentrates from both classifiers go to the concentrate house for dewatering, but the coarse concentrates are re-treated on James No. 3 tables to remove the lead, copper and iron sulphides.

The middlings from Cells 7, 8, 9, 10 and 11 of the rougher unit are returned to the roughing flotation machine after classification and regrinding in Hardinge mills. The bottom discharge from Cells 4 and 8, of the finisher unit, are classified and reground with the middlings of the rougher unit, but the middlings overflowing from Cells 4 and 8 of the finisher unit are re-treated in the same machine, being returned by an air lift. The clean tailings from the rougher unit before going to waste are passed through a 36-ft. Dorr thickener for the extraction of hot water which is re-used in the flotation operation.

The agitation compartments of the flotation cells are lined with cast iron and the propellers are made of brass. All agitators of the standard machines are driven from one main shaft by gears protected by steel housings; the gears are so placed that propellers in adjoining cells revolve in opposite directions, thus equalizing strains on the machine and the power transmission. The propeller shaft makes 265 r.p.m., causing the propellers to have a peripheral speed of 1500 ft. per min. The pulp is violently churned and passes to the flotation compartment, where the sulphide-bearing froth is removed; the unfloated gangue and middlings drop to the pointed bottom of the flotation compartment. A pipe connection and valve feed the unfloated material to the next agitating cell, the flow being assisted by the pumping action of the impeller. At this mill the oil is introduced in the agitating compartment of the first cell.



A Compressed-Air Drill Serving as a Stamp Mill

⁂

An Improvised Stamp Mill

An improvised stamp mill which has succeeded in getting the necessary results is shown in the accompanying photographs. It consists of an old reciprocating drill of standard type mounted in a wooden frame and working in a built-up mortar box made of iron sheets and angles. The shoe (which is shown in one of the illustrations) is a cast iron cylinder. Steam is provided by an old boiler of the vertical type.

The capacity of the mill is 0.8 ton per day, the ore being the intermittent production of some high-grade gold stringers. The installation is at Surprise Springs, San Bernardino County, Calif.

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[1] "Bull. of A. I. M. E.," June, 1915.

Company Reports

North Star

The report of the North Star Mines Co., Grass Valley, Calif., shows a profit of $553,603 for 1914, of which $103,603 was added to quick assets and $150,000 paid out in dividends. The North Star mine produced 113,242 tons, which yielded 107,250 tons of sorted ore for the mill. The average grade of the ore before sorting was $9.851, and the sorted ore averaged $10.402 per ton. The production of the North Star amounted to $1,115,587; the Champion Mines produced $301,103, and dividend and interest receipts amounted to $39,547. The total receipts were $1,456,237. Operating and development expenses at the North Star were $582,338. Improvements totaled $10,528 and property purchases, $2153. Champion mine expenses and increase in supplies amounted to $307,615. The total expenditures were $902,634. The following table gives details of operating costs, not including improvements, at the North Star:

	Per Ton of Ore	
Operating expenses:	Mined	Crushed
Mining	$2.882	$3.043
Milling	.588	.621
Cyaniding	.393	.415
Bullion	.028	.030
Miscellaneous	.283	.299
New York office	.180	.190
Taxes	.237	.093
Accident and benefit	.088	.093
Total	$4.679	$4.941
Less sundry receipts	.018	.019
Total operating expense	$4.661	$4.922
Development (2053 ft.)	.481	.508
Total operating and development	$5.142	$5.430

Of the total production, 79.04% was recovered in the mills by amalgamation and 20.96% was recovered by cyanidation. The tailings from the cyanide plant assayed 30.5c. per ton, or a little less than 3% of the value of the metal contents of the ore.

⁂

Isle Royale

The Isle Royale Copper Co., Houghton, Mich., reports for 1914 a profit of $21,374 from 6,601,235 lb. of copper sold at 13.16c. per lb., and silver sales of $17,477. At the end of the year the company had $199,815 of assets on hand exclusive of mine and plant.

The following tabulation will give the operating record of the Isle Royale for the last four years:

	1911	1912	1913	1914
Tons of rock treated	457,440	531,105	314,679	474,349
Yield, pounds of refined copper per ton	16.4	15.4	13.2	13.9
Cost per pound of copper (in cents):				
Mining, milling and transportation	8.97	10.01	16.07	10.67
Construction	.25	.20	.73	.53
No. 7 shaft	.00	.15	.27	.00
Shaft "A" and explorations	.07	.05	.01	.00
Unwatering Huron mine	.06	.08	.10	.05
Smelting, freight, commissions, office, etc.	1.21	1.31	1 53	1.46
Interest	.29	.09	.10	.21
Total cost per pound	10.85	11.89	18.81	13.05
Development work included in above costs:				
Shafts, feet	897	[illegible]	502	225
Openings, etc., feet	[illegible]	19,106	13,626	9,694
Percentage of hoisted rock discarded	[illegible]	11.7	15.4	12.4

The stamp mill was destroyed by fire on Dec. 24; the total loss was between $130,000 and $150,000, of which $100,000 was covered by insurance. The company hopes to have the new mill in operation during the present month. The railroad transported 191,597 tons of rock for the Superior mine for 7c. per ton, thereby reducing the cost of handling the Isle Royale rock to 3.83c. per ton. Work on full time was resumed on Feb. 1, 1915, after operating on three-quarter time on account of the war.

⁂

Federal Mining & Smelting

An analysis of the figures given in the report of the Federal Mining & Smelting Co., Wallace, Idaho, for 1914 shows that there was a balance of $384,268 available for dividends from 1914 operations after deducting all expenditures. Of this amount $117,342 came from a decrease in the investment account. The following table will show the financial statement in detail as worked out by this analysis:

Balance of quick assets at end of 1913		$1,149,061
Balance of quick assets at end of 1914		934,024
Decrease in quick assets during 1914		$215,037
Total receipts during 1914:		
Value of product	$2,200,778	
Rentals	18,852	
Interest	21,258	
Miscellaneous	2,353	
Dividends from investments	84,000	
Dividends from Green Hill-Cleveland Mining Co.	576,000	
From decrease in investments	117,342	
Total receipts		$3,020,583
Total expenditures in 1914:		
For mines and equipment	$285,470	
Cost of production	1,144,866	
Smelter, freight and treatment	866,818	
General expenses	94,663	
Depreciation*	136,861	
Star option and development	39,915	
Flynn group option and development	10,500	
Litigation expense, Norman suit	15,251	
Frisco plant operations	41,970	
Total expenditure		2,636,315
Balance of receipts over expenditures		$384,268
Source of dividends:		
From balance available from 1914		$384,268
From quick assets		215,037
Dividends paid on preferred stock		$599,305

*Apparently a current expenditure.

There were mined in all the properties 421,631 wet tons of ore, of which 21,091 tons were first class. The mills treated 389,450 dry tons of ore. There were produced 57,058 tons of lead concentrates and shipping ore averaging 44.67% lead and 16.01 oz. silver per ton and 1200 tons of zinc shipping ore and concentrates averaging 41.61% zinc. The first-class ore shipped from Wardner averaged 51.2% and from Morning 29.6% lead. The average price for silver was 54.8c. per oz. and $3.869 per cwt. for lead. All development work during the year amounted to 7256 ft. At the Green Hill-Cleveland mill a flotation unit of 65 tons' capacity was installed. The Frisco mill is also being equipped with a flotation unit with a capacity of 350 tons a day. Ding magnetic separators are also installed.

Ore reserves are estimated to contain 988,450 tons of mill ore and 48,640 tons of first-class ore. The average number of men employed at all plants, exclusive of the Wallace office, was 997, at an average wage of $3.675 per shift, as follows: Wardner, 288 men; Morning, 345; Frisco, 55; Star, 11; total Federal proper, 699; Green Hill-Cleveland, 298; total all plants, 997 men. A total of 28 properties was examined by the engineering staff, but none was taken up. The total cost of these examinations amounted to $4835. The decrease in earnings during 1914 was principally due to the suspension of work at the Morning for about five months and other curtailments on account of the war.

⁂

Ahmeek Mining Co.

The Ahmeek Mining Co., Houghton, Mich., reports for 1914 a profit of $462,643 from a production of 13,643,605 lb. of copper which sold at 13.08c. a lb., and silver sales of $4025. Dividends amounting to $200,356 were paid, making a total of $2,400,000 paid to date. After payment of dividends there remained a balance of $262,643, which was added to the assets. The total assets at the end of 1914 were $968,771.

The following table will give the operating record of the Ahmeek for the last four years:

	1911	1912	1913	1914
Tons of rock treated.......	598,549	652,260	383,749	590,519
Yield, pound of refined copper per ton..............	25.4	25.2	24.0	23.1
Cost per pound of refined copper (in cents):				
Mining, milling and transportation	5.61	5.51	7.38	6.73
Construction	.32	1.20	4.53	1.68
Smelting, freights, commissions, etc............	1.19	1.14	1.39	1.30
Interest	.05	...	...	...
Total cost per pound....	7.17	7.85	13.30	9.71
Development work included in above cost:				
Shafts, feet..............	1,284	1,336	104	....
Openings, etc............	11,691	9,828	5,285	4,587
Percentage of hoisted rock discarded	1.9	2.2	0.4	0.03

Plans are being made to resume the work on additions and equipment at the stamp mill, which was suspended in August. Full time was resumed on Feb. 1, 1915, after operating on three-quarter time on account of the war.

⁂

Mason & Barry, Ltd.

The English company of Mason & Barry, Ltd., owns and operates the deposits of copper-bearing pyrites at Sao Domingo, Portugal; it also owns the stock of La Sabina Co. in that country. The report for the year ended Dec. 31, 1914, shows that the capital stock at that date was £185,172 in shares of £1 each.

The total quantity of ore mined in 1914 was 259,238 tons, against 378,929 tons in 1913, a decrease of 119,691 tons, or 31.6%. Shipments, including ore from the cementation works, were 257,616 tons, against 363,208 tons in 1913. The decrease was due to the cessation of shipments to Germany.

The income account shows net earnings from mine operation, £29,008; La Sabina dividends, £7557; interest, etc., £3861; total, £40,426. Managing expenses in England were £7499; depreciation in investments, £1589; total, £9088, leaving a surplus of £31,338. From this the board has appropriated £27,776 for dividends of 15% and £1000 for the staff pension fund, leaving a surplus of £2562. The dividends paid in 1913 were 35%. Adding the balance of £15,550 brought forward from 1913 leaves £18,112, brought forward to current year.

The stocks of ore and copper precipitate on hand in England and Portugal were valued at £64,061, a decrease of £20,523 from the previous year.

Dividends have been paid in each year from 1892, varying from 10 to 65%; the total paid in the 23 years having been £7 2s., or 710% per share.

⁂

Utah Consolidated

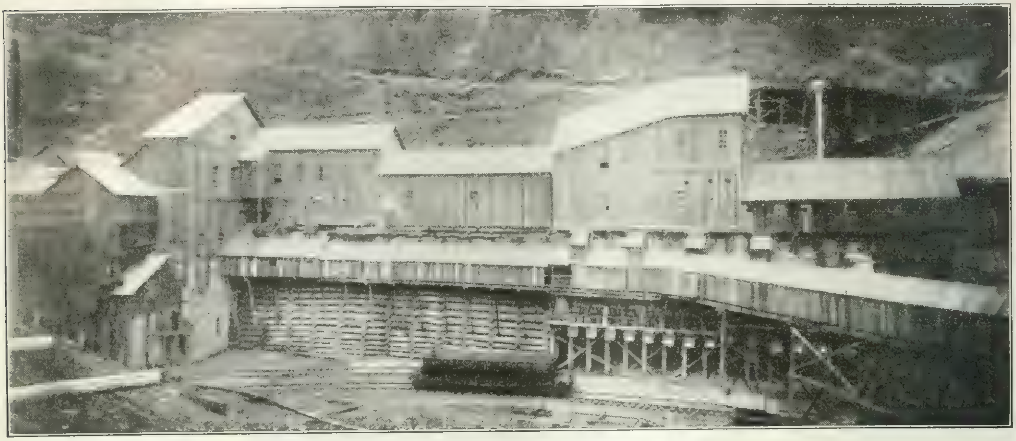
The Utah Consolidated Mining Co., Bingham Cañon, Utah, reports for 1914 that 153,345 tons of copper ore and 48,492 tons of lead ore were mined. The production from this ore consisted of 7,584,391 lb. of copper, 14,588,276 lb. of lead, 284,196 oz. of silver and 15,528 oz. of gold. Profits reported for the year were $565,665 and dividend payments aggregated $600,000. The average assay of the copper ore was 2.509% Cu, 0.085 oz. Au, 0.966 oz. Ag. The lead ore averaged 16.713% Pb, 0.053 oz. Au, 3.275 oz. Ag, and 0.755% Cu. The 1913 report refers to a 1500-ft. crosscut that was being driven into the upper limestone. This work was completed, and in addition 3500 ft. of drifting and raising was done and an incline shaft sunk at present to 689 ft. The ore in this area occurs in irregular-sized shoots, with an average width of 4 ft. and an average assay of 16% Pb, 2.06 oz. Ag and 0.043 oz. Au. There are indications that the orebodies in this ground will be maintained as to size and grade. The ore reserves are estimated to contain 256,521 tons of ore averaging 1.9% copper, 0.054 oz. gold, 0.697 oz. silver and 50,365 tons of ore averaging 16.48% lead, 0.048 oz. gold, 2.68 oz. silver and 0.6% copper. The profit, as stated, does not take into account an expenditure of $24,275 for mine plant written off profit and loss account.

⁂

Hedley Gold Mining Co.

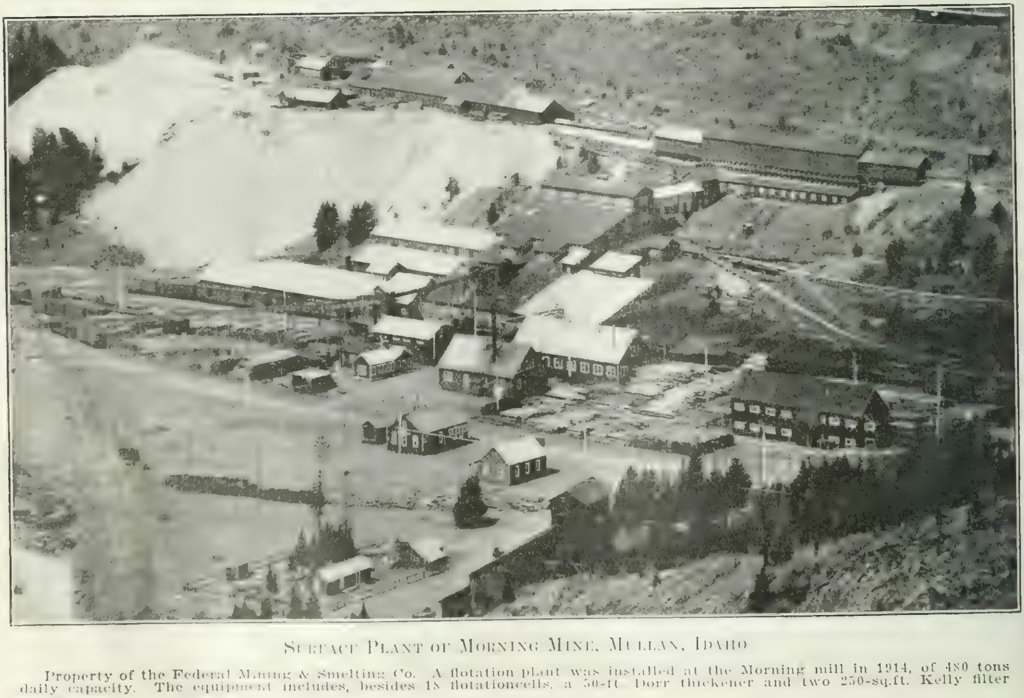
The Hedley Gold Mining Co., Hedley, B. C., for 1914 reports a production of 78,494 tons of ore yielding $797,340. Expenditures, after crediting $6274 in interest receipts on funds of the company, amounted to $409,112. Profits were $388,228 and dividends aggregated $300,000, which is 25% upon the issued capital stock. An 1800-hp. hydro-electric power plant was completed at a cost of $192,009, or $7991 below the original estimate of cost. Since the company was formed $474,275 has been expended and charged to capital account. Of this amount $136,353 was for additions to the mill, $145,913 for new claims purchased and $192,009 for the new power plant. The mill heads averaged $10.80 by assay, or a total of $847,349. Of this $644,851 was extracted by concentration and $152,489 by cyanidation. The total mill extraction was 94.09%. At the end of 1913 it was estimated that the mine contained 113,000 tons of $10 ore in reserve. In this report it is stated that diamond drilling, drifting, and stoping indicate that there is now as much ore in reserve as there was at the end of last year. The company ended the year with a surplus of cash and bills receivable amounting to $166,049. There were no current liabilities reported.

Photographs from the Field



ORE BINS AND SORTING PLANT OF THE LAST CHANCE MINE, WARDNER, IDAHO

Property of the Federal Mining & Smelting Co. In 1914 there was an average of 288 men employed here. The first-class shipping ore carried 51.2% lead



SURFACE PLANT OF MORNING MINE, MULLAN, IDAHO

Property of the Federal Mining & Smelting Co. A flotation plant was installed at the Morning mill in 1914, of 480 tons daily capacity. The equipment includes, besides 18 flotationcells, a 50-ft. Dorr thickener and two 250-sq.ft. Kelly filter presses.

A View of Juneau, Alaska, and Its Harbor

Correspondence and Discussion

Employment for Idle Engineers

The suggestions under "Employment for Idle Engineers" in the May 1 issue of the valued and indispensable JOURNAL are a real inspiration in these hard times, especially to the species without resources.

After the most skeptical and scrutinizing dissection of your so hopeful evangelism, which even does not exclude a "Freiberg aristocrat" from a possible grubstake, I am able without dignity's fear (having "done" only assaying, mill work and surveying) to muster enough courage (youth's fire and enthusiasm having not quite subsided) to accept the cherished assumption that some adventurous capitalist may invest some of his spare coin in a grubstake and gamble it against the chances of *not* finding a mine.

It is unquestionable, there are immense areas out West which have only been prospected by the ways of '49 and which may yield big rewards to the modern prospector. There is, for example, a big section east of Sumpter practically virgin, though with the finest probabilities, of which the surface compares most favorably in geological and mineralogical appearance to some of our biggest mineral districts, the main features being big deposits of limonite and hematite 50 to 100 ft. wide between limestone and argillaceous shales (porphyritic). This iron hat can be traced for approximately 2½ miles. Erosion was not active and the gossan is much leached and porous and seems to extend to considerable depth. No commercial minerals are discernible on the surface, but a gold assay from a trace to a few dollars may be obtained occasionally. Wad, hydrated manganous manganate, with slight impurities, gives an appreciable Co reaction. In my opinion these indications ought to justify a moderate expenditure for drilling tests, which most likely would prove considerable orebodies in depth.

Then about 26 miles west of Sumpter is an area of biotite gneiss intruded by granite (pegmatite), andesite and rhyolite dikes. The work performed in the early days by old timers can be much improved on. This district is practically abandoned. Float that I assayed from this section gave very high return in gold and silver, tellurides being present.

In addition some data on about 1000 acres of ideal possible dredging ground well worth prospecting ought to loosen the heart and purse strings of some Crœsus with gambling propensities.

C. A. BRAUNGER.

Sumpter, Ore., May 5, 1915.

Timbering Stopes for Safety

In "Timbering Stopes for Safety," by H. H. Hodgkinson, in the JOURNAL of May 8, is this sentence: "Considerable time and labor will be saved in cutting the miter of two timbers by bisecting the angle formed by them and cutting each timber at a bevel of that angle."

How are this angle and the consequent proper miter bevel determined? Is the timber used in these stopes recovered; and if so, how is this accomplished in the case of a truss set high above the floor?

SOURDOUGH.

Goldfield, May 13, 1915.

Bill McGinty, Prospector—III

Misther Editor—Well, we lost so much time foolin' with the felly that had the spicimins av titanium iron ore that the *mozos* an' carga got pretty well ahead av us; but we caught up in time to camp that night close to the Continental Divide again. The third day we got to where 'tis all on the Pacific Slope. There ye have fine timber, plenty av deer, wild turkey, quail, hot springs an' fuchure health resorts, fine ripplin' an' plungin' streams av clear an' glad-soundin' water, ivery wance in a while full av hungry trout; an', take it all in all, most iverything to make life wan sweet song excipt the kind av thing the Stars an' Stripes was invinted to protict. The fellies that live there are Mexicans, but they're different from the fellies around the towns an' the patrishuns' peonized *haciendas.* Some av thim are like William Tell, an' as skilful at shootin'.

The third night we camped in a delightful pine forest, a little ways beyond the Guitarra ranch, leavin' the trail far enough to pick out a suitable boodwar near a spring. Durin' the night a light snow fell, an' the air was what ye might call invig'ratin'. In the mornin' we solved the myst'ry av some queer groanin' noises which had disturbed our beauty sleep. Close to the trail was what had wance been a fine Holstein cow, belongin' to some Michigan folks. The $NaCN$ for the mill av the Bacis Gold & Silver Mining Co. was either carelessly packed for shipment via the mule train or had been meddled with by some suspicious Custom House official. The poor cow, not havin' the advantage av even a coryspondinse coorse, mistook it for $NaCl$—earnin' a mark av 75% in spellin', a failure in chemistry, an' 100 per cint. extraction av the vital spark.

On the fourth day we went down a little, up a little, down some more an' on through park after park; crossin' trout streams, an' me wishin' for a leader an' flies; killin' a squirrel with a rifle-shot from the saddle an' then havin' the cinch-strap bust when pickin' him up with the right low reach I learned when a young felly in a cavalry troop. Annyhow, I got the squirrel first; but 'tis a good thing to raymimber that a mule is built different from a horse, an' if ye try stunts ye must expict trouble. Pick out flat places for fancy work, an' if ye have much uphill an' downhill travelin' use a single cinch an' a breast strap an' crupper—on the mule, I mane. Get off an' walk wance in a while when the goin' is steep, an' the mule will eat out av yer hand. If ye don't she may try to bite yer leg or step into the saddle an' change places with ye. A nice, well-bred lady mule will gin'r'lly act like a lady if ye treat her like wan; but a *macho* is more like a dimmycrat after four raypublican administrayshuns.

Now an' then from an open part av the trail ye can get a glimse av the valley av the Bacis River. Most av the country over which we had passed in the first part av the trip seemed to be pretty well covered over with sidimintary an' lava-flow volcanic rocks. I can hear the tungsten felly offerin' an objection to the word *sidimintary.* Wance durin' the ensuin' summer I was havin' a picnic av a trip down toward Ventanas, tryin' to find the old Indian route from Huehuento Mountain to Tayoltita, in company with a real ingineer crony named Adam C. Walters, or somethin' like that. We rollicked along, sizin' up the geology in a superfish'l way like Jim Furman. Somewhere near the top av the world we rode under a kind av overhangin' cave. The rock was a curious kind av a big nachr'l puddin', with big boulders for plums, little boulders for currants, an' ashy sandy stuff for flour an' sugar. "'Tis cooked," sez Adam. "Help yersilf," sez I; "I'm not hungry." "It luks like a sidimintary," sez he; "an' I wud call it a conglom'rate on suspishun." "'Tis volcanic," sez I. "By their ash ye shall know thim."

"'Twas dayposited," sez he, "an' I can prove it." Jist then came a clap av thunder follyed by a flash av lightin', simultaneously speakin', an' hailstones began to pelt us. "Ride for yer life," sez I as loud as I cud. "'Tis bein' dayposited on us this minute." Whin we was safely camped in a *jacal* at the cul-de-sac ind av the wrong trail, we filled up on *frijoles* an' *tortillas* an' thin got ready to raysoom the argymint.

"Mac," says Adam, "we're both right. 'Tis sidimintary, 'tis volcanic, 'twas dayposited, 'tis ash, 'tis puddin', 'tis conglom'rate, 'twas made in a river, 'twas made in a lake, 'twas made on the top av the mountain. That stuff was dayposited like the hailstones, from the sky. It fell on the lakes an' rivers av lava on the mountains. That piece av a cave was made by some that fell on the edge av a puddle av lava, an' a million years later the lava slid out from under. The geology is satisfact'ry."

We niver got back to that same spot again, so we have not as yet altered our opinions. Wud it not be interestin' to have some av the cellybrated geologists go back to the scenes av the inspirashun av some av their long an' l'arned discoorses, after some av the ign'rant an' un-eddicated impractical miners have gotten rich minin' out some av the ore that was theoretically non-existent?

Brooklyn, N. Y., May 15, 1915. BILL McGINTY.

(*Cheer up, the end is in sight!*)

Murders in Mexico

In the JOURNAL of May 8 the Douglas, Ariz., correspondent, writing of conditions in northern Sonora, says: "During all this trouble Americans and foreigners have been well treated by both parties, and the two Americans who were killed near Nacozari by Mexican miners have been avenged by the authorities, who captured the two men and had them shot next day." The two men who were murdered (Dunn and Francis) were British subjects. At first they were thought to be Americans and nothing was done toward having the murderers arrested, but the British vice-consul at Douglas took the matter up, with the result stated by your correspondent. I have not heard of any well-authenticated case of any Mexican being executed for murdering Americans since the revolution started.

Miami, Ariz., May 15, 1915. W. MOTHERWELL.

Mexican Mining Law

In the JOURNAL of Apr. 10, 1915, there appears an editorial under the caption, "A New Mining Law in Mexico?" While the essence of your message to the men who are interested in mining in Mexico will undoubtedly meet the approval of a majority, there is one minor point which should be made a little more clear. I do not desire to precipitate a controversy, as Mexico is already over-supplied with that sort of thing, but almost every writer of Mexican mining news (I do not exclude myself from this category) falls into the error of considering that the mines are indeed owned by individuals and corporations. The Mexican mining law of 1910, sometimes characterized as the "Calero Law," states in the first article of the first chapter that certain deposits of inorganic substances are the property of the direct dominion of the nation. Article 2 of the same chapter specifies what class of deposits are the exclusive property of the owner of the soil.

Dating from the conquest of Mexico by Spain, all mines such as gold, silver, etc., have been the property of the government. Leases of such mines to miners and mining companies have, in many cases, continued in force for so many years that the operators have acquired the habit of considering themselves the actual owners of the mines. Further, under the *avie* system, the lessees from the government conceded what were practically subleases to "habilitators." These habilitators, in turn, after many years of uninterrupted enjoyment of the profits derived from their operations, acquired the rocking-chair habit of complacently considering themselves the owners of the mining properties. To drop into the vernacular, it might be said that as long as they could put this stuff over they got away with the goods, but sometimes a day of reckoning comes. In criticizing apparently hasty and unjust new mining edicts, it would be well to study carefully the history of each mining property concerning which complaints may be made. A well-known mining engineer, author and editor, in a book of travels which included a journey through Guanajuato and other Mexican camps, made specific reference to the slim chances which the owners of the old *aviado* rights in certain Guanajuato properties stood of ever getting another accounting on the old contracts. This because of the clever system of bookkeeping, which showed the operating expenses to be so high that there was a monotonous repetition of "nothing doing" on the credit balance. The author in question wrote as if approving of the practice, or at least leaning somewhat toward a *laissez faire* policy.

While Villa's edicts may be hasty and open to the criticism that they savor of an illegal alteration of contract conditions during the term of a lease, or of a "horse bucking off his rider while crossing a stream" (this is cribbed from the maxim about changing horses, etc.), it may, nevertheless, be urged that the celebrated Alexander broke a few old-fashioned rules when he cut the Gordian knot instead of attempting to untie it.

Coming back to the original quibble, how can a *de facto* government confiscate foreign-owned property when the property really belongs to a *de jure* government which does not exist, but is temporarily represented by separate *de facto* governments in different localities?

WILLIAM [illegible] McKINLAY.

New York, May 18, 1915.

Dinner to Professor Munroe

A testimonial dinner to Henry Smith Munroe, professor of mining in Columbia University, 1877-1915, was given by his old students in the Schools of Mines, Engineering and Chemistry at the Chemists' Club, New York, on May 28. The special occasion for this was the approaching retirement of Professor Munroe, which is to occur coincidently with the close of the present collegiate year. Professor Munroe, who is the senior member of the faculty, will then have completed 38 years of service.

The dinner was arranged by a committee of which George C. Stone, '79, was the chairman. Over 100 attended. The speaking following the dinner was begun by R. V. Norris, president of the Alumni Association, who introduced Prof. J. F. Kemp as toastmaster. The other speakers were Nicholas Murray Butler for the university; Thomas Haight Leggett for the American Institute of Mining Engineers; Walter Renton Ingalls for the Mining and Metallurgical Society of America; and John Parke Channing for the Alumni. In concluding his remarks, Mr. Channing gracefully presented to Professor Munroe, on behalf of the former students of the latter, a massive bronze—the Sluice-Miner—by Louis Potter.

Professor Munroe in acknowledgment of the testimonial to him delivered the address that is printed herewith. This was received with warm appreciation by those at the meeting, who considered that it revealed Professor Munroe to a depth that had not previously been perceived even by his oldest and most intimate students. President Butler had previously aroused great enthusiasm by the expression of his own views of the high quality of the man and by his pronouncement that the old School of Mines, in which Professor Munroe was always important, was without any doubt the real foundation of the new and great Columbia. The meeting was one of which both Professor Munroe and Columbia men generally have reason to be proud.

Professor Munroe's Address

A wise man once said, "An ounce of taffy is worth a pound of epitaffy." I suppose that I shall have to do without the epitaffy. I feel a little as if I were attending my own funeral feast. A year ago I came very near to being the subject for a funeral discourse, but thanks to Heaven and to the doctors, I am very much alive tonight and able to hear and enjoy the very flattering things that have been said about my work.

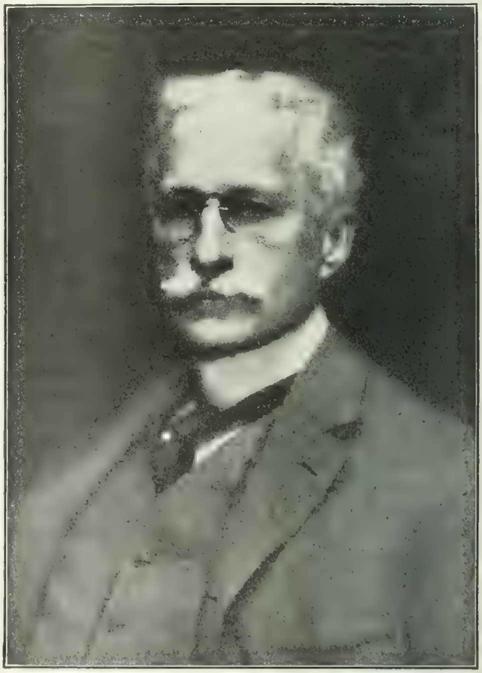
Not Easy to Reply to Eulogies

It is not easy for a modest man to stand as much eulogy, as many obituaries, as I have heard tonight, and it is not easy for a diffident man to reply to such praise or to acknowledge it as it deserves, especially if one is embarrased by the knowledge that the picture is overdrawn, that one has not really earned quite so much credit. It would be strange indeed, and I should be much ashamed of myself, if in 38 years I had done nothing out of the ordinary. I am proud of my modest contributions to the reputation and influence of the School of Mines of this great university. I have enjoyed the working out of new ideas in the education of mining engineers. It has been a great pleasure to contribute to the usefulness of the School of Mines and to the efficiency of its graduates.

I am, however, quite conscious that I have left undone some things that I ought to have done; and have done, sometimes, what I ought not to have done. Perhaps I may be able to do some of these things left undone in the future. But one often makes good resolutions. It is not easy to be altogether cheerful when the time comes that one must surrender that which makes life most worth living, to give up one's chief interest in life, whether that be the struggle for wealth, the pursuit of happiness, or just plain everyday work. It is not easy to say—"It is done." And when one's work is also one's pleasure, when one's occupation is as interesting and absorbing as mine has been, the thought of giving it up is not made any easier.

Credit for the Development of the School of Mines

The credit for developing a scheme of instruction in such an institution as the School of Mines must be divided. No one man can claim or should be given credit for more than a small share in the final result. We must not for a moment forget what we owe to the founders of the School of Mines, Egleston, Chandler, Newberry, Vinton and Barnard. The idea was Egleston's. His was the vision of what might be done for the country by a well-equipped school in which the sciences of mining and metallurgy should be well taught. Chandler was from the beginning the organizer and administrator. He made the idea practicable and the teaching practical and effective. Vinton was an erratic genius, a fine mathematician, an able engineer, a skilled draftsman, and he laid the foundations which made the School of Mines an engineering rather than a scientific school. At first the instruction in geology



Prof. Henry S. Munroe

was assigned to Professor Chandler, but later the new School of Mines was fortunate in securing John S. Newberry, whose reputation as a geologist, whose experience as an administrator and whose lovable nature added much to the strength and character of the teaching force. President Barnard, scholar, mathematician, physicist and eminent educator, gave to the new school encouragement, sympathy, wise guidance and enthusiastic support.

We must not overlook the services of others, who from the beginning have contributed financial support, wise counsel, helpful guidance and personal service. President Low, President Butler, the trustees of the university, later members of the faculty, Ricketts, Hutton, Kemp, Peele, Walker, and many others, the alumni of the college and of the School of Mines, and the many benefactors, including the donor of the School of Mines building, Mr. Adolph Lewisohn.

As we all know, the new school was a success from the beginning. Planned for a few students, it had to increase its teaching force immediately. To meet the unexpected emergency, a number of the Columbia professors volunteered their services and were at once enlisted in the work. Van Amringe, Peck, Rood and Joy took the subjects of mathematics, mechanics, physics and general chemistry.

School of Mines Founded on Practical Instruction

The original idea was to make the School of Mines a graduate school, but it was soon found that a preparatory year was necessary. This afterward became the first year of the late four-year course. Now this preparatory work is to be relegated to the colleges and the original idea of the founders is to be given another trial. And again, we call upon the faculty of Columbia College for this necessary work.

In a school for the training of engineers—the men who do things—the instruction should be practical. We have often heard Chandler tell how he wandered from one college to another in this country trying to find an institution where he could be taught chemistry in a laboratory, how he obtained his wish in a measure at Harvard, but was finally compelled to complete his education in Germany.

When the School of Mines was made ready for students, the first thing done by Chandler was to provide chemical laboratories—qualitative, quantitative and assay laboratories. Egleston had from the beginning his blowpipe laboratory and his students' collection of minerals in open drawers, as well as the show collection under glass. Vinton had his drafting rooms where the students were taught to make wonderful working drawings like Joseph's coat, in many colors.

What has been done since in laboratory equipment is familiar to everyone here present—engineering laboratories, civil, mechanical, electrical, chemical, metallurgical and mining. The summer work in surveying, in geology, in metallurgy and in mining is but an extension of the same idea.

It is not yet certain that we have exhausted the possibilities of this sort of education. It was 34 years after the founding of the school before we had laboratory instruction in physics. It will perhaps be equally long before we have laboratory work "elbow teaching" in mathematics to train the young idea, for example, to visualize mathematical conceptions involving three dimensions (and perhaps, who can say, extend such teaching to the "fourth dimension!"). I find students whose mental vision seems to be limited to a single plane, and to whom the third dimension is almost as unreal as the fourth dimension to the rest of us. In many other ways laboratory teaching in mathematics may prove desirable.

Not only in its laboratory and field instruction, but also in its presentation of the different subjects taught, is the School of Mines practical. Chandler's course in applied chemistry, with the Chandler museum illustrating this subject, Professor Newberry's lectures on economic geology, and his collection of ores and useful minerals, are good examples. The traditions thus established have been followed in other departments, and the School of Mines is preëminently a School of Applied Science.

Engineering the Basic Requisite for Mining Men

A mining engineer must first be an engineer (it almost goes without saying). This has not always been recognized. When the school was organized there were few real mining engineers in the country, but many mining experts, mostly geologists. The mines were managed by so-called practical men, and the engineering was "rule of thumb" and in the hands of boss carpenters, machinists and blacksmiths. It was fortunate that Egleston and Vinton were graduates of the Ecole des Mines of Paris and that Vinton, Peele and Trowbridge were graduates of West Point. It was most fortunate for the reputation and usefulness of the new School of Mines not only that these men were engineers, but that they had the courage of their convictions and adopted the educational traditions of the old world, instead of adapting their teaching to the existing practice of the new. The school would have been much more popular had the training been less strenuous. It would, however, never have attained its present influence and prestige.

While the School of Mines was thus organized from the beginning as an engineering school, with instruction in higher mathematics, physics, mechanics, etc., the courses in engineering were not given the prominence they deserve, and that they now have, until 1877, when Professor Trowbridge first took charge of that department with Hutton, Crocker, Mayer, Pupin and Munroe as assistants. As an engineer, the mining engineer is called upon to design structures, headframes, bins, trestles, framed buildings; to construct reservoirs and ditch and pipe lines for water supply; to lay out roads, railways, engine and gravity planes and ropeways for the transportation of mineral; to choose intelligently, and sometimes design, machinery for mining, pumping, ventilating, hoisting and milling, and to design power plants to operate such machinery.

Mining engineers must therefore have instruction in civil, mechanical and electrical engineering, as well as in the many special engineering problems involved in the development and operation of mines.

Exacting Requirements of a Mining Engineer's Education

A mining engineer must, of necessity, be a mineralogist, geologist, and something of a metallurgist. All these subjects demand most thorough instruction in fundamental subjects—mathematics, chemistry, physics, mechanics, hydraulics, thermodynamics and the like. You will all remember your first and second years in the School of Mines as burdened with these subjects.

With the development of civilization and the new applications of science to the daily affairs of life, new demands are made almost every year for more detailed instruction in these fundamentals. The teaching of chemistry, physics and mechanics is today much fuller and more exacting than it was 10 years ago, and another 10 years may see further demands and further development in the same direction. Perhaps two and one-half, perhaps three years, may soon be required for fundamental science subjects. Who can tell?

From an educational standpoint, the training in an engineering school must be broad and thorough in these fundamental subjects. Nothing can be permitted to interfere with this. As the course becomes more crowded, we shall have to devote less time to the professional subjects and perhaps omit many of them altogether.

From the beginning, the founders of the School of Mines determined that it should be strictly and solely a professional school. All subjects of a non-professional character, language, literature, history, philosophy, economics and the like, have been rigorously excluded. French and German were for a time included (on account of their usefulness), but later were made requirements for admission. This policy has been maintained to the present day. Other engineering schools almost without exception devote about one-fourth of the student's time to non-professional subjects and as a result weaken their professional training very seriously, and this without fully accomplishing the object desired. One year out of four is not enough time for liberal studies. It is, of course, true that our graduates are more or less handicapped by the lack of this training unless they get it elsewhere, at home, at school, in college, or by their own efforts.

In 1891, when I was promoted to be the head of the new department of mining, it occurred to me that this lack of general and broad culture, so necessary for one who aspires to be a leader in his profession, could be overcome by a larger proportion of our students if they could be encouraged to attend a college before coming to the professional school. A small number of our students have a first degree on entering, and a larger number have one, two or three years of collegiate work to their credit. To take both collegiate and professional degrees then required eight years. By special arrangements at Columbia and elsewhere, the time could be shortened to seven years without losing the first degree.

The Six-Year Course at Columbia

The work of the first and second years in the School of Mines' four-year course was wholly of a collegiate character—mathematics, chemistry, physics, mineralogy, geology, elementary surveying and the like. There seemed to be no reason why these subjects should not be counted for the first degree and the combined course shortened to six years. A schedule of study was drawn up on these lines and submitted to my colleagues in the university, including among others Professor (now President) Butler. The idea received immediate acceptance in theory and six years later, on removal to the new site, was put into operation. For eight years this combined six-year course has been taken by a few students each year. Next year the six-year schedule will be in force for all students who may be candidates for engineering degrees.

At first the number of students will be much less than at present. The trustees have made the experiment with full knowledge of the financial sacrifice involved. It is a bold step, and one in which the outcome is uncertain. There can be no question as to the wisdom of the new course from an educational standpoint, if the loss of income does not involve and make necessary economies which will affect the efficiency of instruction. No such economy is at present contemplated and we hope none will be necessary. In an educational institution increase in numbers usually increases the deficit. The education of each student always costs more than the fees paid. With few students, the annual deficit should be less.

The Lecture System Discussed

In conclusion, I should like to say a few words as to instruction by lectures. All my academic life I have been a lecturer. No one is more familiar with the defects of the lecture system, or with its great usefulness. The chief disadvantage lies in the necessity for taking notes. But few students are skilled stenographers. If they are, their whole attention is devoted to recording the words as they fall from the lecturer's lips and the brain fails to apprehend or record the ideas conveyed. If the student takes "long-hand" notes, he must condense and so the brain takes temporary cognizance of the ideas. The more the student listens and the less he records in his notebook, the greater the impression left in his brain at the end of the lecture. The best results undoubtedly are secured by taking no notes and writing a summary afterward. I think it important, however, that the student should make his own summary. If a printed syllabus is provided the average student pays less concentrated attention to the lecture, and the better and more complete the syllabus, the more he learns to depend upon it and the more he allows his mind to wander; or, if he follows both the syllabus and the lecturer, the printed word makes the greater impression on the brain and the spoken words are largely forgotten. With a perfect and complete syllabus, the lecture is almost, if not quite, unnecessary.

The principal advantages that may be claimed for the lecture system is that it is always up to date. The lecturer, if he is alive, will give the student the last word on the subject treated. This is especially important in engineering topics, in which every week some advance in practice is recorded in the technical press. In the case of a printed book, the proof sheets are hardly corrected before some modification or correction should be made. To bring a book up to date requires a lecture or more to supplement each chapter. The book then becomes only a less perfect syllabus.

Another advantage that can be claimed for the lecture is the possibility of elaborate illustration. If many cuts, figures, tables, formulas or other illustrations are printed in a book, the mind of the reader is confused and strained by referring back and forth from text to illustration, and much energy is wasted and time lost in endeavoring to establish the desired correlation. In a lecture the eye of the student can remain fixed on the diagram or blackboard, while his ear receives the explanation. In a lecture it is possible to have many diagrams on the wall and refer to one or to several at will, to illustrate the ideas to be conveyed. This would be impossible in a book without greatly fatiguing the reader.

Another advantage, and not the least important of the lecture system in good hands, is the saving of the students' time. To compile the lecture, the instructor has spent many hours in reading. A single line may represent an hour's work. If the student is required to obtain the same information, he will probably consume much more time and get only a confused and contradictory impression as the result. It is true that it is necessary for the student to learn to read intelligently and to draw accurate conclusions from what he reads. This is in itself a valuable and necessary part of his education. He should, however, not be compelled to get all of his information from library research.

Reading should supplement the lecture and should be subordinated to it. The principal disadvantage of the "case system" of teaching law and of book research in graduate work is the great expenditure of time required and the imperfect results obtained. The case system must be supplemented by recitations and lectures and the research work by seminars.

With the crowded condition of our engineering courses, in which the economy of the time of the student is of prime importance, and in which we must secure the maximum result from every hour of the student's work, the lecture system has always played an important rôle and will always continue to be one of the most valuable methods of imparting knowledge. Textbooks, recitations, laboratory work, reading and research should all be used, each in its proper place, but lectures should also be freely employed as giving greater results for the time expended by the student than any of the other methods.

Contact between Lecturer and Student

Finally, the contact between the lecturer and the student and the personal influence that may be exerted by the instructor, while present in any good form of teaching, are perhaps most effective in the lecture. Certainly in no other way can the teacher impress himself on so many in so short a time.

Many years ago Mr. Alexander L. Holley, the eminent metallurgist, read a paper on the "Inadequate Union of Engineering Science and Art." This was followed by a joint discussion by members of the several engineering societies on "Technical Education," which was afterward published in book form.

One result of this discussion was the establishment of the "Summer Class in Practical Mining" at Columbia in order to bring mining students into intimate contact with the art of mining during their professional course. In Germany, all mining students are required to spend several months in practical mining work, with considerable emphasis on manual labor, before beginning their professional training.

The summer school has proved of great advantage, as most of you will testify, but the inadequate union between science and art still obtains. Unless the graduate of the School of Mines goes through some sort of apprenticeship in practical mining, he will have indifferent success as a manager and will quickly become reduced to the ranks of "consulting engineer," in which at present the supply greatly exceeds the demand.

During the past 30 years or more, I have given much thought to this subject, and have made several tentative experiments at a graduate school of practical mining on the lines of the apprentice schools which have been established by several large corporations. None of my experiments have been altogether successful, and I question whether any such school will be of great value unless under the joint direction of an enthusiastic and capable instructor and a hard-headed and rigorous business manager. These two must work together. The apprentice must no longer be a student whose interests are all important, but he must be a wage earner, who gives full value for the wage paid. The latter result cannot be secured in any work solely under academic direction. On the other hand, the apprentice must not be looked upon primarily as a wage earner, and ruthlessly used as a cog in the machine, but he must be treated also as a student and his work so organized as to give him the necessary practical training in the shortest time. It must be recognized that his training is to make him an executive officer, and that it is a waste of time to try and make him a skilled workman.

The best results so far have been secured when the enthusiastic instructor and the hard-headed business manager are one and the same person—when an officer of the company can be induced to take the graduate as an apprentice. Unfortunately, but few mine officials have the time, the training, the sympathy and the inclination to undertake this work.

The next best thing, and one which will serve a larger number of young graduates, will be for some one or more mining companies to organize apprentice schools and delegate the supervision of the work to a competent officer of the company, who will serve in the double capacity of enthusiastic instructor and hard-headed business manager, at least, so far as the apprentices are concerned.

Such an apprentice school should prove valuable to the mining company, as well as of inestimable worth to the profession.

American-Foreign Refugees Club

A club, the American-Foreign Refugees Club, has been recently organized in El Paso, Tex. The object is to form a meeting place for American and foreign refugees from Mexico, and others interested, where they can receive daily news and reports of the state of affairs in the Republic. The society is to be nonpartisan and nonpolitical, and a reading room will be maintained. In this will be kept files of the leading daily papers of Mexico City and such other cities in Mexico from which periodicals can be obtained. There will be copies of the official journals from the capitals of each state, giving the latest decrees, tax impositions, assessments, and other pertinent details. Information of all kinds pertaining to Mexico, its laws and tariffs, will be kept for reference.

A register of the addresses of all Americans and foreigners in Mexico is being kept as far as possible, and all those coming in from there are requested to call and give the club the latest news of the section from which they come. There are small fees collected from members for maintenance of the institution.

Many persons have come from Mexico without resources, and these the club has made efforts to assist in every possible way.

Editorials

The Situation in Spelter

Last week the price for spelter rose above the price for copper, an event unprecedented in the history of the metals. Moreover, it occurred at a time when the price for copper was high—about 18½c. Previous to the war a normal price for copper was commonly considered to be about 14½@15c., for spelter about 5@5½c. What has led to this extraordinary, surprising development and what will result from it?

It is unnecessary to review the conditions that caused Europe to turn to America for a large supply of spelter, or the statistical position, or the shortage of smelting capacity—all of which has been done previously and exhaustively. The matter of chief interest is what has happened during the last three months.

In the early days of March, following large buying from abroad in January and February, the price for spelter had risen to about 10c. That price was regarded as dangerously high by almost everybody of long experience in the industry, and when the demand abated in a rather ominous way, the transactions during the middle fortnight of March having been very light, there was a sharp recession in price, and it was thought that a collapse was threatened then and there. Toward the end of March, however, a strong demand began to reappear, attaining great force in April and increasing during May. This demand emanated especially from ammunition manufacturers in this country and in Canada. There was also buying from abroad, but it was less in volume than the domestic.

The ammunition manufacturers had come into possession of huge contracts for cartridges, shells and shrapnel and required a large quantity of spelter for making the brass used in those things. Their contracts promised to be immensely profitable. The metals, at any reasonable price, constituted but a relatively small part of the cost of manufacture, and when their purchasing agents went into the market to buy them, there was no haggling about price, which was a subordinate consideration, and no disposition to lie low and buy conservatively. On the contrary, the thought and the policy seemed to be "We have a contract to deliver so many shrapnel, beginning in July and ending in December, which is going to require so many tons of spelter. Contract now for all of that spelter, at any price, for deliveries corresponding to our own deliveries of the finished product and rid our minds of the raw material question." With respect to the kind of spelter to be bought, the ammunition manufacturers simply repeated the specifications of the military authorities. It was not their part to ask questions or discuss reasons why. If they were told to use spelter assaying 99.95% Zn, they went into the market to buy just that kind, and no other. The ordinary classifications of spelter as high grade and intermediate were practically abolished, specifications becoming for particular brands or for guaranteed zinc content narrower than the customary limits of the trade.

With such a demand the market became one of sellers' terms, and often a buyer—making specifications that only a few sellers, or perhaps only one, could meet—was required to pay what looked like, and in fact was, an extravagant price, but which created a new precedent and constituted a new point for everybody to cap the next day. A buyer needing a considerable tonnage of spelter for delivery during June, July and August might find only one seller who could supply it, whose terms might be that an equivalent quantity for the next following three months be taken at the same price. Another buyer needing intermediate spelter might find that he could get it only by taking the same quantity of prime western, both at fancy prices. The ammunition manufacturers were indifferent as to this; not so, however, those galvanizers, users of spelter for peaceful purposes, who were caught in the maelstrom.

These developments put the producers in quite a different position from what they occupied during the first quarter of the year. During that time there was a shortage in the supply of spelter for prompt delivery and more or less difficulty in selling ahead. Buyers, having no confidence in the rise already experienced, were reluctant to commit themselves to contracts running far ahead. In so deferring their purchases, however, they found themselves later compelled to pay large premiums to those producers who could supply prompt spelter, and in the end had to do just what they had sought to avoid. As for the producers there were great differences in the averages of sales according to whether they had sold ahead liberally or had not.

In the second quarter there came a change. The demand for deliveries far ahead—to the end of 1915 and even into 1916—arose and producers were delighted to be able to sell thus at the high prices offered, and nobody considered it desirable to confine his sales to near-by deliveries with the hope and expectation of realizing even higher prices later. The purchases of galvanizers, especially interested in near-by deliveries, dwindled, while as for the ammunition manufacturers, the later deliveries were in many cases what they wanted particularly. Business in prompt and near-by deliveries became insignificant, confined to belated consumers who required relatively small quantities. The producers were of course able to supply those, for no smelter will contract for the delivery of all he expects to make in any month, considering accidents that might happen, and as each month ends the reserve for safety is released and may then be peddled out at a premium.

The situation that has developed in spelter is of course paralyzing for the industries using spelter for peaceful purposes. From all quarters come the reports of the use of bright wire instead of galvanized and of black sheets instead of galvanized. The manufacturers are urging their customers to make those substitutions. If black sheets, to be painted, can not be used, try terne plate, or use something entirely different, e.g., instead of galvanized pails use wooden or paper ones. Some galvanizers are already discontinuing the manufacture of galvanized goods. Yet the crest of the wave has not yet broken upon the manufacturers in full force, for while spelter is now above 20c. per lb. the smelters are still delivering spelter that they sold in March and earlier at 8@9c.

What is going to be the outcome of this situation? It is dangerous to venture any prophecy in view of the extraordinary conditions, the destruction of all land-marks, that have resulted from the war. The events of the last week do not indicate that the climax in spelter has yet been reached. Nevertheless, we are not over bold in imagining that it can not be far away; nor in imagining that when the contracts covering the spelter needed in filling the ammunition contracts have been placed there will be a cessation of the furious, reckless buying that has characterized the last few weeks. However, while the war lasts we shall no doubt see high prices for spelter, even if not so high as now. But looking ahead to the end of the war we are going to see some day the possession of an enormous smelting capacity, completely equipped for operation, which will be available for the supply of consumers who are now being trained by force of circumstances to use other things as substitutes for spelter, with the danger that they will find some of those substitutes to be better than spelter and will not want to return to the use of the latter anyhow.

Mexico

At last there is to be a change from the policy of "watchful waiting" with respect to Mexico. It is high time. For many months there has been no organized government in Mexico. The currency of the country is sadly depreciated. In many parts of the country the people are starving. Nowhere is there safety for life and property. The unhappy land is in a state of chaos.

Now humanity dictates that the United States send help to the suffering. Self-interest—self-interest of the ingenuous kind—dictates that we protect ourselves against disease originating in Mexico and relieve ourselves from border disorders.

We know not how any new policy to effect what we shall insist upon can be anything less than a policy of intervention. The administration seems to be making up its mind for that. About ninety-nine per cent. of those who really know Mexico have prophesied this from the beginning of the post-Huerta days.

Lake and Rail Lines

The decision of the Interstate Commerce Commission that the steamer lines on the Great Lakes which are operated by railroad companies come within the definition of competing rail and water lines is bound to cause some disturbance in the Lake trade. The ownership of a combibited by the incidental clauses of the Panama Canal act, hibited by the incidental clauses of the Panama Canal act, and the Interstate Commission holds that the railroads must divest themselves of such ownership at an early date. The only exception made is in the case of certain car-ferry lines on Lake Michigan and Lake Huron, which are held to be, not competing lines, but simply extensions of the railroad line.

This decision, however disturbing it may be to some lines, does not affect those engaged in the transportation of iron ore. The boats in that business are not owned by the railroads, but generally by various steel companies. Moreover, the railroads do not compete for the business of carrying ore from the Lake Superior region to the Chicago or Pittsburgh iron districts. The vessels owned by the steel companies have practically driven the independent boats out of the ore business, but they have done so by their greater size and other advantages, and there has been no question of competition such as arose in connection with the carriers of grain and general freights.

Coal rates on the Lakes are another question; but that is settled by the fact that east-bound freights are largely in excess of west-bound, so that there is always a surplus of tonnage available for coal and rates are always low.

Tin Smelting in the United States

At last the United States is to have a tin-smelting industry. The American Smelting & Refining Co. is now erecting at Perth Amboy a plant that is expected to produce 3000 to 5000 tons of tin per annum. This will be supplied chiefly with ore bought in Bolivia, but parcels will no doubt be obtained also from other sources. It is expected that the new plant will be ready for operation about the end of this year.

The position of the United States as the world's largest consumer of tin and as the producer of none has often been discussed, and it has also been hoped that Bolivian tin ore would at some time be brought here for smelting. We shall now hope that the new enterprise will be so successful that eventually the entire output of Bolivia will come hither.

The Birmingham Water Line

An event of considerable importance to the Alabama iron and coal region was the completion last week of Lock No. 17 on the Black Warrior River. This lock completes a system of improvements giving a depth of 6 ft. at all stages from Lock No. 17 to Mobile Bay and securing the free passage of barges of considerable size and tonnage. Arrangements have already been made for the shipment of coal from the Alabama mines to Mobile by this route. The head of navigation is 18 miles from Birmingham, and a few miles of railroad are still to be built, the completion of which will enable the Birmingham and Ensley mills to use this route to tidewater. This will give them, it is expected, a cheaper freight on export material than they now have.

This connection with the Gulf of Mexico will present especial advantages for trade to South America and through the Panama Canal. The organization for trade to the Gulf is well advanced, and the completion of the short railroad line is now the only thing to be pushed.

* * *

Last week was signalized by the price for Utah copper shares passing that for Amalgamated, something that had long been expected. It happened in the nick of time, for Amalgamated is soon to disappear. Utah increased its dividend from the rate of $3 per annum to $4. There was difference of opinion about this, we understand, one party in the board of directors desiring to defer the increase. There is no question that Utah is earning what it is paying, and more; but certain important members wanted to see it not only in a position to be free from borrowing any money on its copper above ground, but also to have a large cash surplus in addition to what is required for carrying the copper.

BY THE WAY

Prior to the formation of the Goldfield Consolidated, $11,200,000 was taken from the constituent properties by leasers. Since then the Consolidated has produced approximately $50.000,000, from which dividends amounting to $27,398,215 have been paid, while it is hoped that the end is not in sight by many years and dollars.

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A recent refugee from Southern Mexico brought with him a book, probably from some old library that had been looted, treating of ancient metallurgy. The book has been left with the American-Foreign Refugees Club, Coles Bldg., El Paso, Tex., and anyone interested may have full details by addressing that society. The complete introduction to the work is as follows:

"ARTE DE LOS METALES, en que se enseña el verdadero beneficio de los de oro y plata por azogue. El modo de fundirlos todos, y como se han de refinar y apartar unos de otros.

"Compuesto por el Licenciado Alvaro Alonzo Barba, natural de la Villa de Lepe, en la Andalucia, Cura en la Imperial de Potosi de la Parroquia de San Bernardo. Nuevamente ahora añadido. Con el tratado de las antiguas minas de España, que escribió Don Alonzo Carrillo y Laso, Caballero del Avito de Santiago, y Caballerizo de Cordova.

"Publicado en Madrid, con aprobacion de los diputados de la Villa de Potosi en Marzo, 1637, tambien aprobacion de Don Paulo de Barondelet."

The book has 232 pages with 125 chapters, illustrations of tools, assay furnaces, smelting tools and furnaces, etc.

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Portland Buys Stratton's Independence

At the meeting of Stratton's Independence, Ltd., in London on May 17, the sale of this Cripple Creek mine to its neighbor, the Portland Gold Mining Co., was approved by the Stratton shareholders, with only one dissenting vote. The agreement of Mar. 20, 1915, offering the property to the Portland company was the outcome of negotiations on behalf of Stratton's Independence to purchase the Portland dumps. The Independence mine was no longer able to assure an ore supply for the mill, and the inability to secure sufficient dump material, unless the Portland company were willing to sell, left Stratton's Independence with a mill and no ore. Accordingly, the offer of the Portland company of £65,000 for the property was put before the stockholders and accepted by them. The Portland Gold Mining Co. will assume charge of the mine and mill on July 1.

The output of the mine during its existence to the present day, according to the chairman's address, as reported by the *Financial Times*, has been approximately $23,573,500. This output was obtained: (1) By Mr. Stratton when working the mine himself, $3,985,440; (2) by the old Stratton's Independence Co., $15,064,320, and (3) by Stratton's Independence, Ltd., $4,523,740. The old company paid in dividends $4,748,989, which represented 31.5% of the value of the ore produced. In 1908, when the old company found itself owing in America about £25,000, Stratton's Independence, Ltd., was formed and it was decided, on the recommendation of Consulting Engineer Philip Argall, to erect a mill to treat the dumps and, at the same time, to get what ore could be obtained in the mine, the workings of which were badly caved. Exploration in the mine has from time to time been rewarded with some rich ore, but no large tonnages have been found. The most noteworthy achievement of the later years was the success attained by the mill, which exceeded the hopes entertained for it by Mr. Argall.

The stockholders now face the problem of disposing of the surplus, of which it has been proposed to apply about £20,000 to the purchase of a new property. The question of a new property has been previously referred to in these columns, and a poll is now being taken to determine the wishes of the stockholders.

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May Mining Dividends

Dividends paid in May, 1915, by 21 United States mining companies making public returns amount to $1,564,144, as compared with $1,826,064 paid by 22 companies in May, 1914. Industrial and holding companies allied to mining paid $8,335,435, as compared with $9,568,895 in 1914. Canadian and Mexican companies paid $558,540 in May, 1915, and $1,778,960 in May, 1914.

The totals for the first five months are as follows: Mining companies, $15,410,388, as against $25,515,566 in 1914; metallurgical and holding companies, 1915, $26,731,200, as against $38,769,096 in 1914; Canadian and Mexican mines, 1915, $4,180,364, as against $8,876,332 in 1914.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alaska	0.20	36,000
Alaska Treadwell, g	Alaska	1.00	200,000
Alaska United, g..	Alaska	0.40	72,080
Arizona, pfd. A, c	Ariz.	0.17	57,688
Bunker Hill Con., g	Calif.	0.02½	5,000
Bunker Hill & Sullivan, l.s	Idaho	0.25	81,750
Caledonia, l.s.....	Idaho	0.02	52,100
Champion, c...	Mich.	1.00	100,000
Ducktown, c	Tenn.	0.24	48,600
Golden Cycle, g	Colo.	0.02	30,000
Hecla, l.s	Idaho	0.02	20,000
Homestake, g	S. D.	0.65	163,254
May Day, g.s.l.z	Utah	0.03	24,000
Miami, c	Ariz.	0.50	373,380
Nevada Wonder, g.s	Nev.	0.05	70,415
Parrot	Mont.	0.15	34,177
Shattuck-Arizona, c.	Ariz.	0.50	175,000
South Eureka, g	Calif.	0.03	9,900
Terrible, g.s	Colo.	0.06	6,000
Wasp No. 2, g	S. D.	0.00½	2,500
Yellow Aster, g	Calif.	0.02	2,000
Iron, Industrial and Holding Companies			
Amalgamated, c	U. S.	0.50	1,154,159
Cambria Steel, pfd *	Penn.	0.62½	562,500
International Nickel, com	N. J., Can.	2.50	948,133
International Nickel, pfd	N. J., Can.	1.50	133,689
St. Mary's Mineral Land	Mich.	1.00	160,000
U. S. Steel, pfd	U. S.	1.75	6,304,919
Warwick, I. & S.	Penn	0.35	52,035
White Knob Copper & Dev., g	Calif.	0.10	20,000
Canadian, Mexican and Central American Companies			
Coniagas, s	Ont.	0.30	240,000
Dominion Steel, pfd	Can.	1.50	105,000
Hollinger, g...	Ont.	0.20	120,000
Le Roi No.2...	B. C.	0.24	29,160
Lucky Tiger, g.s........................	Mex.	0.09	64,380

* Scrip.

PERSONALS

F. R. Weekes has gone to California on examination work.

Fred T. Williams, of Salt Lake City, is in Arizona on professional business.

Edwin E. Chase will be at Silverton, Colo., during the first two weeks of June.

George M. Packard, of Boston, is at Gold Lake, Manitoba, in the interests of the Calumet-Corbin Mines Co. of Boston.

Horace V. Winchell announces the removal of his office to 826 First National-Soo Line Building, Minneapolis, Minnesota.

C. V. Drew has returned from Peru where he has been for several months in the interests of the Cerro de Pasco company.

A. J. Bennett, of the Backus & Johnston Co., Casapalca, Peru, arrived in New York last week and will spend some time in the United States before returning to Peru.

Lieut. James Gordon Ross, lately consulting engineer of the Milton Hersey Co., Montreal, who is a machine-gun officer in the Canadian contingent, was wounded in a recent engagement.

A. C. Ludlum, of the New York Engineering Co., has gone to Colorado to inspect the dredge which the company is building on the Derry ranch in the Arkansas River valley, about 10 miles from Leadville.

J. H. Lane, Uniontown, Penn., has been named general superintendent of the three coking plants of the Oliver & Snyder Steel Co., Pittsburgh, succeeding the late Fred C. Keighley. Mr. Lane formerly was superintendent of Oliver No. 3 plant.

G. F. Streich, superintendent of the former Cockerill Zinc Smelting Works, and E. J. Bondy, former agent of L. Vogelstein & Co., are in charge of the Bruce smelting plant at Bruce, Kan., which are leased and operated by the Cherokee Zinc Co., of Cherokee, Kansas.

Baron Von Polenz, who has been extensively interested in Cobalt and Porcupine properties for the last three years, has been placed under arrest as an alien enemy and interned at Fort Henry, Kingston, Ont. He was formerly a captain in a Saxon cavalry regiment.

O. B. Perry, general manager of the Yukon Gold Co., left New York last week for San Francisco. After inspecting the company's dredging operations in California, Mr. Perry will proceed to the Northwest where the company has a dredging operation at Iditarod, Alaska, and both dredging and hydraulicking operations in Yukon Territory.

C. E. Weed has been appointed underground mining superintendent at the Lake property, in the Lake Superior copper district, which is being unwatered under the general management of Elton Walker. Mr. Weed has been mining superintendent under George Hooper at the Victoria for several years. He is a graduate of the Michigan College of Mines.

Lincoln G. Eakins, former assistant general manager of the Colorado Department of the American Smelting & Refining Co., has recently been appointed successor to Franklin W. Guiterman, general manager of the company, who died several weeks ago in New York. Mr. Eakins also succeeds Mr. Guiterman as president of the Carbon Coal & Coke Co. Mr. Eakins has returned to Denver from New York.

V. D. Callaghan, who resigned as superintendent of the H. C. Frick Coke Co., at Lemont, Penn., has been succeeded by T. H. Doorley, superintendent of the works at Marguerite, and he has been succeeded by E. S. Woltersberger, of Hecla, in turn succeeded by Robert Ramsey. G. W. English has been promoted from superintendent at Oliphant to Wynn, and J. A. Childs, superintendent at [illegible], has been named superintendent at Bitner also.

OBITUARY

Joseph G. Beale, 77 years old, a prominent gas-well operator, and well-known in the steel trade in western Pennsylvania, died last week in Pittsburgh.

Charles F. Albrecht, 56 years old, former superintendent of the Painter mills of the Carnegie Steel Co., Pittsburgh, died at his home in that city last week. He had been connected with the Painter plant for [illegible] years.

Pierre Martin, whose death at Sireuil, France, was briefly noted in our last issue, originated the use of scrap steel in the openhearth furnace in making steel, now generally employed. Mr. Martin was honored with the award of the Bessemer gold medal by the Iron & Steel Institute on May 13, a few days before his death.

John T. Hodson, a well-known mining operator of Salt Lake City, died May 27, as the result of being struck by a street car a few days previous. Mr. Hodson organized the Nevada Hills Mining Co., and was one of the pioneers in the Bull Valley (Goldstrike) district. He was also interested in mines in the Cottonwood section of this state, also in Nevada, and Idaho.

Henry Wickham, aged 70, died recently at his home in Philadelphia. Mr. Wickham was a former resident of Connellsville, Penn., a builder of the Trotter plant, of the H. C. Frick Coke Co., and one of the first coke plant managers of the Connellsville region. In 1884, the Trotter plant was sold to the Frick company, and Mr. Wickham retired, going to Philadelphia.

Patrick H. Meagher died at Deer Lodge, Mont., May 19, aged 73 years. Born in Canada he went to California when 19 years old and after several years spent in mining there and in Nevada he went to Confederate Gulch in Montana in 1865. He continued to mine there and elsewhere in Montana for many years, also owning a fine ranch in the Deer Lodge Valley. He leaves three sons and five daughters.

Edwin Miles died in Pittsburgh, Penn., May 25, aged 97 years. Born near Valley Forge, Penn., after some years spent in teaching at Huntington he went to Pittsburgh in 1846. After some years with the Schoenberger Iron Co. he became a partner in the Black Diamond Steel Works and later in the Duquesne Iron & Steel Co. He retired from active work about 20 years ago. He was the last survivor of the earlier generation of Pittsburgh steel operators.

SOCIETIES

Worcester Polytechnic Institute—The commencement exercises will be held at Worcester, Mass., June 6-10. The Commencement address will be delivered by Dr. Richard C. Maclaurin, president of the Massachusetts Institute of Technology.

Canadian Mining Institute—The Cobalt branch had an excursion to Porcupine on May 17, which was attended by about 25 members including Dr. Frank D. Adams, of McGill University, J. B. Tyrrell, of Toronto and W. H. Collins, of the Canadian Geological Survey. Visits were made to the principal mines and on May 18 a meeting was held at which it was resolved to revive the Porcupine branch which has for some time been dormant. All the mines of the camp were requested to appoint temporary representatives to an organization committee.

American Institute of Mining Engineers—The annual meeting of the Pennsylvania Anthracite Section will be held at Lansford, Penn., June 11, 1915. The following tentative itinerary has been arranged: At 10 a.m. Hauto: Visit the Lehigh Navigation Electric Co.'s power plant and Panther Valley Water Co.'s hollow buttress dam at Bear Creek, or the Hauto washery. Lansford: Lunch at Old Company's Club House as the guests of the Lehigh Coal & Navigation Co. A business session of the Section will follow the luncheon. The nominating committee nominates for reëlection the present officers and Executive Committee. Afternoon: Inspect electrical hoisting at No. 11 Shaft; new features at No. 10 Breaker; new timber-cutting mill and yard, substation and electric hoists at No. 5 Colliery; and other operations of the L. C. & N. Co. as time permits.

INDUSTRIAL NEWS

Philip N. [illegible] will in future be in charge of all mine car applications of the Hyatt Roller Bearing Co., traveling in the western part of Pennsylvania or Ohio and West Virginia. Mr. [illegible], who formerly covered this territory, will travel in the eastern part of Pennsylvania, New York and New Jersey.

The Nordberg Manufacturing Co., of Milwaukee, Wis., announces that E. W. Swartwout, formerly of the Chicago office, will be associated after June 1 with Mr. McLaren in the New York office of the company. Enlarged offices have recently been taken in the new Equitable Building (120 Broadway), New York. The Chicago office [illegible] of John E. Lord.

Editorial Correspondence

SAN FRANCISCO—May 30

Lassen Peak Burst into Violent Eruption again May 30. Another flow of boiling mud is pouring down the sides of the volcano. Fears are felt for the safety of many investigators known to have been in the danger zone. The mud flow took the direction of Lost and Hat creeks. It was along these creeks that previous devastation was wrought. This eruption is the first since the destructive outbreak of May 22 and marked the first anniversary of the peak as an active volcano. During this year there have been 99 eruptions including the present one.

Tentative Mine Safety Rules prepared by a committee of mining men at the request of the Industrial Accident Commission of California, have been printed and distributed to mining men of the state for suggestions respecting such changes as may be deemed necessary to satisfactory adoption and enforcement. The commission will hold a public hearing to consider the adoption of the rules. After this hearing and approval the authority for their adoption and enforcement will be about the same as for the enforcement of the inspection laws of other states.

Civil Service Examination will be held June 18-19, 1915, and from the list of men who pass the examination one or more deputy mine inspectors will be selected. H. M. Wolflin, who has prepared the way for the application of safety rules, by visiting all the principal mines and offering suggestions as to betterment of conditions relating to the safety of working men, will occupy the position of chief inspector. His pay and expenses have been and will continue to be shared equally by the Industrial Accident Commission and the U. S. Bureau of Mines; the deputy inspectors will be paid by the State. Hence the practical operation of the safety rules will be not only in harmony with but under the supervision of the Bureau of Mines as well as the Industrial Accident Commission. In other words, the mines will be inspected by the dual authority of the United States and the State of California.

Investment in Gold Mines in California was greatly retarded and in some instances absolutely stopped in the early months of the war. Even development of mines already in progress was held up. This condition continued until March, when there was slight improvement and evidence of progress toward development of properties already undertaken. In April there were signs of life in the line of investment. Some inquiry was made for good gold properties that would stand the test of rigid examination and reasonable prices and terms of payment. Owners of gold mines desirous of selling, grown weary of the long delay caused by the war, became impatient over the apparent slow movement of men supposed to be ready for investment. The chief cause of the spirit of unrest seemed to have been the belief obtaining in the early period of the war that the conditions in Europe would of necessity require the investment in and rapid development of mines. Apparently the conclusion was logical. The same belief obtained regarding visitors to the Panama-Pacific Exposition. Now that the investment money seems to have loosened up a little in the past two months, the owners of gold mines are again in a state of jubilant hope, which is likely to be again deferred. The fact that recently the price of copper encouraged the resumption of copper smelting and incidentally improved gold mining encouraged the belief that investment in gold mines must inevitably and speedily follow. There was some improvement also in silver mining, with the probability that there will be a larger percentage of increase in silver than in gold production in California in 1915.

SALT LAKE CITY—May 28

Potash From the Alunite Beds near Edna crater are being investigated by Armour & Co., of Chicago, and its engineer, D. R. Thompson, just returned from Marysvale, 14 miles from Edna crater, states that development work will be begun in the near future. The Armour company is the next to the largest dealer in potash in this country, and as it cannot get potash from Germany under the contracts which it has with the German companies, it will have to get potash in the United States. The supply on hand is equal to the demand for this year, but next year, if the war continues, there may be a shortage.

The New Camp of Goldstrike, in the former Bull Valley district, 38 miles south of Modena in Washington County, is attracting more attention. A letter from the district describes the camp as having about 75 tents and cabins, and more being put up. There is a running stream through the camp, and plenty of timber, mostly cottonwood and cedar. The country is fairly rough, but nothing like Jarbidge. The ore deposits occur in limestone, although there is also porphyry. The Hamburg has a strong vein of high-grade well opened up, with a depth of several hundred feet. On the Hamburg a three-stamp mill is running two shifts on very rich ore. The mineralized area at present indicated is approximately four miles by ten. The road is bad, and there are no regular mails. Stage fare from Modena is $6 one way, and $10 for the round trip. The Salt Lake route is selling round-trip tickets from Salt Lake to Modena on account of the increasing travel.

New Mill for Tintic—The Dern interests will combine with the Knights in building a custom milling plant at Tintic to take the place of the Knight-Christensen mill recently destroyed by fire. With this in view, a consolidation of the Mines Operating Co. and the Knight-Christensen Metallurgical Co. has been practically completed—the new company to be called the Tintic Milling Co. The mill of the Mines Operating Co. at Park City will be dismantled, and shipped to Silver City where it will be used at the new mill, which will be built in the old Knight smeltery yard. The initial capacity is to be 200 or 300 tons daily, and arrangements will be made so that additional units can be added as needed. Both the Knight-Christensen and the Holt-Dern roaster will be tried out, and the one having the greater efficiency selected. The Holt-Dern roaster, successfully used on stope filling from the Ontario at Park City, and now treating American Flag ores at the Park City Mills, can undoubtedly be used for Tintic ores also. The difficulty at the former Knight-Christensen mill appears to have been in the mechanical part of the roasting. Officers mentioned for the new company are: Jesse Knight, president; W. L. Mangum, secretary and treasurer; G. H. Dern, vice-president and general manager. Work will be started on ores from the Knight properties; and contracts have been made which assure the new company enough ore to keep the mill in operation for some time. There is a large tonnage of siliceous ores at various Tintic properties, of too low-grade for shipment.

SEATTLE—May 29

Activity in the Interior and reports from Rex Creek indicate the mining operations are being carried on on larger scale than ever before. Bill Woodward on Rex Creek has tapped his pay channel after running through the rim 100 ft. and the prospects are bright. The R. A. M. Co.'s laymen are digging a ditch to run a ground sluice to their workings. They will have 125-ft. head on their nozzle. Brooks & Co. is building an automatic dam in Lucky Gulch, a tributary to Rex Creek off No. 10 left limit. Bert Carvey is one of the busy operators and is now running three shifts of men eight hours each on his ground and is taking out big money. Art Powell has developed a good paystreak on his ground on Fly Gulch and Slauser & Stantion expect to begin piping gravel shortly and T. S. Taylor is now driving his pipe preparatory to running gravel which is said to be high-grade.

Litigation and High Water are holding up development work to a large extent in the rich Healy River district and not much is expected in the way of shipments until the water subsides and the litigation over a number of the claims is settled. Practically all of Ruby and Kenyon creeks are tied up in the courts. However, there is considerable going on in the district not affected. Morgan and Hammer, on Kenyon Creek, had about 3000 sq.ft. of bedrock blocked out and were hoisting dirt when they were drowned out. They are working on the Mascot association claim. After the flood of water they moved their outfit upstream a short distance and started again to sink a shaft. They think on this ground they will be able to handle the water when bedrock is reached. John Hajdukovich working about 3000 ft. downstream, from where Morgan and Hammer worked all winter, reached bedrock at 147 ft. The same day he reached bedrock he drove a couple of points and the following morning he found the shaft flooded with water to within a few feet of the top. About 4000 ft. downstream from the Morgan ground Lawrence & Albrecht were sinking a shaft and at 200 ft. they struck water a little above bedrock and had to cease work and the same conditions have been met with by many of the operators owing to the abnormal amount of water in the creeks at this time.

The New Mining Law passed by the Territorial Legislature, supplementing the mining laws of the United States in Alaska and repealing the so-called Roden bill passed in 1913, which caused widespread interest in mining circles throughout Alaska, is probably the most important piece of legislation enacted by the governing body since its formation, and carries several radical changes which are of considerable importance in regard to future mining ventures in the North. It provides: That no association placer-mining claim shall be in excess of 40 acres and that on every association claim located since Aug. 1, 1912, not less than $100 worth of labor shall be expended in improvements or work each year for every 20 acres or fraction. That a survey of the claim or claims by the U. S. Mineral Surveyor shall constitute a credit on the annual assessment work: That no individual placer mining claim shall hereafter be more than 1320 ft. in its greatest length and that no association placer claim shall be more than 2640 ft. long: That powers of attorney must be filed before the filing of record of any location, that powers of attorney must be written and signed by those making them and that no one can act on a power of attorney for more than one person a month in one recording district: That an affidavit of assessment work completed shall be filed with the recorder of the district not more than 90 days after the first of every year. The failure so to file will constitute a forfeiture of the claims. Lode claims shall not be more than 1500 ft. long on the center line nor more than 300 ft. on either side of the center line. Tunnel rights on lode claims provide that the tunnel may be 3000 ft. long from the portal to the terminus but not more than this and shall be marked on the surface by monuments not more than 600 ft .apart. The sum of $500 must be expended each year in assessment work on each tunnel site. The proprietor of a lode claim or the owner of a quartz mill or a reduction works situated on the land proposed to be located may locate not more than five acres of nonmineral land as a mill site and during each year after the year of location and until patent is issued must do $25 worth of labor thereon or pay to the recorder the sum of $25 each year in lieu of such labor. Each location of lode claims must make an annual assessment equal to $100, all association claims doing $100 worth of improvement work for each location each year. Not more than two placer claims may be located in one recording district in one year by one party. One trouble with the old law which has been repealed was the difficulty of correctly complying with that portion which provided for the recording work. The new law is clear and is as follows: The certificate shall read as follows: (a) The name and number of the claim; (b) the name of the locator or locators; (c) the date of discovery and of posting of location notice; (d) the number of feet in length and width of claim; (e) it shall set forth the description with reference to some natural object, permanent monument, or well-known mining claim, together with a description of the boundaries thereof so far as applied to the numbering of stakes or monuments. This section is the same for placer claims and lode claims. The initial post shall contain the following in staking a claim, the name and number of the claim, the name of the locator or locators, the date of discovery and of posting notice on claim, the number of feet in length and width of the claim.

HOUGHTON—May 29

Only the Endorsement of the Shareholders of the Hancock Consolidated Co., at their annual meeting to take place in Hancock, June 16, is needed to consummate a deal between the Hancock and Quincy companies, which will result in doubling the production of the Hancock company, the reopening of No. 7 shaft, Quincy, and largely augmenting the Quincy's production. The agreement has been under consideration and discussion among the officials of the two companies for a good many months. There is every reason to believe it will go through. It will be another additional evidence of the prosperity of the copper country for it will mean the employment of at least 400 more men at the two properties. Briefly, under the five-year agreement, Hancock has the use of No. 7 Quincy shaft, half the working hours of each day. This makes it possible for Hancock to tap this rich, proven territory seven years earlier than otherwise for a subshaft would have to be built from the bottom of No. 2 shaft Hancock. Under the agreement the shaft will be sunk from the 60th to the 65th levels with 100 ft. left standing around the shaft for protection to both companies and from the 65th to the 71st, 160 ft. will be left standing for the same purpose. For these pillar protections the Hancock received $35,000 from Quincy. Quincy also buys 75 acres northwest of No. 7, over a mile from surface for $181,000. This land could not be mined inside of 20 years if the Hancock had to wait to get to it. It permits the Quincy to cut it with [illegible] and into further territory of its own at once. The [illegible] for this is $2630 per acre, the highest price ever paid for mineral land in this district, at that depth. This land w[illegible]ed from the Canal company by the Hancock compa[illegible] per acre in 1906, so it looks like a good business [illegible] from the viewpoint of the Hancock shareholder. Considering the fact that Quincy recently purchased a parcel from New Arcadian at $800 per acre the price now secured is justified by the rise in the market for copper.

LORDSBURG, N. M.—May 30

Mine Taxation in New Mexico, as regulated by the recent legislature, is in the hands of a "State Tax Commission" consisting of five men appointed by the Governor of the State. The requirement of the new law is that this commission must prepare each year a book to be called the "Assessment Book of the Net Proceeds of Mines" in which must be entered the final finding and determination of the commission of all and singular, the mineral output of all New Mexico mines. The owners or lessees of mines are compelled to furnish the Tax Commission with these data. No improvements of any nature will be exempt and all surface improvements will be taxed in the same manner as other property of a like kind. All nonproductive patented mining claims and other nonproductive mineral lands known to contain valuable deposits in commercially workable quantities, shall be assessed and taxed upon the reasonable valuation thereof as undeveloped mineral lands in addition to their surface value for grazing, agriculture, timber or other purposes. In fixing such valuation it shall be the duty of the taxing officials to take into consideration the transportation facilities, distance from railroads and opportunity for marketing product of such ground. Any person or persons mining any character of mineral in New Mexico, under the new law, who shall fail or refuse after written notice from the Tax Commission to keep the accounts of mineral production and to forward same to the Tax Commission, shall be guilty of a misdemeanor and liable to a fine not to exceed $25 per day for each day's continuance of such failure or refusal, and also to a civil penalty of a like amount, to be used for and recovered in the name of the state, or to either such a fine or civil penalty as the Tax Commission may determine. Any member of the Tax Commission disclosing any information derived from the examination of the reports filed by the mining companies of New Mexico, is upon conviction subject to a fine of not less than one hundred dollars or not greater than two hundred and fifty dollars. Every such tax is made a lien upon the mines or mining claims. The Commission has begun its work but has not yet got into the mining division of the new legislation.

BALTIMORE—June 1

A Potash Manufacturing Plant, it is announced, is soon to be built in Baltimore by the United States Potash Co., which has been formed with a capital stock of $250,000. The officers are: Samuel Morrison, president; Andrew J. Barron, vice-president; Frederick Kirsch, secretary and treasurer. It is expected that the business of manufacturing potash will be in full swing within six months. The new plant will be located on the tidewater.

TORONTO—May 29

Oil Is Now Being Commercially Produced and refined at the well No. 2 of the Alberta Consolidated in the Calgary oil field. The first public demonstration of oil producing and refining was held on May 24 and was attended by hundreds of visitors. The well is producing a high-grade crude oil, stated to be equal to the best Pennsylvania oils, at the rate of 150 bbl. per day and with the installation of adequate pumping facilities the production is expected to be largely increased. At the refining demonstration it was shown that about 20%-gasoline can be refined from the crude oil exclusive of other products. An 8-hour pumping test is stated by Field Manager Stephenson to have produced 75 bbl without perceptible diminution of the oil in the hole. The development of No. 1 well now some 2160 ft deep is being proceeded with.

CHRISTIANIA—May 1

Old Copper Mine Reopened—The old Enighe[illegible] copper mine at Horstjord in Norway, which was operated [illegible]r back as 1760, was reopened last February and a cons[illegible]nt has been gotten out for shipment. The result of the [illegible]tation shows persistence of ore along strike and at dep[illegible]. There is also a large quantity of usable ore in the old [illegible]. The content is given as 3½% Cu and 16 to 17% S.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—Has placed orders for two 2500-hp. each hydro-electric generators. When these are installed a saving of $3000 per day will be effected.

CLIFF MINE (Valdez)—George C. Treat, E. Smith and Logan Archibald have commenced suit in district court at Valdez for 20% interest in Cliff Mine, pioneer quartz mine of Valdez. They allege that they advanced money for making test shipment to Tacoma smeltery under agreement whereby they were to receive one-fifth interest in claim.

AMALGAMATED OIL CO. (Katalla)—Owing to increased industrial activity in southwestern Alaska following starting of construction work on government railway from Seward, Amalgamated Oil Co., operating refinery at Katalla, has found it necessary to increase size of its plant. Present capacity is about 40 bbl. of gasoline and distillate per day. Several new wells are drilling and outlook for important developments are bright.

SPEEL RIVER POWER (Juneau)—That work of constructing large hydro-electric plant on Speel River, near Juneau, will be started at once is announced by corporation recently formed under laws of California for that purpose. It is planned to establish an electro-chemical factory on Norwegian plan, with special emphasis on fixation of atmospheric nitrogen. Ultimate capacity of Speel River is 100,000 hp., but only 10,000 will be developed at present. Kennedy & Lass, formerly of Treadwell staff, are among promoters of enterprise.

ALASKA GOLD BELT (Juneau)—Makeever Bros. have commenced work with crew of about 25 men on this property, more commonly known as Nelson-Lott mine, on which they recently secured option. Property includes area 12,000 ft. long by 3500 ft. wide adjoining Alaska-Gastineau on south, together with millsite on Gastineau Channel and tunnelsite from millsite to mine. Present crew is employed under direction of A. B. Todd in building compressor house, blacksmith shop, powder house and other small buildings at portal of adit in Sheep Creek Basin. A 600-ft. Ingersoll-Rand air compressor, driven by 100-hp. electric motor, will be installed. Present plans call for 5000 ft. of adit and drifts and large amount of diamond drilling. If satisfactory results are obtained from preliminary prospecting, for which sum of $250,000 has been set aside, company plans to drive a 2¼-mile adit from millsite on Gastineau Channel to tap orebody at depth of 3800 ft. and to build large mill about 400 ft. above sea-level.

ARIZONA

Cochise County

HUACHUCA GOLD (Courtland)—Jack Taylor, who has contract for deepening shaft, has 15 men at work. Cameron pump was recently installed.

Gila County

WARRIOR (Miami)—Warrior force now numbers 60 men and shipments of ore averaging 5 to 7% copper to the smelteries at El Paso and Hayden are regular.

INSPIRATION (Miami)—Underground work is proceeding regularly and during May ore hoisted exceeded any previous month's output. Scorpion shaft, only shaft through which ore is being hoisted at present time, is working to limit of its capacity, about 1000 tons per day. Plans are under way for construction of miners' change house of steel with concrete floors.

Maricopa County

NEW CORNELIA (Gila Bend)—Reparth & McGregor are preparing plans for new Ajo leaching plant.

OLD DOMINION (Globe)—Since shutdown, caused by flooded mine resulting in loss of two months' production, output resumed has expanded to rate of nearly 3,000,000 lb. copper per month. In petition by A. S. Bigelow for reopening Old Dominion litigation, arguments have been finished and finding by master is expected soon.

Mohave County

GILT EDGE (Oatman)—Charles Oster, in interest of New York capitalists, has taken over Gilt Edge group.

GOLCONDA (Union Basin)—Amster interests have taken up [illegible] option on majority stock in Union Basin Mining Co.

[illegible]KOVER (Hackberry)—A. F. Frazer has taken over W[illegible] mine about four miles from railway west of Copper Giant.

LAZY BOY (Oatman)—Lazy Boy group has been taken over by Los Angeles people represented by H. K. Wheeler, of Cripple Creek.

MOONLIGHT (Oatman)—Fred Crosley and J. O. A. Carper, of Cripple Creek, have taken over Straight, Moonlight, Cash Entry, Sunl[illegible] and Hardy groups, adjoining United Eastern property.

ARIZONA [illegible]HWESTERN COPPER (Kingman)—Will sink shaft from [illegible] to 700 level. Big body of lead ore was opened up by [illegible] from 200 level. Company said to be in strong [illegible] condition. J. H. Hoffman is general manager.

Pinal County

KELVIN-SULTAN (Kelvin)—Two cars of concentrates shipped to Hayden smelters. Leasers shipped car of carbonate ore.

Santa Cruz County

FLUX (Patagonia)—Mill equipment beginning to arrive. Arranged to ship ore over new tram, while mill is being [illegible]

Yavapai County

ARIZONA POWER CO. has been granted permission to issue $340,000 in bonds for the purpose of adding to its power plant on Fossil Creek. Company is supplying several mines in Jerome camp and smeltery at Clarkdale as well as power and lights for the Town of Prescott.

MARY E. (Morristown)—Additional men have been put on to continue shaft from which shipping-grade gold ore is being taken.

GOLDEN STATE (Wickenburg)—At recent stockholders' meeting it was voted to resume work on property of company 11 miles north of Wickenburg.

Yuma County

ARICA (Ehrenburg)—Property is being equipped with mill and some additional mining machinery. Shaft to be sunk to 1000-ft. level.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Mine is paying expenses, with surplus in treasury, but continuation of dividends at present is not advisable.

ZEILE (Jackson)—Action brought in Superior Court to quiet title to Yellow Jacket mining claim. Company avers that unrecorded deed was destroyed in San Francisco fire, a source of destruction quite frequently mentioned in the courts.

Butte County

OROVILLE DREDGING (Oroville)—Returns from London dated May 7; for four-week period ended Mar. 25, cubic yards dredged, 169,563; gross return, $18,228.

Fresno County

VALLEY PIPE LINE (Coalinga)—First four sections, comprising about 47 miles of oil pipe-line for Valley Pipe Line Co., subsidiary of Shell Royal Dutch Co., designed and built by Sanderson & Porter, was placed in successful operation on May 15. This line is 170 miles long, extends from Coalinga oil fields to tidewater terminal near Martinez in San Francisco Bay, and will have carrying capacity of 25,000 bbl. per day. Storage capacity at pumping stations now in operation on this first section of line amounts to 225,000 bbl., which is thus made immediately available for storage of surplus production.

Nevada County

BRUNSWICK CONS. (Grass Valley)—Will soon begin erection of cyanide plant.

Shasta County

FIELD PROCESS CO. (Redding)—Will enlarge plant at Redding and engage in manufacture of commercial products from its waste smelting smoke. About $30,000 will be expended.

Sierra County

RED JACKET & GOOD HOPE (Pike City)—Has been bonded by Thomas Rose to H. J. Ellert of Grass Valley, who has begun extensive development work.

GOLD BLUFF-OXFORD (Downieville)—Stamp mill running steadily on Gold Bluff ore. More workmen have been added and tramway is being built to transport rich ore uncovered on Oxford to mill. Both properties are under bond to Grant Snyder and associates of Salt Lake.

TELEGRAPH (Downieville)—Gravel claims of Telegraph company of Chicago have been bonded to Hunt & Bell. Development of this property was under management of late Hon. J. W. Finney, during which rich quartz ledge was struck. Operations were then directed to quartz development, but serious damage to machinery and buildings by fire and snowslides compelled suspension of active work. Gravel has yielded well and there still remains a large extent of virgin channel which will be opened by Hunt & Bell.

COLORADO

Boulder County

BOULDER COUNTY METAL MINERS' ASSOCIATION states that the 1915 metal production of the county will be fully $1,500,000 in gold, silver, tungsten and copper. This is substantial increase over any recent year.

BLACK CLOUD MILL (Salina)—On custom basis, is treating concentrating ores from various parts of county.

LIVINGSTON (Sugar Loaf)—Electric-driven centrifugal pump placed in No. 2 shaft and development is being pushed on several levels.

EUREKA (Boulder)—Up-to-Date Mining Co. is stocking high-grade lead-silver-gold ore taken from large shoot opened by 1100-ft. crosscut adit at depth of 380 ft. Lead ore is novelty in this county.

Clear Creek County

BIG FIVE (Idaho Springs)—Leasers have developed strong oreshoot in Lake vein and have, for several weeks, been shipping several carloads per week of ore averaging about $10 per ton in gold and silver. Other ores coming from this adit are treated in Hudson mill, which is running at capacity under management of Arthur Roller.

Gilpin County

THIS COUNTY'S CUSTOM-MILLING NEEDS are indicated by congestion of few mills now running and fact that every car on Gilpin County Tramway (local narrow-gage ore-handling railway) is loaded. At Iron City mill there are 125 loads of one cord each continually awaiting unloading.

Lake County

GARBUTT (Leadville)—Despite breakdowns in hoist and compressor, mine maintains output of 50 tons per day, averaging $15 per ton. During repairs to compressor, air is piped from Little Jonny plant. Plans being made to build concentration plant at mine.

Summit County

ORO GRANDE PLACER (Dillon)—Col. L. Kingsbury, of Denver, well-known placer operator, has secured option to this 625-acre tract along Blue River and is organizing dredging company. This property has been favorite area for experiments with hydraulic lifts, steam shovels and portable sluice outfits; but it is obviously dredging tract.

Teller County

PROPER (Cripple Creek)—Leasers are shipping from a 10-ft. shoot of $30 ore on 220 level.

VICTOR (Independence)—Schultz et al., leasing 800 level, have developed 100 ft. along 4-ft. body, from which 1.5- to 2-oz. ore is shipped in good amount.

AJAX (Victor)—Supt. A. E. Colburn, Jr., announces that leases will be granted on blocks of ground down to 1100 level and applications are being received.

PORTLAND (Victor)—Leaser L. D. Creclius has shipped eight carloads from vein 26 ft. wide on 220 level. Average settlement value was $18 per ton.

MORNING GLORY (Anaconda)—Hoisting plant will be installed by leasers who hold two blocks of ground that will be worked from this shaft in Doctor-Jack Pot territory.

ISABELLA (Victor)—New ore-houses are to be erected at Isabella and Empire State shafts. New large compressor has beeen purchased to permit greater development. Forty-five sets of leasers.

ECONOMIC (Victor)—W. F. Vansant, general manager of Copeland Ore Sampling Co., has completed tramway and a 100-ton ore-house for handling dump stuff to railroad. Will ship 80 to 100 tons daily to his sampler and then to Golden Cycle cyanide mill, Colorado City.

JERRY JOHNSON (Cripple Creek)—Cripple Creek Deep Leasing Co. will develop new ground in this old mine. C. A. Chapman ships small lots of $15 washings from dump. Frank Caley has completed new 100-ton cyanide mill and expects to start it running in two weeks.

EL PASO (Cripple Creek)—After more than year of unprofitable operations due to destruction by fire of main shaft and equipment and to certain administrative deals, company is getting back into dividend shape. Change in management and policy resulted in mine operating at slight profit during April, with indications of substantial betterment for May.

IDAHO

Shoshone County

INTERSTATE-CALLAHAN (Sunset)—Shipments aggregate 6000 tons of zinc concentrates per month and it is believed that they will be materially increased since new unit to mill and aërial tramway from mill to railroad are in operation. Present production could be continued for 3 years without any further development of ore reserves.

SILVER CABLE (Mullan)—Rich ore recently struck was in raise from lower tunnel. Raise now up 110 ft. and has 200 ft. more to go to connect with intermediate level 100 ft. below No. 1 tunnel. Crosscut from raise at the 100-ft. point opened 4 ft. of high-grade zinc ore and 16 ft. of milling ore. Commissioners of Mineral County constructing road from lower tunnel to railroad, employing convict labor. Shipments will be begun in about 60 days.

REINDEER-QUEEN (Mullan)—As result of consolidation of these two companies long Reindeer tunnel has been driven into old Copper Queen ground and last 30 ft. has been in high-grade milling ore containing considerable first-class ore. Development work has been suspended for a few days, to await completion of ore bins in which first-class ore will be dumped and shipped to smelter. As soon as sufficient ore has been developed work will be started on erection of concentrator.

SNOWSTORM (Mullan)—About 30 men are doing development work on lower level. Company has secured a year's extension on pool of Missoula Copper stock. Less than 10% of pool was released. First payment due in August. Snowstorm has spent $10,000 in development of Missoula ground up to present time. Action started in District Court by Pandora company to secure survey of No. 3 and No. 4 levels of Snowstorm. Claiming that defendants are working in their ground on those levels.

MICHIGAN

Copper

NEW ARCADIAN (Houghton)—Showing on 9th level continues to be as good as of any rock taken out. Vein continues 16 ft. in width and is well mineralized clear across. Sinking is now under way. Michigan smeltery is handling mineral recently stamped at Franklin mill.

CALUMET & HECLA (Calumet)—Two additional furnaces will start operation at C. & H. smelting plant at Hubbell this week, owing to additional mineral coming from old mine and from different subsidiaries. Erection of two new traveling cranes is about completed. One is a 40-ft span and operates inside smeltery. The other 50-ft. span conveys copper from the main smeltery to electrolytic plant, eliminating small cars.

NONESUCH (Otonagon)—Adjoining White Pine is to be opened soon. Property is owned and controlled by Milwaukee people who are not otherwise interested in copper mines of this district. At one time Calumet & Hecla had option on property and did some exploring [illegible] option was not renewed when it expired. Lumber and [illegible] already have been hauled on to location. It is [illegible] that probability of White Pine success has made [illegible] for Nonesuch interest to raise funds for further [illegible]

WHITE PINE (Ontonagon)—The [illegible] subsidiary is operating all new machinery two [illegible] pile is almost exhausted and work is con[illegible] at No. 4 and underground. Underground [illegible] Mill is turning out from 15 to 20 tons [illegible] Chicago Bridge Co. has men at location [illegible] tank for fire protection. Will have capacity of 20[illegible]. Height to top of tank is 97 ft. There are 400 bbl., about [illegible] lb. of mineral, at mill waiting for shipment to the smeltery. If weather continues warm and dry for a period of two weeks it will be possible to convey mineral over rough roads to water front where it can be scowed to Hubbell.

MINNESOTA

Cuyuna Range

MAHNOMEN (Ironton)—Contractors have begun stripping operations on company's orebody of 4,000,000 tons, with large additional tonnage of manganiferous ore, west of Pennington pit. Northern Pacific Ry. will handle traffic. One million yards of overburden will be removed this season.

IRON MOUNTAIN (Iron Mountain)—Entire headframe of shaft tipped over on May 14, due to cars jumping track while switching. To add to difficulty, pumps ceased operating, permitting mine to fill with water. Two men injured, but not fatally. Operation of this manganiferous deposit has been in hard luck and company is not financially strong.

Mesabi Range

LA RUE (Nashwauk)—This operation along with others in district will hereafter get electric current from Great Northern Power Co., which has just completed transmission line to western Mesabi Range. New La Rue washing plant will also be operated by electricity.

ON MESABI RANGE independent producers suspended shipments until June 1, when the lower freight rate became effective. At Keewatin and Nashwauk entire list of shippers, except Bennett, suspended. Shipments from Steel Corporation properties over range continue at normal rate.

MONTANA

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—President Goodale says the only basis for rumor of possible litigation with the Kendall Mining Co. over ore deposits of North Moccasin and Kendall mines is fact that he has been in correspondence with Kendall people relative to an agreement as to boundary of orebody to which each company is entitled, and there is no possibility of any litigation. Only a small portion of the orebody is involved in question of establishing a boundary agreement. North Moccasin's main orebody is in another portion of the ground.

Jefferson County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Tunnel has cut another cross-vein at distance of 1808 ft. from portal. The vein contains copper and silver, lying in layers with quartz. It is regarded as most important discovery yet made in tunnel.

Silver Bow County

ANACONDA (Butte)—Will soon resume work replacing more steam hoists with compressed air hoists, preparations having been made to make change at Neversweat and Moonlight mines next.

BUTTE & SUPERIOR (Butte)—Highest value of concentrates recovered by oil flotation process were those reported for April, value being $62.26 per ton, against $47.38 per ton in March and $48.61 in February.

NEVADA

Esmeralda County

C. O. D. CONSOLIDATED (Goldfield)—Reported negotiations under way to grant working option and control to Tonopah Belmont.

FLORENCE-GOLDFIELD (Goldfield)—Six-foot vein assaying $45 opened on 250 level. Shipments at intervals pay all operating expenses. Drifting on same vein on 350 level under way.

GOLDFIELD CONSOLIDATED (Goldfield)—Lidgerwood cableway for transportation of old tailings from pond to mill completed; installation cost $90,000. Stated profit of $1,500,000 will be made from this source.

Humboldt County

SHIPMENTS FROM WILLARD being made. Honey Bee Co. and Oddie Lease, on same company's ground, hauling ore to railroad. On Finlander, ore bins built so ore can be loaded into wagons without sacking. Ore assaying $18 to $40 gold per ton being broken on this ground. Fifteen sets of leasers working in district.

NEVADA PACKARD (Rochester)—Contract for erection of 100-ton mill awarded to California Extraction Co., San Francisco. Process will be amalgamation and cyanidation. Tests gave 96% extraction on ores assaying 41 to 62c gold and 20 to 37 oz. silver. Mill construction to begin soon. Water lines being laid.

ROCHESTER MINES (Rochester)—Has voted to acquire the Rochester Weaver Mining Co. by purchase. Will increase capitalization from 1,250,000 shares to 2,250,000 shares, of which Weaver will receive 684,000. Consolidation [illegible] because portions of Rochester Mines veins extend in depth into Weaver property and litigation will thus be [illegible]. Four claims of the Weaver can be economically developed by deep tunnel on Rochester.

Nye County

TONOPAH ORE PRODUCTION for week ended May 22 was 10,548 tons valued at $215,824 compared [illegible] 10,617 tons last week. Producers were: Tonopah Belmont, 3709; Tonopah Mining, 2700; Tonopah Extension, 1725; West End, 760; Jim Butler, 1150; Tonopah Merger, 225; Halifax, 104; and miscellaneous leasers 175 tons.

TONOPAH EXTENSION (Tonopah)—Has agreed to purchase Tonopah Merger and Tonopah Victor mines which immediately adjoin Extension property. Will pay all debts of two companies and exchange 7 shares Merger stock for one of Extension and 8½ of Victor for one of Extension.

CASH BOY MINING VS. TONOPAH EXTENSION (Tonopah)—Suit filed in Federal Court, Carson City, to determine end lines and to quiet title to lode or vein now being worked by latter company. Court also asked to define apex rights of companies. No damages asked and no restraining order prayed for.

Ormsby County

GOLD-COPPER STRIKE WEST OF CARSON CITY made recently. Rich float found in this district years ago, but ledge deeply covered by débris. New tunnel site located and work started.

Storey County

BUTTERS CYANIDE PLANT (Virginia City)—This plant in Six-Mile Cañon, 1½ miles east of Virginia City, will resume operations soon. Plant has been shut down for several months.

OPHIR (Virginia)—North drift in Central tunnel advanced 13 ft. following quartz vein 6 ft. wide. Face samples average $12 per ton. Face now 82 ft. from main west crosscut. Last 40 ft. in virgin ground. Repaired old east crosscut. Andes crosscut advanced 15 ft. Face in low-grade quartz. Saved 297 cars of ore from stopes on 56-ft. level and east ledge and from development work. Milled 245 tons of ore.

NEW MEXICO

Grant County

AN ADDITIONAL CATERPILLAR TRACTOR, manufactured by Holt Mfg. Co., of Stockton, Calif., has been placed on 85 Mine-Lordsburg ore haul by Rowan & Downey. Two "caterpillars" operating two shifts are hauling 400 tons daily.

U. S. COPPER (Hanover)—Philadelphia mine being unwatered and preparations being made for resumption of operations. Hodge & Atteberry in charge of work.

WALDO (Lordsburg)—Concentrator being erected at Waldo mine by Los Angeles capitalists. Stebbins dry concentrator being used. Will treat carbonate lead ore now on dump. Flow: Ore bins to rotary jaw crusher to pebble mill to screen to fine ore bin. Over Stebbins table. Tailings to bins, for reconcentration. Framework of mill now being built. Machinery on ground for installation. In experimental plant 65% concentrate secured.

SOUTH DAKOTA

Lawrence County

RAINBOW (Maitland)—Burns, Sanford & Von Woehrmann, leasers of this property, are prosecuting work on body of milling ore which as extracted is piled on dump.

WELLS FARGO (Maitland)—Leasers are regularly shipping mill ore to Golden Reward plant, Deadwood, and occasional carloads of $30 to $40 ore to smelteries.

NORTH HOMESTAKE (Maitland)—Further development on 600 level will be inaugurated soon, according to statement of A. Maitland, of Negaunee, Mich., president and principal owner. Property is believed to contain northerly extension of Homestake vein system.

MINNESOTA (Maitland)—Development is to be instituted on vertical free-milling vein outcropping on west end of property. Adit will be continued along strike of vein, with occasional crosscuts from wall to wall. Nearly 18 ft. of ore is now in sight, but is only meagerly developed.

McHUGH PROPERTIES (Deadwood)—William Flynn and associates, of Pittsburgh, have been given options on McHugh and Gillmore properties, situated between Deadwood and Lead, and it is expected development on broad lines will be inaugurated. Preliminary examination was satisfactory.

ECHO (Maitland)—Since sinking was discontinued May 1 on account of trouble with water, 10x12 single-stage compressor, driven by 30-hp. motor, has been installed, and No. 5 Cameron sinker driven by compressed air will be used. Flow of water not great, but larger than could successfully be handled by bailing. Extra hoisting cable has been spliced on and all preparations made to quickly sink to 300 ft. depth when work is resumed

ORO HONDO (Deadwood)—Sinking has been resumed below 1500 level, to which point auxiliary hoist has been moved. Lateral work is also in progress on that level. In deepening the shaft two compartments are bulkheaded and sinking prosecuted through third compartment; from 1500 level to surface, rock is hoisted in skips in two compartments. Shaft is vertical, self-dumping skips are used But little water has been handled past few months since surrounding rock was drained by continuous work After shaft was unwatered, much pumping was necessary for five or six months.

UTAH

Juab County

TINTIC ORE SHIPMENTS for week ended May 21 were 125 cars, estimated at 6250 tons, valued at $155,000, compared with 147 cars last week Decrease accounted for by stormy weather, which delayed and prevented ore hauling and dump work.

TINTIC STANDARD (Eureka)—Preparations are being made for resumption of work at this property, which has been idle for several weeks.

SCOTIA (Tintic Junction)—Cost of hauling ore from this property to railroad is being investigated Auto trucks will probably be used. Several cars of lead-silver ore have been accumulated.

LOWER MAMMOTH (Mammoth)—On 700 and 1000 levels work is being done on company account; in other parts of mine leasers are working. Some zinc ore carrying over 30% is being shipped.

MAY DAY (Eureka)—Griggs-Carter-Castleton cyanide mill at this property—closed down since fall—is again in operation. Although zinc market is unsettled, May Day company is continuing to mine zinc ore running over 30%.

RIDGE & VALLEY (Eureka)—Work resumed here June 1. Thus far only small part of property has been developed, producing 12,679 tons of ore of gross value of about $359,000. Shares amounting to 250,000 have been placed in treasury to be used for development; of these, first allotment of 50,000 has been taken by present stockholders. Property is on the Centennial-Eureka, Eureka Hill, Bullion Beck and Gemini ore zone, through which latter property work will be carried on.

Summit County

PARK CITY ORE SHIPMENTS for week ended May 22 amounted to 1771 tons, estimated at $70,000, compared with 1666 tons last week. There were five producers.

ONTARIO (Park City)—Mine is again being worked on company account, and it is stated increase will be made in working force. Operations are being carried on on 600 level.

NEW QUINCY (Park City)—Stock of new company being received share for share in exchange for old Thompson-Quincy stock. Work will be undertaken in unprospected ground north of Daly-West, operations to be carried on from Daly-West 1260 level.

SILVER KING COALITION (Park City)—At annual meeting held May 17, officers of preceding year reëlected. David Keith is president and Thomas Kearns vice-president. Conditions at mine stated to be excellent and large tonnage blocked out so that production can be increased when market warrants. Flotation plant to treat sulphide ore from below the Alliance tunnel will be installed.

VIRGINIA

Shenandoah County

POWELL'S FORT (Woodstock)—H. P. Binswanger, of New York City, is developing this manganese property in the Shenandoah Valley, 11 miles from Woodstock. Work is under supervision of J. Carson Adkerson, of Lynchburg, Va., who has been connected with Piedmont Manganese Corporation of Concord, Va., and with its successor, Oxford Mining & Manganese Corporation. Powell's Fort mine produced pyrolusite ore for many years.

WASHINGTON

Stevens County

UNITED COPPER (Chewelah)—First unit of 20 stamps of new plant will start early in June. In conjunction with old plant will give capacity of 200 tons per day. Next month 30 more stamps will be added and additional flotation equipment.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTING (Trail)—Total ore treated in current year to date 144,728 tons. Greater part comes from Rossland.

Nova Scotia

DOMINION STEEL (Sydney)—New benzol and toluol plant is in operation, and considerable quantity of benzol has already been made. Toluol is now being produced. It is understood nitration of toluol is to be undertaken by Canadian Explosives Co., at its Ste. Anne plant.

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for the month of April, were from Cobalt proper: Beaver, 68; Cobalt Comet, 63; Coniagas, 43; Crown Reserve, 99; Kerr Lake, 57; La Rose, 145; McKinley Darragh, 155; Mining Corporation of Canada, Ltd., 404; Cobalt Lake, 100.97; Townsite City, 303.39; Peterson Lake (Seneca Superior Ore), 72.97; Temiskaming, 43.90; from South Porcupine, Dome Lake (gold), 61; from Porquois Junction, Alexo Mine (nickel), 665 tons. Total 1880 tons.

CONIAGAS (Cobalt)—Discovery of 500-oz. ore has been made on 300 level drive from new shaft. Vein is 4 in. wide.

TOUGH OAKES (Kirkland Lake)—A gold bar weighing 835 oz., valued at about $14,000, the result of the cleanup at new mill, has been shipped

CHAMBERS-FERLAND (Cobalt)—No. 1 shaft house was destroyed by fire on the night of May 15, entailing loss of $7000 partly covered by insurance.

IMPERIAL (Porcupine)—Underground development resumed May 19. Ore stated to average between $9 and $10 per ton being taken from 100-ft. level.

HOLLINGER (Timmins)—Usual four-weekly statement for period ended Apr. 22 shows gross profits of $141,457 from treatment of 22,952 tons of ore, average value $10.40 per ton, compared with $11.35 for last period. Working costs were reduced to $3.71 per ton, lowest reported. Mill also treated 4231 tons for Acme.

DOME MINES (South Porcupine))—For last six months mill has averaged between 20,000 and 23,000 tons per month, with saving of 90% to 91%. Next month is expected to get up to 27,000 tons, and in 30 days thereafter to get up to full capacity, between 28,000 and 30,000 tons per month. The president says: "Plan is to double capacity of mill within same mill building, without loss of time, and this completed to build mill of much larger capacity, depending entirely on tonnage developed, with money now being contributed for new stock"

The Market Report

Metal Markets

NEW YORK—June 2

Copper has been a little stronger, but no new buying movement of force has yet developed. The special features of the last week have been a spectacular rise in lead and a continuance of the crazy advance in spelter.

Copper, Tin, Lead and Zinc

Copper—The last was another week of dullness, but there was more inquiry and also there was more business done in outside markets; that is, markets other than New York. At the beginning of the week, sales were made in this market at 18⅝c., regular terms, then at 18¾c. Sellers who then advanced their price to 18⅞c. failed to realize it, such demand as there was being met by cheaper sellers, copper being still available at 18¾c., regular terms, at the close, while it was offered for export at 18½c., cash, New York. Certain large producers maintained their previous asking price of 19c., regular terms, right through the week, and realized the equivalent of that in interior and noncompetitive markets. A renewed buying demand of large proportions is expected to develop, but the news that it had started, communicated through Wall Street channels on June 2, was premature.

Copper Sheets base price 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire, 20@20½c. per lb. at mill, carload lots.

Tin—A moderate business was done with but little fluctuation in price during the week. Deliveries were large.

Nigerian tin production in April was 368 tons concentrates; for the four months ended Apr. 30 it was 1482 tons.

Imports of tin ore into Great Britain in April were: United States, 3 tons; France, 13; Portugal, 16; British India, 33; Spain, 49; South Africa, 242; Nigeria, 658; Bolivia, 3075; total, 4089 long tons, equivalent to about 2450 tons of tin.

Exports of tin from the Straits five months ended May 31 are estimated at 27,785 long tons in 1914 and 26,549 in 1915; a decrease of 1236 tons this year.

Tin output of the Federated Malay States four months ended Apr. 30 was 16,464 tons in 1914, and 14,352 in 1915; a decrease of 2112 tons this year.

Lead—Some large sales at about 4⅜c., New York, just before the close of business on May 26 foreshadowed the advance to 4.40c. that was made by the A. S. & R. Co. on May 28. That company then made advances on each day following, up to June 2. A rather large business was done at the advance. Respecting the meaning of this spectacular advance in lead there are differences of opinion. There has been large buying by ammunition manufacturers and also of lead that is supposed to be destined for export. On the other hand, production has not yet regained the rate of a year ago, and it was desired to stimulate production in view of a larger demand expected later in the year. Of course no such advance as ½c. per lb. in a week would have been necessary to accomplish that. It is possible that the advance having been started for this purpose some nervous buyers foresaw a repetition of the antics in spelter and deemed it wise to be forehanded and thus put up the market on themselves. It is possible also that there may have been buying for speculative account. At all events there were large transactions during the week, with buying a little more quiet on Wednesday than it had been previously.

The substitution of terne plate for galvanized sheets is resulting in an increased demand for lead, but not enough to be an important factor in the recent upward movement in lead.

Spelter—The last week was even more crazy than the crazy week immediately preceding, although the aggregate of transactions was not quite so large. However, we had reports of a very large tonnage. Prices were at sixes and sevens, differences of cents per pound being recorded in the same office on the same day. Some buyers appeared to do no shopping, but paid what was demanded of them. With such conditions existing it is impossible to quote the market with accuracy. A large volume of business was done at an average of about 21¾c. for the week. On June 2 one sale of spot spelter—a round lot—was made at 26½c., and there may have been sales at even higher than that.

The buying of last week was chiefly by brass makers, but there was at least one purchase by a galvanizer. It was a noteworthy feature that among the sales of last week the relatively early deliveries—June-July, July-August, etc.—were more in evidence than in the previous week. American contracts for delivery of spelter in Europe were repurchased on a considerable scale.

A highly important question at the present time is the extent to which producers have contracted their output for the last half of 1915. An estimate by one authority in the trade is that about 75% of the expected production in the third quarter and 30% of that for the fourth quarter have been sold.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
May June	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
27	4.7831	49⅝	18.40 @18.60	37¼	4.40	4.30 @4.35	19 @21
28	4.7850	49½	18.50 @18.60	37½	4.50	4.40 @4.45	20 @22
29	4.7850	49¼	18.50 @18.60	37½	4.75	4.62½ @4.67½	20 @22
31	..	...					..
1	4.7850	49⅜	18.50 @18.60	37¾	4.90	4.82½ @4.87½	21½ @23½
2	4.7838	49¼	18.50 @18.60	37¾	4.90	4.82½ @4.87½	23 @25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Spot									
May-June	Silver	£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
27	23¼	77¼	16.78	78¼		162	161½	20 7/16	4.44	77½	16.84
28	23 7/16	78¼	17.11	79⅜		163¼	163	20¾	4.40	80	17.38
29	23 5/16				..						
31	23 5/16	79⅛	17.19	80⅛		162¾	162½	20 13/16	4.55	84	18.25
1	23⅝	78⅝	17.14	79¾	.	160½	160	21½	4.67	92½	20.10
2	23 5/16	79¼	17.22	80		160	159½	*		[illegible]	[illegible]

*Not received.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound, the following approximate ratios are given, reckoning exchange at $4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = [illegible]. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—June 2

Aluminum continues in demand and prices are firm, 26@27c. per lb. being quoted for No. 1 ingots, New York. The chief producer here is holding back on prices.—**Antimony** is quiet and rather nominal. Business here is restricted to actual present demands. Ordinary brands are 34@36c. per lb and Cookson's is held at 45@47c. No quotations are made on futures.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is firm, and supplies not large. In New York no quotations are made today on large lots. Smaller orders are $75@80 per flask of 75 lb. San Francisco price is telegraphed at $65@67.50 nominal, but dealers hold for as high as $80. London price is £11 15s. per flask, with £11 12s. 6d. named from second hands.

Gold, Silver and Platinum

Gold imports continue, $7,500,000 having been received from Ottawa last week and $2,000,000 from France. Some more gold from Japan is also reported on the way.

Iridium is rather scarce, as it has been for some time. It is difficult to quote any general prices as transactions are generally on private terms and for small quantities.

Platinum is quiet with no large business reported. The market continues dull in a general way. Dealers ask $37@39 per oz. for refined platinum, and $41@44 for hard metal, according to grade.

Silver—The market continues quiet with a moderate demand and small fluctuations. Latest London advices report that competition for supplies is rather slight at present, but at the same time there is a disposition to consider possble advance as not an unreasonable expectation.

Gold and Silver Movement in the United States four months ended Apr. 30 is reported by the Department of Commerce as follows:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$19,032,269	$3,482,985	$16,026,149	$16,139,271
Imports	24,953,859	61,446,385	9,013,052	9,767,051
Excess	I.$5,921,590	I. $57,963,400	E. $7,013,052	E. $6,372,220

Gold imports in April were $16,203,028; exports, $813,706; excess of imports, $15,389,322. Exports of merchandise for the four months in 1915 were valued at $1,158,767,333; imports, $565,829,830,565; excess of imports, $592,937,768. Adding the gold and silver gives $541,346,588 as the net export balance.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 29

The competitive or open market base price paid for 60% zinc ore the past week advanced to $75 per ton. The base price paid for 80% lead ore was $55 per ton. The Edgar Zinc Co., the Picher Lead Co., and the Lanyon Zinc & Acid Co., have entered this field as buyers of zinc ore.

SHIPMENTS, WEEK ENDED MAY 29

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,263,260	196,450	1,350,140
Year	75,468,120	2,915,190	10,269,590

Shipped during week to separating plants, 4,625,940 lb. zinc ore.

JOPLIN, MO.—May 29

Blende, high price $88; assay base per ton of 60% zinc, premium ore $85; medium grades $83@81; lower grades down to $70. Calamine base, per ton of 40% zinc, $61@55; average, all grades of zinc, $75.81 per ton. Lead, high price $54.50; base $51@52 per ton of 80% metal content; average, all grades of lead, $50.13 per ton.

SHIPMENTS WEEK ENDED MAY 29

	Blende	Calamine	Lead	Values
Totals this week	13,498,600	1,690,540	1,535,720	$614,120
Totals 5 months	237,794,030	21,544,860	35,075,130	8,713,810

Blende value, the week, $532,290; 5 months, $7,448,080.
Calamine value, the week, $43,350; 5 months, $408,160.
Lead value, the week, $38,480; 5 months, $857,570.

Premium ore was advanced $10 per ton, and a number of sellers declined this price. The week's purchases clean up the last bin of surplus ore in the district, except what is owned by the Granby Mining & Smelting Co. at Granby. All other large bins are sold and much of it delivered. Undelivered stock will aggregate tonight about 7000 tons, the bulk of which is sold.

Iron Trade Review

NEW YORK—June 2

The position of the iron and steel trades remains about the same. Domestic business is improving slowly and the foreign trade continues to develop into rather large proportions.

The foreign trade has been subdivided to such an extent that it is not easy to trace it; perhaps, also, the contractors are not anxious to make their orders too public. It is calling for large quantities of material from the mills, at any rate.

While structural steel is still rather quiet there is a good demand for smaller building material. A special feature is the demand for hard bars for reinforced concrete work. Railroad orders also are coming in more freely than they have been for some time.

The pig iron market is improving slowly, and foundry iron seems to be more in demand. More iron is also being called for on contract deliveries.

PITTSBURGH—June 1

There has been a further improvement in the steel trade, both in actual shipping orders booked and in the outlook. Steel trade sentiment is now hopeful in the extreme and it is regarded as practically certain that before long the mills will be operating substantially at capacity.

Nearly all the large steel interests booked larger tonnages in May than in April, in actual shipping orders. In contracting not so much was done, partly because May was the middle month in the quarter and partly because the mills are rather reserved about incurring market obligations. A fair tonnage of steel bars for the implement trade was booked, for shipment over the second half of the year. The Steel Corporation's unfilled obligations promise to show a slight increase during May, after two months of small decreases.

Galvanized steel products have advanced sharply, on account of the high price and scarcity of spelter. Effective today, the American Sheet & Tin Plate Co., almost the only seller of galvanized sheets, advanced to 4.25c. for 28-gage, making a total advance since last December of no less than $32 a ton, due entirely to the spelter situation since black sheets are unchanged at 1.80c.

The car shops that participated in the Pennsylvania awards of 14,000 freight cars are covering the steel and will shortly furnish specifications for rolling. The Pennsylvania's orders for 138,000 tons of rails are likely to be placed within a week and rolling should begin almost at once.

The Pittsburgh and Valley steel mills are operating at 80 to 90% of the capacity, and the average of the whole country has risen above 75%, with prospects of 80 to 85% by the end of the month.

Pig Iron—The pig iron market continues surprisingly dull in view of the further improvement in steel. Shipments, however, are slightly better and more activity in the near future is confidently expected. W. P. Snyder & Co. announce average prices in May, based on actual sales in 1000-ton lots and over, of $13.659, Valley, for bessemer, and $12.65, Valley, for basic. We quote: Bessemer, $13.75; basic, $12.50@12.65; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Chemicals

NEW YORK—June 2

The general markets show some signs of improvement, though business in most lines is only fairly active.

Arsenic—Demand continues on a moderate scale only. The market is rather steady. Quotations continue about $4 per 100 lb. for both spot and futures.

Copper Sulphate—On a fair business prices are unchanged. Current quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business shows little change. Demand is fair. Quotations are 2.30c. per lb. for spot and all positions this year.

Potash Salts—Imports of potash salts into the United States for the four months ended Apr. 30 are reported by the Department of Commerce as follows:

	1914	1915	Changes
Potash salts, lb.	13,966,683	12,334,868	D. 1,631,815
Fertilizer salts, tons	396,982	80,925	D. 316,057

Fertilizer salts include kainit, sulphate and muriate of potash and manure salts or crude salts.

Pyrites—Imports at Baltimore for the week include 5203 tons of pyrites from Huelva, Spain.

Assessments

Company	Delinq.	Sale	Amt.
Argenta, Ida	May 10	June 10	$0.001
Belcher, Nev., (post.)	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Blue Star, Ida	June 19	July 10	0.01
Cash Boy, Nev	May 17	June 17	0.01
Cedar Creek, Ida	May 5	June 5	0.005
Contact Copper, Mich	May 15	.	0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida....	June 5	July 8	0.001
Emerald, Utah (three assts.)		June 9	0.01
Glen Metal, Ida	May 31	July 1	0.002
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3	.	1.00
Houghton, Mich	May 25		1.00
Idaho-Nevada, Ida	May 10	June 5	0.002
Laclede, Ida......	May 24	June 14	0.003
Majestic-Idol, Nev	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Monarch Pitts., Nev	June 14	July 14	0.01
Moonlight, Ida		June 5	0.005
Mullan, Ida., (post.)		June 24	0.002
Nevada-Douglas, Nev.......	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich	Dec. 1	.	0.50
North Bunker Hill, Ida	June 12	July 17	0.002
North Lake, Mich..	.	June 15	1.00
O. K. Silver, Utah....	May 3	June 5	0.0025
Ophir, Nev	June 1	June 25	0.05
Overman, Nev.............	May 19	June 8	0.05
Rainbow, Ida..	July 7	Aug. 7	0.002
Raymond-Illinois, Utah.	May 24	June 9	0.005
Raven, Ida.	May 15	June 14	0.0006
Royal, Ida...	June 1	July 6	0.0015
Samson, Ida (post.)		June 3	0.002
Selma, Utah	May 29	June 16	0.005
Silver Moon, Ida...........	May 18	June 18	0.005
Silver Mountain, Ida.	May 15	June 15	0.002
Silver Pick, Nev..	June 5	July 12	0.01
Treasure, Calif.		.	0.05
Union, Nev	June 18	July 9	0.05
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Virginia, Ida., (post.)	...	June 29	0.02
Wisconsin, Ida.....	May 15	June 15	0.003
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

Stock Quotations

Among sales at auction we note: In Boston, 500 Potosi Mine pfg., $25 lot; in Philadelphia, 500 Buck Mountain (Nev.) Gold, $2 lot. No mining shares at auction in New York.

COLO. SPRINGS June 1	
Name of Comp.	Bid
Acacia.....	‡.01½
Cripple Cr'k Con...	‡.01¼
C. K. & N..	‡.03½
Doctor Jack Pot...	.10
Elkton Con........	.40
El Paso.....	1.05
Findlay.	.04½
Gold Dollar	.02
Gold Sovereign	.05
Golden Cycle	1.73
Isabella ..	.18¼
Jack Pot...	.06½
Jennie Sample	‡.02
Jerry Johnson.	.04
Lexington	‡.008
Mary McKinney	.35
Pharmacist.	‡.01½
Portland..	1.47
Raven B. H.	‡.03
Vindicator	1.58

SALT LAKE May 29	
Name of Comp.	Bid
Beck Tunnel	.04
Black Jack	.06
Colorado Mining	.10
Crown Point	.01½
Daly-Judge	5.30
Gold Chain	.10
Grand Central	.55
Iron Blossom	.70
Little Bell	14
Lower Mammoth	‡.04
Mason Valley	‡2.00
May Day	.15½
Opohongo	.01
Prince Con.	.40½
Seven Troughs	.01¾
Silver King Coalition	3.07½
Silver King Con....	1.87½
Sioux Con.	.03
Uncle Sam	.04
Yankee	.01

TORONTO May 29			
Bailey....	.02	Dome Ext.	.10
Coniagas....	.04½	Foley-O'Brien	.30
Peterson Lake...	.24	Hollinger	25.75
Right of Way...	.03	Imperial	.06
Seneca Superior	1.12½	Jupiter	.10
Silver Queen	.01	McIntyre	.40
T. & Hudson Bay	†20.00	Pearl Lake	.01
Timiskaming	.31	Porcu. Crown	.80
Wettlaufer-Lor...	.03	Preston E. D.	.02
Big Dome	14.25	Rea	.10

SAN FRANCISCO June 1			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.01	Belmont	1.40
Andes	.05	Jim Butler	.75
Belcher....	‡.13	Lone Star	‡.07
Best & Belcher....	.05	MacNamara	.03
Caledonia...	‡.20	Midway	.17
Challenge Con.	‡.06	Mont.-Tonopah	.30
Confidence	.06	North Star	.16
Con. Virginia..	.08	Rescue Eula	.11
Gould & Curry.	.02	West End Con	‡.74
Hale & Norcross.	.03	Atlanta	.72
Julia	‡.01	Booth	.53
Mexican.	.30	C.O.D. Con	.04
Occidental...	.79	Comb. Frac.	.09
Ophir.......	.11	Jumbo Extension	1.15
Overman.....	.05	Pitts-Silver Peak	‡.12
Potosi......	‡.01	Round Mountain	.41
Savage......	.02	Sandstorm Kendall	‡.08½
Sierra Nevada...	.06	Silver Pick..	.10
Union Con..	.15	Central Eureka	‡.14
Yellow Jacket	.30	So. Eureka	‡2.25

N. Y. EXCH. May 29	
Name of Comp.	Clg.
Amalgamated.	65½
Am. Sm. & Ref., com	65¼
Am. Sm. & Ref., pf	103
Am. Sm. Sec., pf. B	82
Anaconda	31¼
Batopilas Min	1⅛
Bethlehem Steel.	137
Bethlehem Steel, pf	112
Chino.	44¼
Colo. Fuel & Iron..	30
Federal M. & S., pf	34½
Great Nor., ore., ctf.	31½
Guggen. Exp.	59½
Homestake	117
Inspiration Con.	29¼
Mex. Petroleum	68
Miami Copper.	25½
Nat'l Lead, com	60
National Lead, pf..	109¼
Nev. Consol ..	13¾
Ontario Min	3
Quicksilver, pf......	1½
Ray Con ..	23¼
Republic I&S, com	27½
Republic I&S, pf.	83½
SlossSheff'd, com	32
Tennessee Copper	32½
Utah Copper	65½
U. S. Steel, com	54½
U. S. Steel, pf......	106⅝

N. Y. CURB May 29	
Name of Comp.	Clg.
Alaska Juneau, w.i.	13¾
Alta Con	.85
Beaver Con.......	‡.35
Big Four.	‡.07
Blue Bell	‡.03
Braden Copper	7½
Buffalo Mines	$\frac{13}{16}$
Can. Cop. Corpn.	‡$\frac{15}{16}$
Can. G. & S.	‡.03½
Caribou	.45
Cashboy	.08
Chambers Ferland	‡.17
Con. Ariz. Sm.	.75
Con. Coppermines	2
Davis-Daly	‡.99
Diam'field-Daisy	‡.07
Dia. Black B.	‡.04
Florence	.55
Goldfield Con	1½
Goldfield Merger.	‡.25
Greene Cananea	30
Kerr Lake........	$4\frac{11}{16}$
La Rose	
McKinley-Dar-Sa	.30
Mines of Am.	2
Nevada Hills	.21
New Utah Bingham	2¼
Nipissing Mines	5¾
Ohio Copper	$\frac{9}{16}$
Oro.............	.09½
South Utah	‡⅜
Stand'd Oil of N.J.	398
Standard S. L.	1¼
Stewart	1⅛
Tonopah	6⅞
Tonopah Ex.	$3\frac{1}{16}$
Tonopah Merger	.37
Tribullion...	½
Tularosa	‡.18½
West End Ex.	.04
Yukon Gold	2½

LONDON May 19	
Alaska Tre'dwell	£7 7s 6d
Cam & Motor	0 15 0
Camp Bird	0 6 0
El Oro.....	0 7 3
Esperanza....	0 7 9
Mexico Mines	3 12 6
Oroville.	0 12 0
Santa Gert'dis	0 7 6
Tomboy	1 4 6
Tough Oakes	0 12 6

BOSTON EXCH. May 29	
Name of Comp.	Clg.
Adventure	2¼
Ahmeek..	288
Alaska Gold M.	34½
Algomah	3½
Allouez	54¼
Am. Zinc	47¼
Ariz. Com., ctfs.	7½
Bonanza	‡.35
Butte-Balaklava	3¼
Butte & Superior	70¼
Calumet & Ariz	62
Calumet & Hecla	565
Centennial	18
Cliff	‡1¼
Copper Range	51
Daly West	2
East Butte	11
Franklin	9¾
Granby	79
Hancock	21
Hedley	‡28
Helvetia	‡.70
Indiana	7½
Island Cr'k, com	43
Island Cr'k, pfd.	90
Isle Royale	27
Keweenaw	2½
Lake	12¼
La Salle.	6½
Mass	13
Mayflower.....	5
Michigan	1½
Mohawk	70
New Arcadian	8½
North Butte.	31
North Lake	2¼
Ojibway	2¼
Old Colony	4½
Old Dominion	53
Osceola	79½
Quincy.	87
Santa Fe	2⅜
Shannon	8¼
Shattuck-Ariz	27
Superior	27½
Superior & Bost.	3½
Tamarack	34
Trinity	1½
Tuolumne	.40
U. S. Smelting...	35½
U. S. Smelt'g, pf.	44
Utah Apex	$3\frac{5}{16}$
Utah Con	13¼
Victoria.	3
Winona	4
Wolverine.	56
Wyandot	1⅛

BOSTON CURB May 29	
Name of Comp.	Bid
Alvarado	‡.65
Bingham Mines....	.06½
Boston Ely........	.30
Butte & Lon'n Dev.	‡.17
Calaveras	2
Calumet Corbin	.09
Chief Con	.85
Corbin....	.90
Cortez	.20
Crown Reserve	.75
Eagle & Blue Bell	1¼
First Nat. Cop.	2
Houghton Copper	1⅛
Iron Cap Cop., pf	5
Majestic	.55
Mexican Metals	.16
Nevada-Douglas.	.65
New Baltic	3¼
Oneco	1¼
Raven Copper	.10
Smokey Dev.	.35
So. Lake	6½
Tonopah Victor	‡.31
Trethewey	‡.14
United Verde Ext.	4¼

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February..	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.704
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471		27.199	25.948	
July.	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year....	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver. London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	[illegible]	[illegible]	[illegible]	[illegible]	65.719
February..	14.491	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March....	14.131	14.787	[illegible]	[illegible]	[illegible]	[illegible]
April.....	14.211	16.811	64.747	75.069	[illegible]	[illegible]
May......	13.996	18.506	[illegible]	[illegible]	[illegible]	[illegible]
June	13.603		61.336		[illegible]	
July.	13.223		60.540		[illegible]	
August	*		‡		‡	
September	*		‡		‡	
October..	*		‡		‡	
November.	11.739		53.227		‡	
December.	12.801		56.841		‡	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March.	38.038	48.129	173.619	180.141
April	36.154	47.884	163.963	166.225
May.....	33.360	38.790	150.702	162.675
June.	30.577		138.321	......
July.	31.707		142.517	......
August	*		‡	......
September ..	32.675		‡	...
October.	30.284		‡	...
November	33.304		139.391	...
December	33.601		147.102	..
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January...	4.111	3.729	4.011	3.548	19.665	18.606
February..	4.048	3.827	3.937	3.718	19.606	19.122
March.	3.970	4.053	3.850	3.997	19.651	21.883
April.	3.810	4.221	3.688	4.142	18.225	21.094
May.	3.900	4.274	3.808	4.182	18.503	20.347
June......	3.900		3.810		19.411	.....
July	3.891		3.738		19.051	.....
August....	3.875		3.715		‡	....
September	3.828		3.658		‡	....
October ...	3.528		3.384		‡	....
November.	3.683		3.585		18.500	..
December.	3.800		3.662		19.097	.
Year....	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January..	5.262	6.386	5.112	6.211	21.533	30.844
February..	5.377	8.436	5.228	8.255	21.413	39.819
March.	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	[illegible]	68.100
June	5.000		4.850		21.345	
July.	4.920		4.770		21.568	.
August....	5.568		5.418		‡	
September	5.380		5.230		‡	
October....	4.909		4.750		‡	
November	5.112		4.962		25.016	...
December.	5.592		5.430		27.369	.
Year	5.213		5.061			....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January...	$14.94	$14.59	$13.23	[illegible]	$13.99	$13.90
February..	15.06	14.55	14.12	[illegible]	14.08	13.90
March ...	15.07	14.55	13.94	[illegible]	14.10	13.95
April	14.90	14.55	13.90	[illegible]	14.13	13.95
May	14.90	14.61	13.90	[illegible]	14.27	13.83
June	14.90		13.90		13.90	...
July. ..	14.90		13.90		13.90	...
August....	14.90		[illegible]		14.08	...
September	14.90		[illegible]		14.03	...
October	14.84		[illegible]		13.97	...
November	14.59		[illegible]		[illegible]	..
December.	14.70		[illegible]		[illegible]	..
Year..	$14.88		[illegible]		$14.01	.....

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

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1125—COAL-DUST FIRED REVERBERATORY FURNACES. (Bull. A. I. M. E., May, 1915; 12½ pp.) Discussion of paper by D. H. Browne, previously indexed.

1126—CRUSHING PLANT of the Ohio Copper Co.'s Mill. Robert S. Lewis. (Eng. and Min. Journ., Apr. 24, 1915; 1½ pp., illus.) 20c.

1127—FLOTATION of Copper Ores. (Min. and Sci. Press, May 1, 1915; 2 pp. 20c.

1128—LEACHING—Efficiency of Acid in Copper Leaching. Oliver C. Ralston and D. A. Lyon. (Salt Lake Min. Rev., Apr. 30, 1915; 1 p.) 20c.

1129—LEACHING—New Anaconda Leaching and Acid Plants. E. P. Mathewson. (Eng. and Min. Journ., Apr. 24, 1915; 4½ pp., illus.) 20c.

1130—LEACHING—Simple and Efficient Precipitant for Copper from Acid Solutions. Wm. Thompson. (Min. and Eng. Wld., May 1, 1915; ¾ p.) 20c.

1131—LEACHING—Solution Control in Ferric-Chloride Leaching of Sulphide Copper Ores. F. N. Flynn and Roger H. Hatchett. (Met. and Chem. Eng., May, 1915; 1 p.) 40c.

1132—MICHIGAN—Copper Mining in Michigan. Thomas T. Read. (Min. Mag., Apr., 1915; 5 pp., illus.) 60c.

1133—MINING Low-Grade Copper Ore by Ray Consolidated. Alec N. Penny. (Eng. and Min. Journ., May 1, 1915; 3¾ pp., illus.) 20c.

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1135—NORWAY—The Grong Copper and Pyrites Mines of Norway. Andreas Dahl Udhany. (Eng. and Min. Journ., May 22, 1915; 3¼ pp., illus.) 20c.

1136—ORE DEPOSITION—On Temperatures that Obtain in Zones of Chalcocitization. W. H. Emmons. (Econ. Geol., Feb.-Mar., 1915; 9½ pp.) 60c.

1137—PRODUCTION of Copper in the United States in 1914. B. S. Butler. (Advance statement, U. S. Geol. Surv., 1915; 4 pp.)

1138—REFINING—Waste-Heat Boilers at Chrome, N. J. Clarence L. Brower. (Eng. and Min. Journ., May 22, 1915; 2¾ pp., illus.) Describes installation of two 250-hp. vertical Cahall boilers installed on 75-ton reverberatory refining furnace; the installation was not successful. 20c.

1139—SMELTING of Copper Ores in the Electric Furnace. Dorsey A. Lyon and Robert M. Keeney. (Bull. 81, U. S. Bureau of Mines, 1915; 80 pp.)

1140—WAR—The Position of Copper During the War Period. John B. C. Kershaw. (Engineer, May 7, 1915; 1 p., illus.) 40c.

GOLD AND SILVER—GEOLOGY

1141—ALASKA—Geology of Juneau District. (Eng. and Min. Journ., May 22, 1915; 1¼ pp.) From a paper by F. B. Hyder before Min. and Eng. Soc. of Alaska. 20c.

1142—ASHANTI—Notes of Some Gold Occurrences in Ashanti. J. Morrow Campbell. (Bull. 127, I. M. M., Apr. 8, 1915; ½ p.) Further contributed remarks on paper previously indexed; also author's reply to discussion.

1143—YUKON TERRITORY—The Geology and Economic Minerals of Yukon Territory. Erle Chadwick Annes. (Mine, Quarry and Derrick, Apr. 14, 1915; 5 pp.) 40c.

GOLD DREDGING AND PLACER MINING

1144—ALASKA—Yakataga Beach Placers. Arthur G. Thompson. (Eng. and Min. Journ., May 1, 1915; 2½ pp., illus.) 20c.

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GOLD AND SILVER CYANIDING

1151—CHOSEN—Mill and Cyanide Plant of Chiksan Mines, Chosen. Chas. W. DeWitt. (Bull. A. I. M. E., May, 1915; 6 pp., illus.) 40c.

1152—MINERALIZED WATERS—The Effect of Mineralized Waters in Cyanide Plants. Thos. B. Stevens and W. S. Bradley. (Bull. 127, I. M. M., Apr. 8, 1915; 14 pp., illus.)

1153—NEW ZEALAND—Cyaniding of Gold-Silver Ores at Waihi Grand Junction. Nöel Carless. (Bull. 127, I. M. M., Apr. 8, 1915; 19 pp., illus.)

1154—PRECIPITATION—The Precipitating Action of Carbon in Contact with Auriferous Cyanide Solutions. W. R. Feldtmann. (Bull. 127, I. M. M., Apr. 8, 1915; 15 pp.)

1155—RAND—Recent Rand Metallurgical Practice. M. Thornton Murray. (Eng. and Min. Journ., May 1, 1915; 2½ pp.) 20c.

1156—SOLUTIONS—Method for the Determination of Gold and Silver in Cyanide Solution. (Bull. A. I. M. E., May, 1915; 1¾ pp.) Discussion of paper by L. H. Bahney, previously indexed.

1157—ZINC BOX—A Temporary Zinc Box. A. W. Allen. (Min. and Sci. Press, Apr. 24, 1915; 1¼ pp., illus.) 20c.

GOLD AND SILVER—GENERAL

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The Eiderlinsky Gold Mines

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SYNOPSIS—The Russian Gold Exploration Co. controls about 14,000 acres near Eiderla, 130 miles southwest of the Ural Range. Quartz veins in granodiorite are mined from one inclined and three vertical shafts. Scarcity of labor prohibits hand drilling. Machine drills and drill sharpeners of American manufacture are used.

The Eiderlinsky mines of the Russian Gold Exploration Co. are situated in the Government of Orenburg, Russia, 93 miles east of the town of Orsk and 180 miles south of the town of Troitzk. The camp lies southwest of the Ural Range, which is about 130 miles distant. The neighboring large mining camps are Baymak (Tanalyk Corporation, Ltd.), 95 miles northwest, producing copper, gold and lead, and Kochkar, 200 miles north-northwest, representing the most important gold field in the South Ural range.

Lomanaya Shaft of Russian Gold Exploration Co., Government of Orenburg, Russia

The Russian Gold Exploration Co. (Rossiiskoye Zolotopromishlennoye Obshestvo) has at Eiderla a group of 63 claims, covering 14,053 acres. The gold-bearing veins are connected with a granodiorite mass, which represents the country rock. The granodiorite occupies an area about 1½ miles north and south and 1¾ miles east and west. The adjacent rocks are: On the eastern side, amygdaloids, porphyries, quartzite and schists; on the southern side, granodiorite is adjoined by amygdaloids, porphyry, quartzite and serpentine; the western contact of granodiorite is amygdaloid, quartzite and limestone; to the north lie porphyry, amygdaloid, limestone and a vast area of microcline granite. The rock of greatest importance to the mine is the granodiorite; the richest claims are located on this formation or on its eastern contact with the porphyries.

Quartz Veins in Granodiorite

Only a few of the 63 claims are developed and working now. The rocks are similar to those of the Kochkar district. Three principal veins are now developed and working—Uklonnaya, Miasskaya and Safonovskaya. The vein matter is white quartz with a small quantity of disseminated sulphides; gold is found either in native form or with the sulphides of arsenic, antimony and silver. Hanging and foot walls of the veins are granodiorite, often altered and sometimes soft and likely to cave.

The dips of the various veins are decidedly different. The principal vein of the mine, Uklonnaya, has an average dip of 28° E. and the strike is 5° NE. The average width of the quartz vein is 3½ ft., ranging from 2 to 12½ ft. As a part of the hanging and foot walls of the vein contains gold, the average working width is 4½ ft. One square sazhen[1] of the vein contains 21 short tons of ore. All veins split frequently into two or three parallel veins separated by areas of country rock from 6 in. to 2 ft. thick.

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[1] 1 sazhen = 7 ft.; 1 sq. sazhen = 49 sq. ft.

The Miasskaya vein dips 70° N. and the strike is 77° NE. The average width is 3 ft., varying from 2 to 7 ft. One square sagene of the vein contains 17 tons of ore. The Uklonnaya and Miasskaya veins are at an angle of 70° to each other.

The Safonovskaya vein has a strike 23° NW and dips 71° SW. One square sagene of the vein gives 15 tons of ore, the average width being 2 ft. There are many other quartz veins in the deposit, part of them being of milling value.

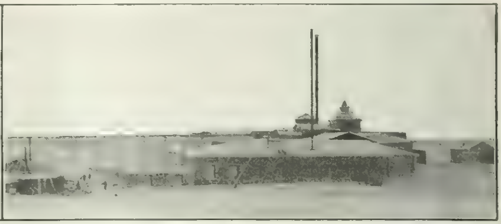
THREE VERTICAL AND ONE INCLINE SHAFT

Mining is carried on through four principal shafts of rectangular section. Three of the shafts are vertical: Lomanaya is 280 ft. deep; Miasskaya, 370 ft.; and Safonovskaya, 210 ft. Uklonnaya is an incline 1000 ft. deep on the vein. Lomanaya and Uklonnaya shafts are on the Uklonnaya vein; the Miasskaya and Safonovskaya shafts are on the two corresponding veins.

All vertical shafts are of the same size, having four compartments arranged in a straight line. The length of the shafts inside the timbers is 13 ft. 1 in. and the width 4 ft. 4 ½ in. The two hoisting compartments are 4 ft. 11½ in. by 3 ft. 6 in. each; the ladderway and manway is 4 ft. 11½ in. by 2 ft. 4 in. A pump compartment is arranged for carrying pipe lines. The shafts are cribbed with 7 in. round timber, hand-framed; 4x3¾-in. guides are used, held by 8x¼-in. nails. Native fir timber is used in all shaft work; this is obtained from forests 40 miles distant. Hoisting in vertical shafts is done on one- and two-deck cages.

The Uklonnaya incline is in the vein and has dimensions 13 ft. 9 in. by 7 ft. 2 in., outside of the timbers. This shaft has three compartments, two hoisting ways 5 ft. 7 in. by 3 ft. 2½ in. in the clear and one manway 5 ft. 7 in. by 2 ft. 9 in. Hoisting is done by cars in trains of two or three cars on an 18-in. track of 5-lb. rails.

CAMEL TRAIN STARTING ON A TRIP FOR TIMBER



THE MILL AT EIDERLA, ORENBURG, RUSSIA

ERECTING THE HEADFRAME OF THE NEW KAPITALNAYA SHAFT

ONE SET OF TIMBERING FOR THE KAPITALNAYA SHAFT

SHAFT EQUIPMENTS

The property heretofore has not been equipped with a plant sufficient to produce the proper amount of tonnage. Lomanaya shaft is equipped at present with a Davey, Paxman & Co. 12x14-in. double-cylinder winding engine; four Davey, Paxman & Co. locomotive-type boilers, two of 726 and two of 565 sq.ft. of heating surface, built for a working pressure of 140 and 120 lb. respectively; one Ingersoll-Rand class A 18x18¼x18-in. steam-driven air compressor, and several Cameron underground pumps. One compound 16x10x14-in. Imperial type XB-2 air compressor is driven by a 110-hp. Wolf type CL-IV locomobile, which also drives one 11-in. Cornish pump. Fifteen drills are working from the Lomanaya shaft. Besides the drills, the compressors furnish air underground for pumps and two 5x7-in. double-cylinder Holman hoists.

One Cockerill double-cylinder hoisting engine is installed at Uklonnaya shaft, steam for which is furnished at 75-lb. pressure by a Cornish boiler having 384 sq.ft. of heating surface. The air-compressor plant at Miasskaya shaft consists of one Imperial type XB-2 14x9x12-in. air compressor driven by one 85-hp. Wolf type CL-1 locomobile, which also drives one 7¾-in. Cornish pump. Two 30-hp. Paxman locomotive-type boilers generate steam at 120-lb. pressure for a 12x14-in. double-cylinder winding engine made by Davey, Paxman & Co. and several Cameron pumps in the mine. At the Miasskaya shaft there is also one Flottmann single-cylinder, belt-driven, class K-25 compressor, which delivers 300 cu.ft. of free air per minute and is driven by one vertical 10x10-in. Tangye steam engine. Another Flottmann compressor, class K-18, for 230 cu.ft. per min. was used at the Miasskaya shaft previously, but did not prove so efficient as those of Ingersoll-Rand make.

There are two 30-hp. Paxman boilers at the Safonovskaya shaft supplying steam at 90-lb. pressure for one

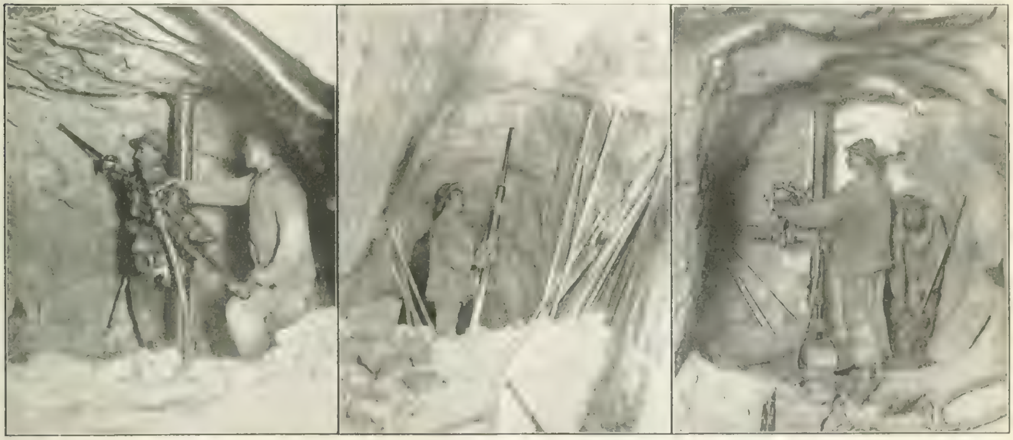
12x14-in. Paxman winding engine and for an engine driving an 8x8-in. Ingersoll class NE-1 straight-line air compressor.

Drilling Equipment

The drilling equipment at the Lomanaya shaft consists of C-110 Ingersoll-Rand butterfly-valve 2¾-in. piston drills for general use in drifting and stoping; for drilling in hard quartz, six E-24 Ingersoll 3¼-in. drills are used. There are also a few A-86 2¼-in. drills, which have proved useful in soft rock, drifting along faults, crosscutting in altered granodiorite, etc.; however, they will be replaced in the future by C-110 drills, which are lighter and more efficient. Jackhamer BCR-430 drills are used for down holes in underhand stopes and BC-21 butterfly-valve telescope-feed hammer drills for raises and starting ore chutes.

At Miasskaya and Safonovskaya shafts, with the vein dipping 70°, Ingersoll-Rand BC-21 butterfly-valve stoping drills are in use now, with a few Ingersoll MC-32 and Sullivan DA-21 stoping drills.

To standardize the work, the management will in the future use only C-110 piston drills for all drifting and stoping in the flat Uklonnaya vein, BC-21 for all stoping in Miasskaya and Safonovskaya veins, and BCR-430 for down-hole drilling.


Drilling by Contract in the Eiderlinsky Mines of the Russian Gold Exploration Co.

Methods of Mining

On the Uklonnaya vein the levels are 105 ft. apart. The vertical Lomanaya shaft cuts the vein at the depth of 280 ft. A station is cut and the fourth level established approximately 120 ft. on the incline below the outcrop; above this level all operations were carried on through this shaft, but these have been discontinued except for pumping, hoisting men and lowering the timber. Almost all ore now mined is hoisted through the inclined Uklonnaya shaft from the third, fourth and fifth levels, where stations are established.

The drifts are single track, 7x6 ft. outside the timbers. For a distance of 28 ft. from each station, the drifts are of double-track size, 7x10½ ft. The drifts are timbered with 8-in. round timber, 5-ft. cap, 7-ft. posts and 3- to 5-in. lagging. The sets are 3 to 4 ft. apart.

When beginning stoping operations, a raise is cut from the drift to the level above and a breast is started in the direction of the strike for the whole length of the raise, a pillar 7 ft. wide being left to protect the level. The stope consists of several (five to seven) faces, each 14 ft. long; the lowest face is carried 4 to 7 ft. in advance of the one above, and so on, the successive arrangement of the faces being as in overhand stopes. Where the hanging wall near the vein is weak, stull timbering of the stope is necessary, using slab lagging 3 to 5 in. thick and 5- to 9-in. posts. The ore is shoveled from the stopes to the chutes. After the ore is taken out, stopes are partly filled with the waste, if such is available from the level above, and partly caved. Four levels are working on the south and two levels on the north.

Stoping is done mostly on contract with hand drilling. The miners are paid at so much per square sagene; where machine drilling is used in stopes, the miners are paid for extra vershoks[2] drilled during one 8-hr. shift above a certain length of hole. The contract prices for stoping vary from 25 to 50 rubles per square sagene ($9 to $18 per square fathom) of the vein for breaking ground, including timbering, explosives and candles. A close supervision is necessary to avoid breaking waste with the ore, especially when adjacent to a soft hanging wall.

Miasskaya shaft is 370 ft. deep and has three working levels—230, 300 and 370 ft. deep. The shrinkage system is in use at the third level. The length of the stope is 140 ft., its back being horizontal. Since the distance between levels is but 70 to 100 ft., no raise is previously made to the level above, two manways being timbered in each stope from the drift each side of the stope and ladders installed. One floor from the back of the level is timbered with stulls lagged with 5-in. round timber, and "Chinaman chutes" are put up every 20 ft. Stoping is begun from this second floor and carried on vertically, the broken ore accumulating on lagging. The back stands well without support; the ore is kept 6 to 7 ft. from the back and 7-ft. pillars are left under the level above for protecting it when filling the stope with the waste. Ingersoll BC-21 telescope-feed hammer drills are used in the stopes, one man operating each drill. No timber or support is required except for the two manways and the first floor.

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[2] 1 vershok = 1¾ in

Underhand stoping is carried on in the second level east with stull timbering and double-hand drilling. Overhand stoping with the use of stulls is carried on at the first level of Miasskaya shaft and in Safonovskaya shaft, filling being occasionally used. Owing to the high price of timber, the management is going to put in practice the shrinkage system for all veins of steep dip.

Hand and Machine Drilling by Contract

Through shortage of labor, machine drilling is the general practice at these mines, but double-hand drilling is used where machines are not working. Three shifts of 8 hr. are worked. A bonus system is used with hand drilling; two men have to drill from 30 to 40 vershoks (4 ft. 5 in. to 5 ft. 10 in.) for a fixed wage of one ruble. For holes drilled beyond this length, the drillers are paid 5 kopecks (2½c.) for every vershok. The task is 30 vershoks in overhand stoping where holes are horizontal and 40 vershoks in underhand stopes where holes are vertical. The sizes of the bits for hand drilling are 1½, 1⅜, 1¼, 1⅛ and 1 in.; ⅞-in. octagon steel is used. Two drillers make up to 10 ft. of holes during the 8-hr. shift.

In raises only machine drilling is used. Task work is used also in machine drilling. The shift task for one C-110 drill is 80 vershoks (11 ft. 8 in.) for which the machineman gets one ruble and the helper 80 kopecks. The men are paid, besides these wages, a bonus of one kopeck for every extra vershok drilled during the shift. Solid 1-in. octagon steel is used for machine drilling; solid cross-bits are used for piston drills, the sizes being 2¼, 2, 1¾, 1½ and 1¼ in., and high-center cross-bits, 2, 1¾, 1½ and 1¼ in., are used.

Drill Sharpening

Special attention is paid to drill sharpening. All drill sharpening is done with machines. One Ajax D-24 drill sharpener is used at Lomanaya shaft and one Leyner TR model 5 drill sharpener at Miasskaya shaft, the latter making also 1⅛-in. hexagon drill shanks for telescope feed hammer drills and square shanks with collar on hollow round steel. To standardize work, all shanks on solid steel are of one type and size. The Leyner drill sharpener, in connection with the Leyner No. 5 oil forge, proved to be an excellent equipment for sharpening and shanking of all kinds. Sharpening results at Miasskaya shaft for June, 1914, are given in an accompanying table.

DRILL SHARPENING AT MIASSKAYA IN JUNE, 1914

Drills sharpened:	
Chisel bits for hand drilling, ⅞-in. octagon steel....	5,874
High-center cross-bits for telescope-feed hammer drills, 1-in. octagon steel....................	4,286
Cross-bits for piston drills, 1-in. octagon steel.......	1,026
Total bits sharpened........	18,306
Bits sharpened per 8-hr. shift, 232.	
Sharpening expenses:	Rubles*
Blacksmith's wages, 79 eight-hour shifts	84.20
Helper's wages...	51.90
Total labor	136.10
Oil used, 201.15 poods at 1 ruble...	201.15
Power (air), 79 shifts at 2.48 rubles	195.92
Total	533.17
Cost of sharpening one drill bit	Kopecks*
Labor ..	0.74
Oil . .	1.10
Air (power)	1.06
Total	2.9

The cost of sharpening per drill in July was 2.74 kopecks (1.3c.); the total number of bits sharpened during the month was 18,170. Operating the sharpening machine is not difficult, and common smiths soon become accustomed to it. Good work, of course, requires time. The cost of sharpening by hand one chisel bit is 2.9 kopecks (1.49c.) and one cross-bit 7.59 kopecks (3.91c.). For drilling, Russian steel, costing 2.50 rubles ($1.29) per pood (36 lb.), from the Zlatoust Government steel works is used. The tempering of the bits is done in a long wooden tank, 1 ft. deep and 1 ft. wide, with a grate permitting the bit to be immersed to a depth of ¾ in. The water inlet is at the bottom and the outlet ¾ in. above the grate; a small flow of fresh water is permitted.

I consider it impossible to get good results in machine drilling without machine sharpening. In an accompanying table are given the results of machine drilling at the Miasskaya and Lomanaya shafts during the month of June, 1914. The cost of mining at Lomanaya shaft in March was 9.91 kopecks per pood ($2.83 per ton), 249,277 poods being hoisted.

New Vertical Shaft Being Sunk

The company is sinking a new vertical shaft, Kapitalnaya, which should reach the Uklonnaya vein at the depth of 100 sagenes (700 ft.). The shaft has four compartments—two skipways, 4x5 ft. each; one ladderway, 3½x 5 ft., and one pump compartment, 4x5 ft. inside the timber. All compartments are arranged in one line, making the total dimensions of the shaft 17 ft. 6 in. by 5 ft., inside the timber, and 19 ft. 2 in. by 6 ft. 8 in., outside the timber. The shaft is timbered by 10x10-in. square timbers. Each set consists of two wall plates, 19 ft. 2 in. by 10 in. by 10 in.; two end plates, 6 ft. 8 in. by 10 in. by 10 in.; three 10x8-in. dividers, and 10 posts, 4 ft. 2 in. The hanging bolts are of 1⅛-in. best Taguil (Ural) iron, four bolts being used on each side-wall plate. The guides are of 6x5-in. section; 2-in. lagging is used on the walls outside the timber. Much care is paid to good wedging of the timber. This kind of timbering compared with old-type cribbing permits of much greater speed in sinking. The total cost of such timbering per square sagene is 145.22 rubles.

MACHINE-DRILLING RESULTS IN JUNE, 1914

	Miasskaya Shaft	Lomannaya Shaft
Piston drills E-24, C-24, C-110, A-86, shifts	91	556
Telescope-feed hammer drills BC-21, MC-32, DA-21, shifts......................	563½	15
Total vershoks drilled......................	58,564	61,011
Vershoks drilled per drill-shift	89.48	107.00
Vershoks drilled per man-shift	78.42	54
Holes drilled..................................	2,624	2,234
Average depth of holes, vershoks.........	22.32	27
Dull bits..	11,590	6,081
Dull bits per one arsheen* of hole........	3.16	1.6
Cost of air per drill-shift, rubles..........	2.48	3.37
Cost of operating one drill per shift, including labor..............................	4.08	6.71
Cost of drilling one vershok of hole, kopecks	5.69	6.27
Steel consumption, poods..................	19½	11¾
Cost of breaking one square sagene of the vein	61.32	74.85
Cost of drilling one vershok by hand, kopecks	8.46	9.02

*1 arsheen = 28 in.

All the ore from the mine is transported by teams to the mill one mile distant at the price of 60 kopecks per 100 poods. There are 12 chilean mills, running from 12 to 15 r.p.m., and each treating up to 1200 poods (20 tons) of ore in 24 hr. The mill treated 3,753,994 poods (70,000 tons) of ore during the first 11 months of 1913, with average recovery 5.73 zolotniks per 100 poods (0.424 oz. per ton) by amalgamation. The ore is in the main free milling and the extraction is 87%. The average contents of tailings for the period from Aug. 20 to Dec. 1, 1913, were 0.52 zolotnik of gold and 1 zolotnik of silver per 100 poods.

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*One ruble = $0.515. One kopeck = $0.00515.

The mine has good possibilities when the railroad line from Troitzk to Orsk is constructed; this line will pass about five miles from the mine and will connect it with collieries situated 140 versts to the north. Development of the collieries has already been commenced by a private company and a contract entered into for coal for the Russian Gold Exploration Co. This will reduce the cost of fuel by half; the present fuel at the mines is wood. Plans have been made for erecting a 1500-kw. central electric station, which will greatly reduce the power costs. With the completion of the railway, the mine will have the possibility of obtaining cheap outside labor, the local population not being sufficient.

Koyukuk Placer-Mining District

Special Correspondence

Wiseman, the principal town, is 633 miles up the Koyukuk River on the middle fork, 150 meridian and 67 parallel. The post office is called Nolan. Light-draft sternwheel boats make from three to five trips up the river during the summer as far as Bettles, which is 543 miles from Nulato at the junction of the river with the Yukon. From Bettles to Wiseman the freight and passenger business is handled on small scows drawn by horses. The freight rate on this haul is 7c. per lb.; so it is evident that all food and mining supplies are expensive. Owing to the long distance from civilization, only the hardiest men come here to prospect. The district has been self-supporting—that is, no one has brought any large amount of money to invest.

The present winter has been unusually mild—in fact, not cold enough to suit the operators, and a number were delayed in commencing operations due to the streams not freezing up until late. The coldest weather experienced up to Apr. 1 was 12° below zero, and that cold snap did not last more than a week. The snowfall has been heavy—about 2½ ft. on the level.

Points of Activity

The points of most activity this winter have been the following: The Hammond River, a stream which empties into the Koyukuk about four miles above Wiseman; Discovery claim, which is about 1½ miles from the river mouth, and No. 1 Above, which was located by "Fiddler" John, who first found pay in the deep channel. "Fiddler" John sold out to Plummer, Ellingston and Gilbert for a large sum of money, and two years ago left for the outside in a motorboat in the company of two men and one woman. One of the party killed and robbed "Fiddler" and the others. The present owners sank a new shaft this winter, but struck the rim. They put down an incline some 80 ft. to prospect the ground, but encountered water. It being so late in the season, they have quit until next fall, when a suitable pump will be put in.

Collins and Dow have pumped out an old shaft on No. 2 Above and intend trying out the gravel along the rims, which were formerly thought not rich enough to pay for handling. No. 3 Above is being worked by Kelly & Co. in good pay. Bedrock of the deep channel at this point is about 95 ft. deep and about 18 ft. wide. The ground is thawed and full of big boulders, which taxes a man's skill to handle, as the roof must be constantly timbered.

Vernon Watts is operating on the [illegible] of No. 3 Above. He tried to get three different shafts down during the early winter, but on account of mild weather the stream was not frozen enough and he had to give it up. He is now driving to the ground from an old shaft some distance below.

Ellingston and Smith are reworking the middle third of No. 4 Above, which last season produced a $2500 nugget. Their "pickups" during the past week have amounted to $7000. On this part of the river the operators figure the ground yields in the dump about twice the amount of the "pickups." The latter consist of nuggets from $5 up. They lie principally in the mud-filled cracks of the bedrock. The operators are taking up about 3 ft. of bedrock or to the clean bedrock. The largest nugget found this year was worth $252, figuring at $18 an ounce.

Holzer, Wilson and Ellingston are working the upper third of No. 4 and reworking part of the middle third, and have a considerable dump. They have found a $556 nugget. They are employing 16 men, the largest force on the river.

Bob Crawford owns and is working No. 5 Above, but the ground has not proved so rich as the claims below, since the gold is much finer. He was drowned out last month, but has secured a pump and is now endeavoring to unwater the workings. No. 6 Above is shallow ground and has never produced much. The ground above this has not shown pay.

Hammond River District

Hammond River above discovery has been famous for its coarse gold, but there are no paystreaks in the district. Gold is found in spots, such as under a big boulder, a crevice, or a boil-hole. One boil-hole on No. 2 Above, about the size of a barrel, yielded over $10,000. A crevice on No. 3 yielded $19,000.

From present indications Hammond River will produce this season something over $125,000, which will work out nearly all of the virgin frozen ground. On No. 1 Below, Corbett brothers are sinking an incline shaft to bedrock, but cannot complete the work this season. This lower Hammond River ground has live water on bedrock, and no one has large enough equipment or capital to undertake working the ground. Swift and Vermont Creeks, which are short, steep creeks emptying into Hammond, are shallow diggings and have been worked out.

Nolan Creek, which empties into the Wiseman, has produced a number of small fortunes during the last eight years, but was considered about worked out. It is showing up well this season. Benson & Co. sank a shaft on a small piece of virgin ground on No. 2 Below and have found good pay. Postlethwaite and Wool have found good pay on No. 4 Below. There are two other outfits working on No. 1 and No. 4. Henley and Hillberg are taking a dump out on Smith Creek, which empties into Nolan Creek.

Other Rivers and Creeks

Across the divide from Nolan Creek, about five miles away, two prospecting parties have been sinking on Glazier Creek, which empties into the north fork of Wild River. Some years ago Mascot and Washington Creeks, which are the headwaters of Glazier, produced considerable gold, and since that time every effort has been made to find pay in the main stream. Jim Stevenson and partners have just completed a hole to bedrock, 164 ft., but failed to find anything. Ness and Charlton, above them, sank 230 ft. and have not found anything. Glazier is a good-sized stream, and the location of "pay" would open up at least three miles of ground.

About 10 years ago there was a stampede into John and Wild Rivers, but the ground was not thoroughly prospected and nothing worth working was uncovered. Since that time a few men have been going into that country, and last fall Joe Matthews came out from Wild River with $5000 that he ground-sluiced on Jay "pup." This caused another renewal of interest in this part of the district. About 40 men spent the winter there, but as yet nothing has been found. As usual, there are many different opinions regarding the country. It seems probable that some good spots will be found on the small "pups" both on Wild and John Rivers, which run nearly parallel.

Jay empties into Rye Creek, and Rye into Flat Creek, which is a fork of Wild River. Several holes were started on Rye, but encountered water, and it will be necessary to get in boilers and pumps to prospect this ground.

One hole was sunk on Flat Creek. After getting down about 100 ft. in the gravel, they encountered clear ice, and went down 100 ft. in this, and worked a piece of pipe down 30 ft. more and quit without finding bedrock. Larson and Jensen own Nos. 1 and 2, Fred Swift owns No. 3 and A. Tobin owns No. 4, all on Jay "pup."

Nothing of interest has been found on John River, except that Bruno Keller and M. Camant have located some pay in shallow ground on Crevice Creek.

There are a few prospectors on Linda, Sheep, Marion, Minnie, Myrtle and Hackett Creeks. Marion deep channel has never been worked on account of live water on bedrock. There are several men shoveling in on Myrtle Creek each summer.

Pingle, Williams and Watts have good bench claims on Nolan Creek that they work each summer, but a limited water-supply handicaps their operations. Smith and two partners are hand-drilling the benches near the mouth of South Fork of the Koyukuk. The South Fork benches are extensive and if the drilling proves them up favorably, there undoubtedly will be considerable activity at this point next year. It is estimated there are about 250 men in this district, and all are hoping that some new diggings will be formed soon.

Production of Pyrites in 1914

The production of pyrites in the United States in 1914, according to W. C. Phalen of the U. S. Geological Survey, was 336,662 long tons. In 1913, the production was 341,338 tons. Virginia was the leading state both in production and in value. The output of this state diminished slightly in 1914, as compared with 1913. The output in California showed a slight gain, and there was a substantial gain in the production in New York, which, though ranking third in production, stands second in value. In Illinois, where pyrite is obtained as a byproduct in connection with coal mining, the output more than doubled that for 1913. In Indiana, where, as in Illinois and Ohio, pyrite is obtained in connection with coal mining, there was a slight increase. In Wisconsin, Ohio and Missouri there was a decreased production. In Georgia there was a slight increase.

The imports of pyrites for consumption in 1914 were 1,026,617 long tons, valued at $4,797,326. These figures show a marked increase compared with the imports of 1913, which were 850,592 tons.

Butte & Superior Copper Co.

The report of the Butte & Superior Copper Co., Ltd., for the first quarter of 1915 shows that 117,860 dry tons of ore were milled, the average content being 17.356% zinc and 7.95 oz. silver per ton. There was produced 70,634,000 lb. of zinc concentrates containing 52.9246% zinc and 22.6488 oz. silver per ton. The mill recovery of zinc in concentrates was 91.319%. Mining cost was $3 per ton, and milling cost, $1.8659 per ton, or a total cost of $4.8664 per ton.

The total net value of the production, including miscellaneous income, amounted to $2,011,510. The operating costs were $848,354, leaving a profit of $1,163,156. The profit is based on 7c. spelter for January and 8½c. spelter for February and March, or an average of 7.99c. The actual amount realized will probably be in excess of this estimate.

Mineral Production of British Guiana in 1914

According to U. S. Consular reports, summarized from official returns, the gold production of British Guiana was $1,106,783 in 1914, showing a decrease of $272,195, or 19.7%, from 1913. About one-sixth of the gold in 1914 was from dredge operations; the balance from placer washings. Quartz and hydraulic mining were at a standstill. By districts, 28,200 oz. were reported from the Cuyuni; 16,400 oz. from the Mazaruni; 14,800 oz. from the Potaro and 10,700 oz. from the Barima.

Notwithstanding the collapse in the diamond trade caused by the war, the exports of diamonds in 1914 were 9582 carats valued at $86,497, against 7217 carats valued at $66,781 in the previous year.

The deposits of bauxite on the Demarara River about Wismar have been investigated and found of importance. Several leases on these lands have been entered, and arrangements have been made to begin work at once, exporting the material to the United States.

Russians Set Oil Wells Afire

According to dispatches from Berlin, news from the Galacian front concerning the retreat of the Russians indicates that they fired twenty or more oil wells in the oil-producing region between Boryslaw and Drohobycz, lying to the west of Stry. Although the fires have been brought under control by the Austrian and German troops, the whole territory is covered with smoke. The blazes were extinguished by choking the wells with earth.

The Russians had been using the wells for the production of illuminating oil, benzine, and wax. They are said to have spared the English and French wells, but damaged the oil-carrying apparatus and railroad stations, and carried away tank cars. The Austro-German forces recaptured the mineral wax mines at Boryslaw, the only ones in Europe. Their annual product is valued at 3,000,000 crowns ($600,000).

Development Methods at Fairbanks

By Hubert I. Ellis*

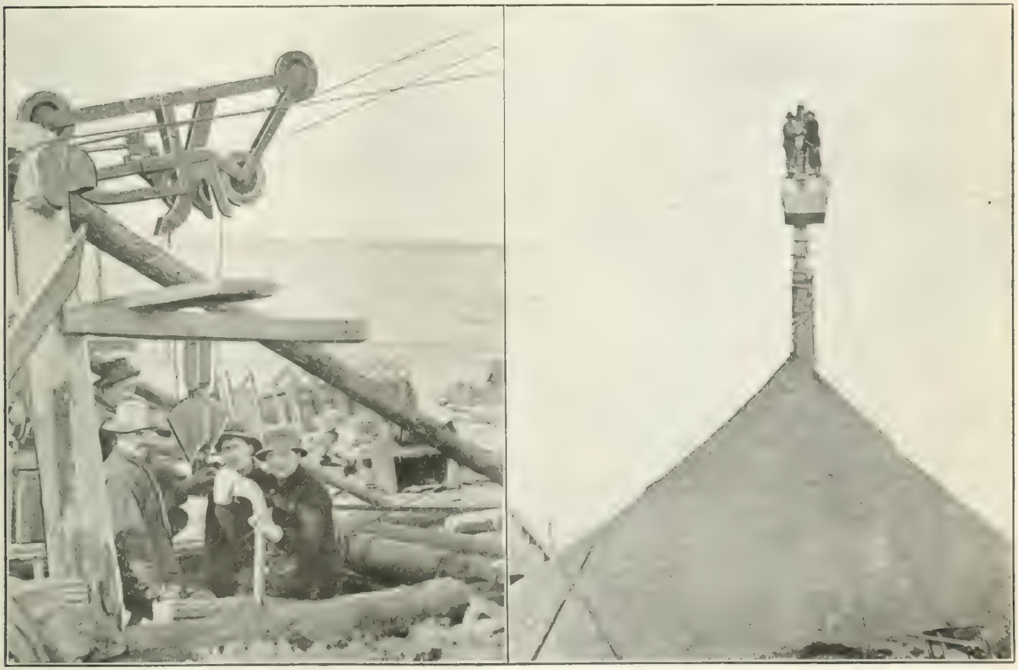
SYNOPSIS—Development methods differ for summer and winter work, material being sluiced as fast as extracted in the former case and stored for spring sluicing in the latter. Wide orebodies are developed by shaft and drifts in four directions. Timbering is usually required, sometimes to a large extent. All plants are erected as cheaply as possible, since the life of a deposit is short. Special hoisting and transportation methods and devices have been developed.

No two Fairbanks placer miners have exactly the same ideas as to the best methods for working a given block of ground. There are certain broad principles to which all must adhere, but each varies the details in accordance with his individual judgment. It is not feasible to describe all the variations in practice, or even such as I personally know, but it has been attempted in the present description to outline the practice that appears, from my own experience and observation, to be best and most representative. Other operators will find much to criticize, but this, far from being the last word on the subject, is intended to be only the first.

Two broad divisions may be made of placer mining at Fairbanks—summer mining and winter mining. In summer work the gravel is sluiced and the gold recovered as fast as it is removed from the mine; in winter mining the gravel is stored on the so-called "winter dumps" at the surface and sluiced as early as possible in the spring by means of water from melting snow. Hoppers are sometimes built and the gravel stored for several days or weeks in summer when the water supply is uncertain, but this is not the usual practice.

Summer mining may be further divided into drift mining and opencut work. Drifting in summer—the ground being prepared during winter by sinking the shaft, driving tunnels, installing machinery, erecting sluice-boxes, and doing other dead work—has contributed much the greater proportion of the $64,000,000 credited to the Fairbanks placer mines during the last 10 years. This method being the most important, as well as the most representative of the practice developed in the district, will be described first in its application to fairly wide paystreaks, say 60 ft. or more. Opening up or developing a mine for winter or for summer work is done in much the same way, except as to timbering, and the following description is characteristic of both, though strictly applicable only where the ground is being prepared for summer mining. Drift mining in narrow and irregular paystreaks as carried on in the Vault Creek portion of the district follows a different practice and will be described later.

In opening up a block of placer ground it is essential that the approximate location of the paystreak be known



Fairbanks Overhead Carrier and Bucket

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from previous prospecting or other work. The paystreak may be directly under the present creek, as at Discovery, Cleary Creek, or it may be a thousand feet or more away, as on Engineer Creek. The place of the paystreak being known, the first step in preparing a block for mining is choosing the site for the shaft. If the pay is more than 50 or 60 ft. wide, it is usually aimed to sink as nearly in the center as possible, to avoid moving the dirt underground farther than is necessary. With narrow paystreaks it is often better to sink on the lower side, or even in waste, to facilitate drainage, if, as sometimes happens, the bedrock is slightly higher under the pay than a few feet toward the creek.

The site for the shaft having been chosen, the next step is placing the boiler and hoist, and this involves the selection of the "plant." A mining outfit at Fairbanks is rated according to the nominal capacity of the boiler or boilers. A "50-horse plant" is therefore one that includes a 50-hp. boiler, hoist, cables, blocks, bucket, wheelbarrows, points, etc., in such number and such sizes as are best suited for use with a boiler of that capacity. Horizontal boilers are used exclusively for sizes larger than 10 hp., and these vary in capacity from 12 to 100 hp. The larger sizes are not popular, owing to the difficulty of moving over poor roads and owing to the fact that the use of two boilers with a combined rating equal to that of one larger boiler permits of one being cleaned while the other is in use. This is important when, as frequently happens, the feed water is muddy or otherwise impure; but it is a point that is often ignored, boilers sometimes being run for weeks or months on muddy water without other attention than "blowing-off" through the mud-valve two or three times a day.

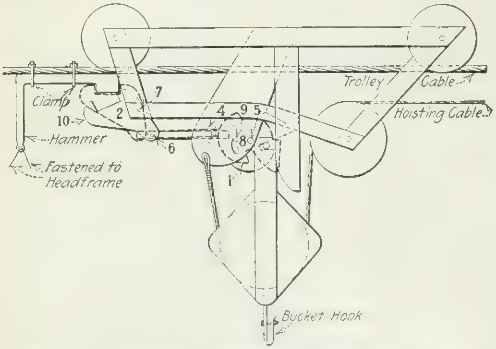


Fig. 1. Fairbanks Automatic Overhead Carrier

For sizes smaller than 30 hp. the Scotch marine type is usually preferred, but for larger sizes the Pennsylvania return-flue tubular is very popular. Some operators conserve their wood supply by covering their boilers with asbestos, which gives an increased efficiency of about 16%; but this has the disadvantage of leaving the boiler house prohibitively cold during winter and part of the sluicing season. It is probable that a stove could be used with profit to heat the building and dry the clothing of the miners, but this has not been tried. Since steam is used intermittently for hoisting, exhaust steam cannot be used to heat the building.

It is not uncommon for operators to equip their boilers with auxiliary injector, steam gage and water gage, so that in case of accident it will not be necessary for the engineer to stop hoisting to repair the damage.

Hoists of various makes and sizes are used, but the most popular is probably the American single-drum friction-type hoist with double horizontal cylinders, built by the American Hoist & Derrick Co., of St. Louis. These engines are roughly made, but they are light, strong and reliable, and will stand a great deal of abuse. Lidgerwood hoists are also much used. The size of the cylinder varies, the most common being 7x9 in., 7x10 and 5½x8 for those with double cylinders. Single-cylinder vertical engines are used by many operators, the 7x7-in. size being especially popular. Smaller hoists with both double and single cylinders are used at many small mines, and larger hoists with double cylinders and two or three drums find extensive application in opencut work.

Patent locked-coil cable, 1-in. diameter, is preferred for the trolley line, and ½- or ⅝-in. flexible steel cable, lang-lay, is used mostly for hoisting. Guys for the ginpole are often made from discarded hoisting cable, as is the trip line and the dumping cable.

Fairbanks Overhead Carrier

Aside from the steam point, the most important contribution of the North to the technology of mining is probably the overhead carrier, developed more or less independently at Fairbanks, Nome and Dawson. Fairbanks, being the younger of the three camps, had the advantage of starting where the others left off, and drift-mining methods are probably more advanced there than at the other camps. There is thus undoubted basis for the belief of the miners of Fairbanks that their particular carrier is the best. There are two makes, similar in principle but slightly different in construction, in use at Fairbanks, of which the more satisfactory is shown in Fig. 1.

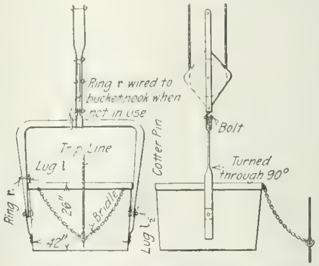


Fig. 2. Hoisting Bucket, Hook and Sheave

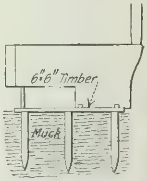


Fig. 4. Foundation for Boiler

When the bucket arrives at the top of the shaft, bolt 11 attached to the extended frame of the bucket sheave, shown in more detail in Fig. 2, is guided by the framework of the carrier against tumbler 1, which is in the position shown by the light dotted lines. The tumbler turns until it is stopped by bolt 9 in the cutout portion 8. The pull on the hoisting cable is then transferred directly to carrier and acts in the direction of the ginpole. The carrier is held in position only by 2, which hooks over the lug on the "hammer," as shown by the light broken lines. This pull, combined with the tension of the spring (not shown) and the unbalanced weight of the extra-heavy tip of 2, and with the jar of the bucket, as its upward motion is abruptly stopped, causes 2 to drop into the position shown by the heavy black lines. Bar 3, pivoted to 2, is forced forward by the rotation of 2 and, being held from moving up or down by bolts 4, prevents 1 from turning down and releasing the bucket. The bucket moves up the trolley cable, dumps as shown in Fig. 3, and returns by gravity to its position over the shaft. The point of 2 engages the hammer and throws 2 into the locked position, drawing back 3, which frees 1 and permits it to turn, dropping the bucket down the shaft.

The whole operation takes place in the space of a few seconds, as many as 60 buckets having been hoisted from a depth of 60 ft. and dumped in the space of 30 min.—an average of 30 sec. for a round trip, including the time of loading and dumping. At the same plant one engineer averaged more than a bucket a minute for 9 hr.

CARRIER BUCKET

The type of bucket used in connection with the Fairbanks carrier is illustrated in Figs. 2 and 3. They are made of sheet iron of different weights, to hold from 2 to 8 wheelbarrow loads of gravel. An 8-wheelbarrow bucket has a capacity of about 27 cu.ft. The best practice is to load only 7 wheelbarrows in an 8-wheelbarrow bucket, to avoid danger from rocks dropping off in case the bucket swings against the cribbing, as often happens with rapid hoisting. On the left side of the bucket will be noted a lug over which slides a ring on the bail, thus preventing the bucket from turning when men or tools are being raised or lowered. This ring, when not in use, is attached to the bucket hook by means of a small wire.

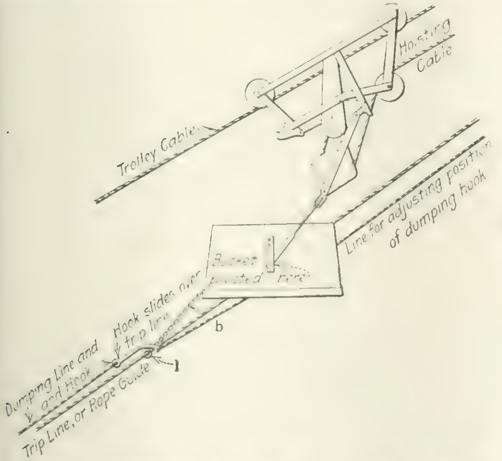

Hoisting Cable
Trolley Cable
Line for adjusting position of dumping hook
Bucket pivoted here
Hook slides over trip line
b
Dumping Line and Y and Hook
1
Trip Line, or Rope Guide

FIG. 3. POSITION OF BUCKET AND CARRIER WHEN DISCHARGING

Most operators, in timbered shafts of moderate depth, use a single-trip line and bridle as illustrated; but for deep shafts without timbers, where the bucket has more room to swing, double-trip lines and two bridles are used, one for each fore corner of the bucket. Fig. 3 shows the bucket in the act of dumping. The ring in the bridle engages some obstruction placed on the trip line, pulls the forward side of the bucket under, and spills the load. No strain from dumping comes on the trip line, the auxiliary dumping cable taking the entire load.

Since the surface is usually of muck, which thaws readily under pressure if a little heat is present, the matter of foundation for boiler and hoist is important. Long mudsills and cross-timbers are much used, but these may give trouble with heavy boilers. Short skids of sawed 6x6-in. timbers are usually bolted to lugs on the boiler, as shown in Fig. 4, and the rear end of the boiler is sometimes supported by placing lagging crosswise under them. Owing to the greater heat at the forward end of the boiler and the greater weight of the firebox and smokestack, the front end is more difficult to support. Probably the best way is to thaw vertical holes in the muck 6 or 8 ft. deep by means of steam points or plain pipe, and in these holes place posts on which rest the boiler skids, either directly, as shown in Fig. 4, or through the medium of cross-timbers placed on the posts. If this work is done during cold weather, or if the holes are deep enough, the thawed muck remaining in the holes around the posts soon freezes again and holds the posts as firmly as if they were planted in a bed of concrete.

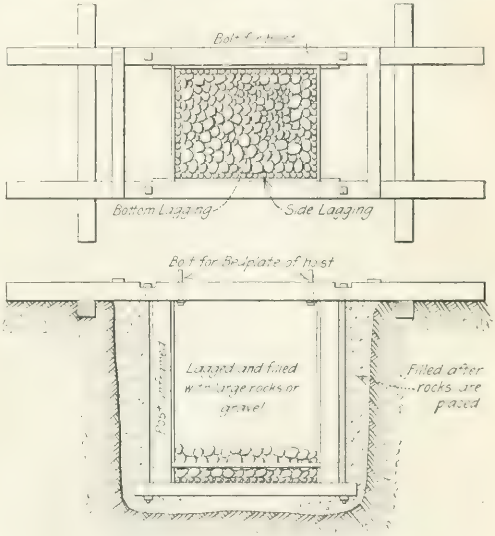

Bolt for base
Bottom Lagging
Side Lagging
Bolt for Bedplate of hoist
Post
Lagged and filled with large rocks or gravel
Filled after rocks are placed

FIG. 5. FOUNDATION FOR HOIST

Another method of supporting the boiler—particularly applicable to low places where there is considerable surface water—consists in placing two layers of long poles on the ground at right angles and one above the other, and covering these with several feet of gravel. The gravel soon packs so firmly that the whole mass acts as a unit, supporting the boiler without difficulty and absorbing much of the vibration of the hoist. In the infrequent cases where gravel comes clear to the surface, light skids under the boiler are all that is required.

HOIST FOUNDATIONS

The foundation for the hoist is usually obtained by sinking four posts in the muck as described above and bolting the hoist to heavy timbers placed on the posts and fastened to them by drift bolts. For small hoists, and where it is not desired to run at high speed a simpler foundation may be used, consisting of long timbers laid in trenches and tamped with gravel, with suitable cross-timbers. Another foundation is illustrated in Fig. 5. It consists essentially of a sort of box tied together with long bolts and filled with gravel to give weight and absorb the vibrations of the hoist. This support is particularly advantageous where gravel extends to the surface.

While considering the subject of power, it may be well to note that 4-ft. wood is used exclusively as fuel. There was formerly an abundant supply of birch and spruce on the hills in the mining area, but this has largely been exhausted, and in recent years it has become necessary to go farther and farther afield, with the result that wood now costs the operator from $7 to $15 a cord, depending on the situation of the mine with regard to the source of supply. The stumpage charged by the Government is at the rate of 25 cents a cord; cutting costs about $3.50 a cord; the rest is the cost of transportation. Seasoned 4-ft. split birch is the best wood, but 16-ft. spruce is more widely used. In cutting spruce the custom is to set fire to a patch of green timber when conditions are such that there is little danger of the fire spreading too far. This burns off most of the limbs and kills the tree without doing the trunk appreciable damage. The wood is cut into 16-ft. lengths after it has had time to season and is hauled over the snow to the mines, as much as five or six cords being taken at a single load. As a general rule, other things being equal, it is more economical for the operator to buy 4-ft. wood than to buy the 16-ft. length, even though there is a considerable difference in price, since the short wood piles more closely and has a smaller proportion of voids. It takes about four cords of 16-ft. wood to make three cords of the 4-ft. size.

A circular saw is an essential part of every plant, and is used for cutting wood, cribbing and for other purposes. The saw is placed outside the main building, but may have a shed roof for protection from rain and snow. It may be driven from the flywheel of the hoist if a vertical engine is used for hoisting, or from a separate vertical engine if the hoist cannot be used.

For the sake of sending tools to and from the surface and for general convenience, the boiler house is placed near the shaft, as shown in Fig. 6, which illustrates in a general way the layout of the entire surface plant. The blacksmith shop and work-bench are usually in the same room as the boiler and hoist, although this makes it difficult to keep the machinery clean.

The most important part of the boiler house, especially if it is intended for winter use, is the roof, since careless construction causes constant sweating in cold weather. To obviate this difficulty, tar paper is laid on a roof of 1x10-in. boards and battened down; or, more commonly, galvanized or painted corrugated iron is placed directly on the paper or on strips to hold it off the paper and thus give a more satisfactory air space. The rest of the boiler house is constructed as simply and as cheaply as possible, since it is rarely intended to be used more than one or two seasons before being torn down and removed to another site. Some operators make portions of the building, especially the sides, in sections that can be removed or replaced in a moment.

Ginpole and Headframe

The ginpole is placed at such distance from the shaft and in such situation as to leave ample room for dumping waste without interfering with other operations and to permit the sluice-boxes to be at sufficient elevation to provide room for the disposal of tailings. A simple and efficient method of raising a ginpole was described in a recent issue of *Power* and is illustrated in Fig. 7, which is self-explanatory. By hammering the foot-block with a heavy ram the pole can be shifted at any time in case the cable does not wind properly on the drum of the hoist. Fig. 6 shows the relation of guys and the trolley cable to the rest of the surface equipment. "Deadmen" for anchors may be prepared in the usual manner by digging trenches, or by thawing oblique holes in the muck and driving in posts, much as is done in making foundations for boilers and hoists. Stumps of trees are sometimes used for anchors, but these are unreliable, since the frost in the ground keeps the roots from penetrating deeply enough to get a firm hold. The headframe is simply made and is of the type shown in Fig. 8. It is not called on to bear heavy strains and is never a source of trouble.

The muck through which the shaft passes may be removed by picking, by blasting or by thawing. In blasting, the holes are usually thawed by steam, one being in each corner and one in the center. By using more holes the charge of powder may be correspondingly decreased. Since the muck is very brittle, a high explosive is used to give a shattering effect. If the shaft is to be timbered, as it must be if used in summer, the muck is often thawed by steam and the hole "squared up" to the proper size by picking. The gravel is always thawed by steam points and unthawed protuberances are removed by blasting or by means of warm water under a slight pressure from the boiler or from a siphon or injector.

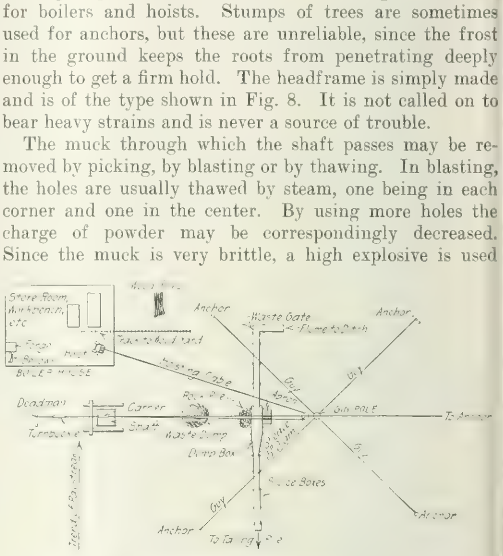


FIG. 6. LAYOUT OF SURFACE PLANT AT A TYPICAL FAIRBANKS PLACER MINE

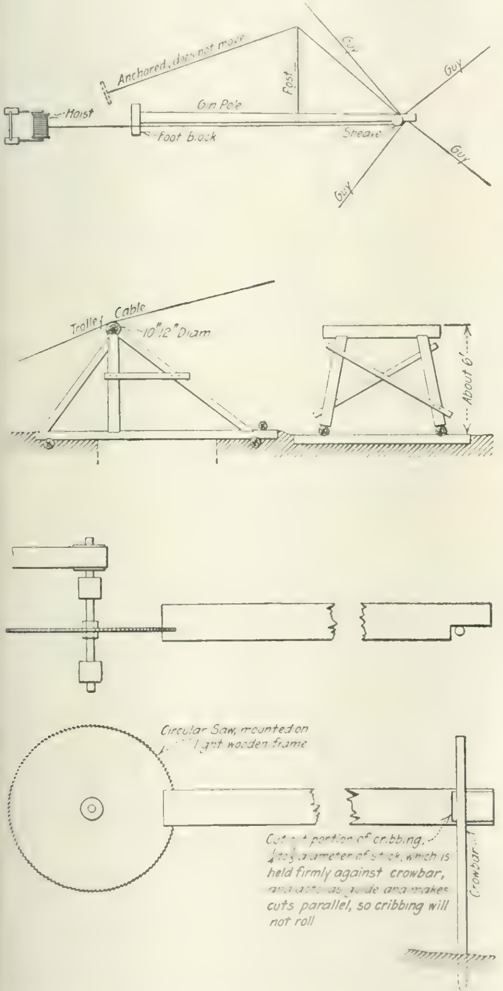
The usual practice is to sink the shaft to bedrock, cut the sump and the station, put in the square set, and then proceed with the rest of the development work. It is difficult and dangerous to timber a shaft at a temperature of 30° or 40° below zero, and there is absolutely no need for timber until spring comes, so shaft timbering is almost always left until warm weather permits the work being done more easily and in less time.

Most working shafts at Fairbanks are 6 to 7 ft. square in the clear, and all are timbered with round-pole cribbing 3 to 6 in. in diameter, cut from 16-ft. wood and notched by circular saw as shown in Fig. 9. A station set, or "square set," is shown in Fig. 10, together with the cribbing immediately above. The space between the timbers and the frozen gravel is filled with gravel, or moss may be used to advantage through the muck near the surface, either of which must be tamped firmly into place. In timbering a sort of cage, Fig. 11, is used at some mines.

The timbers are kept plumb by means of lines suspended in the corners. Timbering may be done from the bucket instead of from the cage, but the bucket is so much smaller than the shaft that it swings too freely, making the work disagreeable and dangerous.

CRIBBING THE SHAFT

With a gang of skilled workmen cribbing can be carried up very rapidly. In one case on Vault Creek, where the mine inspector ordered that the shaft be timbered or the mine closed, and where great haste was necessary on account of the coming of spring, 180 ft. of cribbing was placed in five days by five men. About 1500 pieces of cribbing were required. The manner of cutting the cribbing is illustrated in Fig. 9. The chief difficulty is in making the two longitudinal cuts on the ends parallel, and this is done by means of a vertical guide. One piece is cut out, as shown, the pole is reversed, and the other cut is made, the smooth face of the cut-out portion being held firmly against the guide. If there is sufficient room in the shaft to insert the cribbing without crowding, the "toe" is cut fairly long to prevent the ends sliding off each other in case the timbering "corkscrews."


Anchored, does not move
Guy
Post
Guy
Gin Pole
Hoist
Foot Block
Sheave
Guy
Guy
Trolley
Cable
10"-12" Diam
About 6'
Circular Saw, mounted on light wooden frame
Cut-out portion of cribbing, ¼ to ⅓ diameter of stick, which is held firmly against crowbar, and acts as guide and makes cuts parallel, so cribbing will not roll
Crowbar

FIGS. 7, 8 AND 9. METHOD OF RAISING GINPOLE. FAIRBANKS TYPE OF HEADFRAME. CUTTING CRIBBING WITH CIRCULAR SAW

Muck is easily held, owing to the slowness with which it thaws; but gravel is the bugbear of the shaft timberman. It thaws readily for a variable distance from the shaft and when thawed occupies appreciably less space than when frozen. Consequently it settles, and the filling, no matter how firmly it is tamped, also settles, especially if there is a little water seeping down from the surface. Since the cribbing is held in place only by the surrounding gravel, it also tends to shift, more or less unevenly, the consequence of which is that the shaft takes on a corkscrew aspect, and the individual poles, if small, are likely to ride over each other, or "jack-knife." Anchors can be used in muck to hold the timbers in place, but these are worse than useless in gravel, since the anchor notches are soon included in the thawed area and settle with the rest. The anchors, being longer than the other timbers, do not settle evenly with them and thus aggravate the tendency of the shaft to get out of line. In a shaft passing through 60 or 70 ft. of gravel the top cribbing may settle several feet in a month or two on the coming of warm weather, in which case more cribbing is added from time to time to keep the top level with the surface.

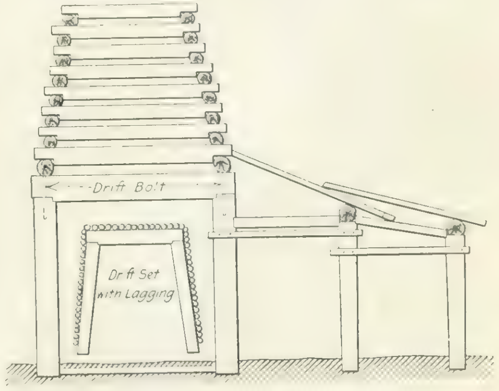


FIG. 10. STATION TIMBERING

Cribbing larger than 6 in. in diameter or smaller than 3 in. is rarely used. The direct pressure is comparatively insignificant, no instance being known to the writer where the shaft caved because of the breaking of sound timbers. Small poles, owing to the smaller hold they take on each other, corkscrew and jack-knife much more readily than large poles, and are not used where there is a good supply of the larger sizes. In general, since it is rarely desired to work from one shaft more than a year or two, it may be said that where proper precautions are taken little trouble is experienced with this part of the mine.

Steam line and water line are carried in one corner of the shaft and the bell cord in another. The steam line is usually inclosed in a box or is wrapped with some insulating material to avoid loss from condensation and to avoid unnecessary thawing of the gravel around the shaft. The size of the steam line varies, but is usually 1 in. or 1¼ in. The smaller sizes are to be preferred where they are capable of delivering all the steam required, since their smaller area gives less loss from condensation. Some shafts are equipped with ladders, which invariably run directly to the surface without intermediate platforms; but these are a nuisance except where there is only one night man, whose duty is to fire the boiler and regulate the points, necessitating occasional trips underground. There is always danger when hoisting is in progress that the swinging of the bucket will knock someone off the ladder or that a rock will become dislodged from the bucket or from the cribbing, so in many shafts no ladders are found. Even in traveling back and forth in the bucket great care is exercised, the laborers being cautioned to bend forward over the bail and never to look up, so that if they are struck by falling rocks they will stay in the bucket.

Working the Paystreak

If the paystreak is very wide, say 150 ft. or more, tunnels are usually driven in four directions from the shaft (see *a*, Fig. 12). The usual practice, however, is to drive upstream and downstream, possibly driving incidental prospect tunnels at right angles to the trend of the paystreak, as shown at *b*. The latter method, for the sake of simplicity, will be described in detail.

The length of paystreak to be worked from a single shaft is rarely more than 400 ft.—200 ft. each way from the shaft. If mining is carried on at a greater distance from the shaft the item of underground transportation raises mining costs to such a figure that it is cheaper to sink a new shaft and move the surface equipment. This is true whether cars or wheelbarrows are used. With wheelbarrows each shoveler runs out his own dirt. If working 200 ft. along the tunnel from the shaft he has about a 250-ft. trip from the face, or 500 ft. a round trip. If handling 100 wheelbarrows a day (and at many mines the duty is from 120 to 150), he must trundle his barrow 50,000 ft. a day, or nearly 10 miles, besides picking and shoveling the gravel. If cars are used it takes so long to make a trip that the shovelers often have to wait on the carman.

Bedrock grade is another factor that militates against long tunnels, especially downstream. It is aimed to sink the sump at the shaft deep enough to drain all the workings by gravity, a small duplex pump being used intermittently to raise the water to the surface. The tunnels must, therefore, have sufficient grade to carry the water from the face. With bedrock falling and the tunnel bottom rising, there is obviously a limit to the practicable length of tunnel possible without making the sump so deep and starting the drifts so low in bedrock as to greatly interfere with working the ground adjacent to the shaft. Tunnels have been driven long distances entirely in bedrock, but this has the grave disadvantage of failing to prospect the ground, and several failures have resulted from getting off an irregular paystreak or running into an unsuspected low-grade area.

Some operators drive large tunnels and put in heavy timbers as they proceed; others drive small tunnels and use small timbers and just as few of them as possible. With ground that holds up well it is possible to get along with little timber, but where each rock drops from the roof as it thaws, or the gravel thaws a few inches and then comes down in bunches, timbers are necessary for efficient work.

Timbering in the Drifts

Three-piece sets are used to timber drifts and mudsills are added where bedrock is too soft and mushy to give good footing for the posts. Sprags or spreaders are also sometimes placed between the bottoms of the posts to prevent crowding inward from lateral pressure. The timbers are not required to be of great size, since they have to bear the weight only of such gravel as thaws around the tunnel from the heat of the steam line and the escaped steam from thawing operations. Round timbers 6 to 15 in. in diameter are used, the medium sizes finding the widest application. Sets are placed 5 to 8 ft. apart and lagged with round poles of 2 to 5 in. diameter. The size of drift varies, but 4x6½ ft. in the clear is probably a fair average. Details are shown in Fig. 10. Swelling bedrock, which gave considerable trouble in portions of the Dawson district, is rarely found at Fairbanks, owing to the permanently frozen condition of bedrock and gravel. Where mining is attempted in thawed ground, however, it is likely to cause much difficulty.

In driving tunnels for immediate timbering from two to four steam points are used, and sufficient gravel is

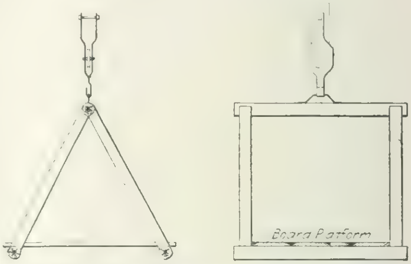


Fig. 11. Cage Used in Timbering Shaft

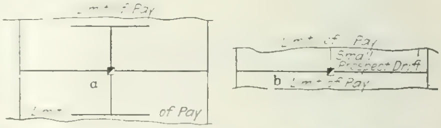


Fig. 12. Tunnels Driven to Open Wide and Narrow Paystreaks

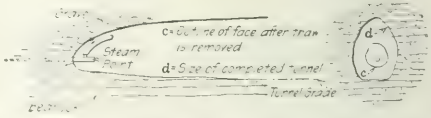

c= Outline of face after thaw is removed
Steam Point
d= Size of completed tunnel
d
c
Tunnel Grade

Fig. 13-a. Driving Tunnel with Single Steam Point

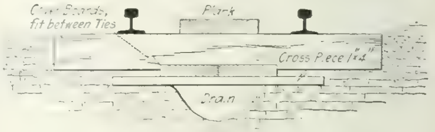


Fig. 13-b. Drain under Car Track

thawed to insert the timbers at once. A more economical method, where conditions will permit its application, is that used by E. M. Keys, the Chatanika operator. One 8-ft. point is driven near the top of bedrock, where driving is easiest, and steam is turned on for 10 hr. or more, depending on the character of the gravel and the readiness with which it thaws. When the thawed gravel is removed this leaves a round bore just large enough for a man to work in, say 3½ ft. in diameter at the forward and smaller end. The thawed material having been removed, the point is driven into the new face and steam is turned on. The hot water draining away from the face thaws the bottom of the preceding section and enough steam escapes, especially in driving, to thaw some of the roof. This is removed, or as much of it as desired, before the new thaw is taken out. By such successive enlargements the tunnel may be increased to any size, but it is usually kept as small as possible and the roof arched to obviate the need of timbers. The method is illustrated in Fig. 13. The drift is run with uneven grade, the idea being to get to the end as soon as possible. One man, with an assistant to wheel away the gravel, makes an advance of 8 ft. per day, driving his point for the next thaw and shoveling the gravel into the wheelbarrow. Tunnels are usually driven in four directions from the shaft at Chatanika, where the method is used most, and one wheeler is thus enabled to serve several shovelers. After the tunnel has been driven and the grade of bedrock accurately determined, bedrock is taken up where necessary and the tunnel made of even grade throughout its length, resistant hummocks being removed by blasting. A few sets of timbers are placed next the shaft and at such other points as needed.

Transportation Problems

Drifts made in this manner are just large enough for the cars, it being necessary in many cases for one desiring to pass a car to climb over it. While this is a very cheap and economical method where the gravel stands well enough to make its use possible, it is inapplicable to most of the ground of the Fairbanks district, since the gravel usually falls from the roof as fast as it thaws, cluttering up the track or wheeling plank and rendering timber necessary. When used great care is essential in driving points and in thawing to prevent the escape of more steam than is absolutely necessary.

Some operators dig a small ditch for drainage at the side of the wheeling plank or car track, as the case may be, but this has a fatal tendency to become clogged periodically, and the better practice is to put a covered drain under the runway, as illustrated in Fig. 13*a*. Short cover boards that will fit between the ties are used. They can thus be taken up and the ditch cleaned out without disturbing the track.

The main tunnels having been driven along the center of the paystreak, crosscuts or lateral drifts are turned off at the ends and run to the limits of the pay. The procedure is much the same as outlined above, but the drifts are made smaller and are not timbered. They serve as the starting point for stoping, which is carried toward the shaft from both directions in order that the laborers may never have to work under the unsupported roof.

The problem of transportation must be given due consideration in opening up a block of ground. There are three possible methods of moving the material from the face to the shaft—by wheelbarrow, by car, or by the use of both. Wheelbarrows were formerly used entirely, but they have now been replaced at the larger mines by cars. The use of wheelbarrows permits a more flexible system, requires less capital outlay and less expense for development, and is still popular at many of the smaller mines where paystreaks are narrow and irregular and the pay uncertain. In preparing for wheeling, the tunnels may be driven smaller than when intended for cars, and are driven about as deep in bedrock as pay extends. Two-inch planks, 10 or 12 in. wide, are used for the "runways", and owing to the grinding of small rocks on these under the wheels they wear out rapidly and require frequent replacing.

Where cars are used it is necessary to drive the main tunnels with fairly even grade and to avoid sharp turns. Right angle turns are necessary in going from the tunnels into the crosscuts, and heavy sheet-iron turnplates are placed there. The carmen become so skillful that they make these turns on the run without a second's delay.

When cars are used in conjunction with wheelbarrows the gravel is shoveled into the latter at the face, wheeled to the main tunnel and dumped into the waiting car. The main tunnels must be deeper in bedrock than the crosscuts to permit dumping without wheeling up a steep grade.

Which one of the last two systems—cars alone or wheelbarrows with cars—is to be preferred depends largely on the character of the bedrock surface and the notions of the operator; frequently both are used at different faces in the same mine. It is usually considered best to shovel directly into the cars, but where bedrock rises rapidly upstream this may not be possible without giving the tunnel a prohibitive grade. Similarly, bedrock may fall so rapidly downstream that it is not feasible to dump the wheelbarrows into the cars without driving that portion of the tunnel next the shaft too deep in bedrock for economical handling of the upstream gravel and of that next the shaft.

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Fuller's Earth Production in 1914

The production of fuller's earth in the United States in 1914 amounted to 40,981 tons, an increase of 2387 tons over 1913, while imports increased by 6349 tons. Florida produces about 75% of the American output, according to the U. S. Geological Survey.

Fuller's earth is used in this country principally in bleaching, clarifying or filtering fats, greases and oils; it is not now much employed for fulling cloth, the use from which it obtained its name. It is also used in the manufacture of pigments for printing wall papers, for the detection of certain coloring matters in some food products, and as a substitute for talcum powder. The common practice with mineral oils is to dry the earth carefully, after which it is ground to suitable sizes and run into long cylinders, through which the crude mineral oils are allowed to percolate slowly. As a result, the oil that first comes out is perfectly water white and much thinner than that which follows. The oil is allowed to continue percolating through the earth until the color reaches a certain maximum shade.

With the vegetable oils the process is radically different. The oil is heated in large tanks beyond the boiling point of water; from 5 to 10 per cent. of its weight of fuller's earth is then added; and the mixture is vigorously stirred and then filtered off through bag filters. The coloring matter remains with the earth, the filtered oil being of a pale straw color.

Lawsuit Revives Recollections of Romantic Mining Enterprise in the Butte Camp

BUTTE CORRESPONDENCE

The intensely prosaic methods with which stupendous enterprises were launched in the Butte camp almost every day without arousing so much as a ripple of admiration or astonishment among the natives were pleasantly interrupted one day by the appearance in the Butte field of one Captain O'Hara from the Emerald Isles. A picturesque character was O'Hara, and he took it into his head to instill into the matter-of-fact methods of the Butte camp some of the romance of the past and to turn into a regular gala day the launching of an enterprise of his own. This was nothing less than the starting of a huge gold dredge which was to dig fabulous wealth out of thousands of acres of placer ground, situated near Rocker in the western section of the Butte district. O'Hara had acquired this with the aid of British capital that flowed freely into his hands upon the assurance that, Midas-like, whatever he touched he would turn into gold.

Invitations were issued to all the notables of the state and the country at large to witness the starting of the dredge. The general public was also invited. Stockholders and others who had no interest beyond a natural curiosity flocked to Rocker on a special train to see the thing go. The then governor, Edwin Norris, came over from Helena to make a speech from the captain's bridge of the dredge. The promoter's stenographer—later his wife—broke a bottle of champagne over the stately head of the dredge to the strains of a brass band which was engaged to bring joy and gladness to the hearts of all those present. Then there was lunch, and as the sun sank behind the distant hills everything had assumed a golden hue and those less familiar with Butte's ore deposits were lulled by the magnificence of the occasion into dreams of another Klondike at the very doors of Butte.

Then came disaster, and then the sheriff. A week or two of dredging operations failed to disclose the presence of placer gold. The huge buckets of the dredge, one by one poured forth upon the gold tables mud and water with ceaseless regularity, but never a glimmer of gold. It was discouraging. For there was no market for mud or water. The operations were discontinued and O'Hara with his bride betook himself to more promising fields of operation.

For years the huge dredge which was installed at a cost of more than $50,000 stood on the same spot on which it was baptized, a monument of folly. On Feb. 13—note the ominous number—of the year 1915 a judgment for $7500 was issued against the British-Butte Company, owner of the dredge. As the judgment was not satisfied, the dredge was ordered sold at sheriff's sale 10 days later. At this sale Deputy County Attorney Melzner of Silver Bow County bid $1000 for the dredge and got it. Then W. E. Ward, the representative of the British-Butte Company, came rushing to Butte on a 5000-mile trip from South America to dismantle the dredge with the apparent intention of selling it for scrap material. Thereupon Melzner, the present dredge-master, applied to the courts for an order to restrain Ward and his cohorts from tearing the dredge to pieces. The injunction was granted May 19, under which Ward is temporarily prevented from interfering with the property until a hearing is had on the question of a permanent injunction.

Thus the famous gold-digger who was ushered under such glorious auspices into the everyday routine life of the Butte camp has at last turned into a sordid trouble-digger, the end of which is not yet, as both parties to the contention are determined to fight to the bitter end for the possession of the beloved dredge—or what is left of it.

Status of French Metallurgical Companies

The status of the large French metallurgical companies is thus summed up in *Commerce Reports,* May 18, 1915: The great Schneider Works (Creusot), one of the largest manufacturers of artillery in the world, has all of its various establishments, except its iron-ore mine in the Meurthe et Moselle, in full operation. The Société de la Basse Loire at Trignac is well provided with orders for steel for war purposes and for rails for the railway companies. La Société Metallurgique de l'Ariège, which owns plants for making shells, only slackened up a few days after the mobilization and is now running at full capacity.

The Hauts Fourneaux de Caen is somewhat handicapped by the delay in the erection of its new furnaces caused by the lack of labor and building materials. La Société Française des Metaux, the Trefileries du Havre, and L'Electro Metallurgique de Dives are all in full operation. In addition to those cited in the foregoing, other steel and iron plants in the south and center of France are working at their full capacity, almost exclusively on orders from the government.

Portland Cement Production in 1914

The production of portland cement in the United States in 1914 was 88,230,170 bbl., as compared with 92,097,131 bbl. in 1913, according to advance figures furnished by the U. S. Geological Survey. Shipments were 86,437,956 bbl. in 1914 and 88,689,377 bbl. in 1913, so that stocks on hand increased during 1914 from 11,220,328 to 12,893,863 bbl., while the average yearly price fell from $1.005 to $0.927. Of the total production, 24,614,933 bbl. were made in the Lehigh district and 11,532,605 bbl. in Illinois and northwestern Indiana.

The Metcalf Incline

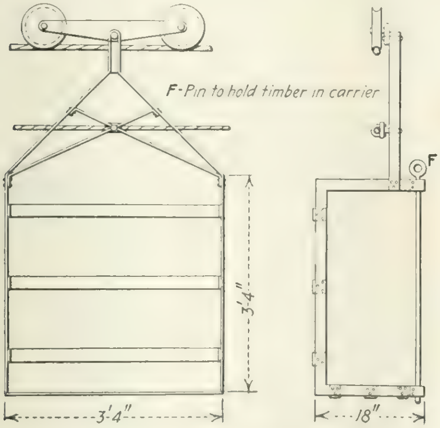
In "Photographs from the Field" in the JOURNAL of Apr. 10, 1915, p. 633, we published what was erroneously described as a view of the Arizona Copper Mining Co.'s incline at Metcalf. It was, in fact, one of the old Shannon inclines at the same place. In order to give an entirely clear record, illustrations are given in this week's "Photographs from the Field" of the Arizona Copper company's inclines at the same point.

Details of Practical Mining

Timber Carriers for Aerial Tram

By Frederick W. Foote*

When the original carriers on a 4-mile double-rope type gravity aërial tram had to be replaced new carriers as shown in the accompanying sketch were fabricated in the mine shops. The carriage and wheels were the same as those used for the tram buckets. The framework was built up of 3/8x2½-in. strap iron, bent and riveted together as shown. The pins *F* are removable and used to keep the timber from falling out. Other things, such as barrels, etc., are lashed in with a lash rope. These carriers face toward the outside, so that they may be loaded and unloaded with the greatest facility. In loading timber and rails care must be taken to lash only at one point in the middle of each carrier, so that when mounting the cable to pass a tower the load can pivot and thus overcome the vertical displacement. Should the timber be lashed at both ends of the carrier the lever action is such that the traction wheels are lifted off the traction cable on passing a tower, and much trouble is caused thereby, sometimes even pulling down the tower over which the load is passing.



Timber Carrier for Aërial Tram

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The Negative Wire

It is often desirable to know which is the positive and which is the negative wire in an electrical circuit when no instruments are at hand to make the test. A simple method, given in *Power*, June 1, is to put the ends of the wires into a cup of water containing a little salt, acid or sal-ammoniac. The wire around which the most bubbles are seen is the negative.

Efficiencies of Mine Pumps

By P. E. Barbour

The development of the multistage centrifugal pump has put a new competitor into the field of mine pumping and has in a way complicated the problem of choosing a pump for that particular kind of a service. When reciprocating pumps only were used there was little chance for argument, except as to the relative merits of similar pumps. The centrifugal pump underground requires a motor, and this means bringing power into the mine by electrical conductors instead of by steampipe. Consequently, when comparing the efficiencies of the units to be installed, one should always consider the over-all, or wire to water efficiency. This, of course, is less than the mechanical efficiency of the pump itself, and its consideration emphasizes a fact which was not often enough given serious thought before this particular phase of the question made it so prominent a consideration.

Air-Lifts

The air-lift pump is often advocated for mine use because of its extreme simplicity, and having in mind the many difficulties always incident to operating underground pumps, it is said of the air-lift that all you have to do is to stick the pipe in the water and turn on air and you will get water delivered. This statement is correct, *if* the pipes are properly proportioned, *if* the air jet is sufficiently broken up at the point of delivery and *if* the submergence is in proper proportion. On account of the fact that the length of pipe submerged has to be such a large proportion of the total length of the lift, the use of this pump is precluded for unwatering a shaft to the bottom, except under most extraordinary conditions which can rarely be attained except at disproportionate cost and inconvenience.

Under anything like ordinary good conditions, the air-lift never achieves a greater mechanical efficiency than about 40%, and no mechanically operated pump of decent construction falls so low as this.

In the table is given the efficiency of an air-lift pump, *A*, under actual test, and under unusually favorable conditions, as to submergence, head and quantities handled. At a submergence of 75% this pump reaches its maximum efficiency of 37.7%. If we multiply this by 0.80, a fair average value for the efficiency of the air compressor, we get an ultimate over-all efficiency for this air-lift of 30.16%.

Except under most unusual conditions, the air-lift should never be considered as a part of a permanent installation in mine pumping.

The Cornish Pump

The Cornish pump is a very efficient pump when properly installed, but when improperly installed is a source of very great trouble, inconvenience and expense for maintenance. This type of pump is not so popular as formerly and is ordinarily not a competitor with reciprocating and centrifugal pumps. The Cornish pump *C* in the table was described in the JOURNAL of May 15, 1915, p. 858.

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*University, Va.

RECIPROCATING PUMPS

A standard type of reciprocating pump will generally have a higher mechanical and over-all efficiency than a centrifugal pump when used against the heads usual in mine practice. In the table, *D* and *E* show this type of pump by two different manufacturers. The guaranteed efficiency of pump *D*, 90 to 92%, is high, but it represents a specialized type of pump. However, to attain this high degree of pumping efficiency involves construction including a considerable number of valves, etc., and it is probable that the maintenance cost of this pump, especially on mine water, which is rarely clear and free from grit, would be a very considerable factor. The pump *E* was a guaranteed pump and was an actual proposition made for the drainage of a Utah mine, and it is interesting to note that after due consideration was given to all details a multistage centrifugal pump was installed instead of a reciprocating type.

CENTRIFUGAL PUMP

Pump *B* is mentioned in the table to show the high efficiency of the single-stage centrifugal pump operating under the favorable conditions for which it was originally designed—large volume and low head. This pump was used on an irrigation scheme, and was driven by a direct-connected, horizontal, cross-compound, four-valve steam engine.

PUMP EFFICIENCIES

	Efficiency in Per Cent Pump Alone	Efficiency in Per Cent Over-all	Capacity in Gal per Min.	Head in Feet	Remark
A Air lift (City Wells, Hattiesburg, Miss.) (a)	37.7	30.16	1,100	37	Test
B Single-stage centrifugal (Mont Belvieu, Tex.) (b)	87.8	80.79	15,760	43	Test
C Cornish (Chapin, Minn.) (c)		88.6	1,922	1513	Test
D Plunger (Epping-Carpenter) (d)	90–92	80.1	1,000	800	Guarantee
E Plunger (Cent.-Eureka) (e)	80.0	70.6	500	1690	Guarantee
F Multistage centrifugal (Cent.-Eureka) (e)	65.0	58.7	500	1680	Guarantee
G Multistage centrifugal (Cent.-Eureka) (e)	72.[illegible]	64.0	1,000	1680	Guarantee
H Multistage Centrifugal (Roodepoort, Transvaal) (f)	62.0	57.0	375	2490	Guarantee
I Multistage centrifugal (Roodepoort, Transvaal) (f)	65.0	59.8	449	2520	Test
J Multistage centrifugal (Roodepoort, Transvaal) (f)	63.4	58.3	406.5	2549	Test
K Multistage centrifugal (Chapin, Minn.) (c)		72.0	3,000	965	Test

(a) Ivens' Pumping by Compressed Air
(b) Engineering News, Apr. 1, 1915, p. 648.
(c) Engineering and Mining Journal., May 15, 1915, p. 858
(d) Coal Age, May 1, 1915, p. 763.
(e) Engineering and Mining Journal, May 9, 1914, p. 957
(f) Journal of South African Institute of Engineers, Jan., 1915

The pumps *H*, *I* and *J* are centrifugals operating satisfactorily in the Roodepoort mine in the Transvaal, *H* being the builder's guarantee and *I* and *J* the actual pumps furnished. When the installation of these pumps was considered the advantages and disadvantages of both reciprocating and centrifugal pumps were carefully compared. And it was decided that although the efficiency of the reciprocating pump was greater than that of the centrifugal under the circumstances, the cost of installation and, more particularly, the cost of maintenance were so much in favor of the centrifugal that that type was installed. After a year's operation, comparisons of operating and maintenance costs with both centrifugal and reciprocating pumps in the same mine showed that the judgment was justified and the advantages in this case were actually in favor of the centrifugal pump.

Pump *K* is a multistage centrifugal pump at the Chapin mine in Minnesota and was described in the JOURNAL of May 15, p. 857.

In the table, pumps *F* to *J* inclusive are multistage centrifugal pumps of foreign manufacture, while pump *K* is a United States pump. It will be noted that the efficiency of the home product is considerably higher than that of the foreign-made pumps, but it is only fair to call attention also to the fact that it is a much larger pump in the first place and that secondly it is operating under a much less head than any of the others.

For conditions to which the centrifugal pump is adapted it is probable that its efficiency will be nearly as high as that of the displacement pump for the same condition and its maintenance cost will be considerably less.

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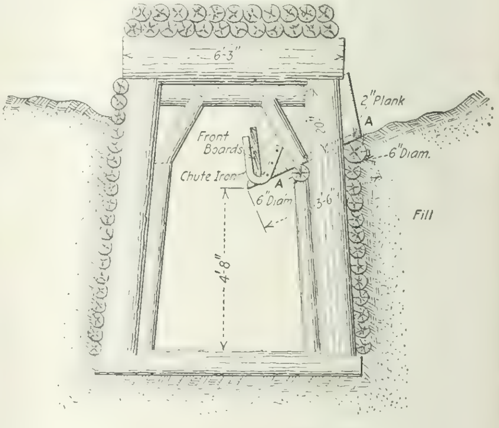
A Simple, Strong Chute

BY H. H. HODGKINSON*

The chute here described is substantial, capable of ready removal and easily operated. The drift sets are placed so that they are alternately 3 ft. and 4 ft. apart center to center. The chutes are constructed on alternate sides in the spaces between the sets, which are 4 ft. apart. This facilitates the removal of the muck from the stope above and gives much more space in the set timbers in operating the chutes.



A SIMPLE, STRONG CHUTE

The chutes are constructed of 2-in. planks, which are held in place by ½x4-in. lagscrews. The cross-pieces *A A* are fastened to the posts by ½x8-in. lagscrews. The use of lagscrews instead of spikes permits the removal of the chutes without damage and the recovery of the lagscrews themselves.

The front boards are of 2-in. planks about 5 ft. long, although the chute is only 30 in. wide inside. These boards are held by chute irons, which are made of ⅝x2-in. straps bent in the shape shown, bolted to the side planks by means of ½x3-in. machine bolts and fastened by ½x½-in. lagscrews to the bottom planks.

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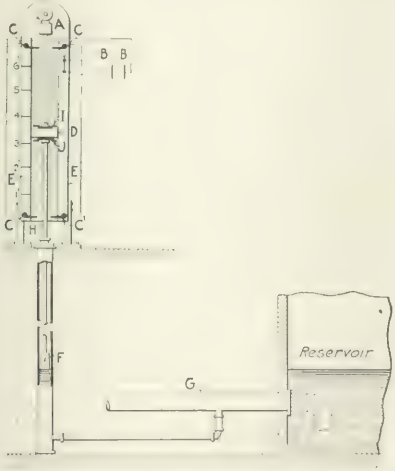
*Mining engineer, Franklin Furnace, N. J.

Lagging is placed behind the set timbers as shown, and behind this the fill is placed to a height of 7½ ft., but sloping down toward the chutes at about the same angle as the chute bottoms. Fill or waste supports the sets better than the ore, since it packs tighter and is much lighter to handle.

Water-Tank Indicating Gage

For installations where the tank is situated on about the same level as the observer, the indicating gage described by Thomas K. Lee* in *Power,* June 1, has given satisfaction.

On a 1x6-in. board, the length of which corresponds to the depth of the reservoir, fasten two pieces of 2-in. maple flooring *E* with their grooves facing each other. A block *D*, to slide freely in the grooves, is fastened to a light rod *H*, and on the end of this rod is a float *F*. A 3-in. pipe is used for the float to work in, and this extends down to the level of the bottom of the reservoir. A ½-in. pipe connects the 3-in. pipe to the suction pipe *G* (or to the bottom of the reservoir itself) and maintains the same water level in the 3-in. pipe as that in the reservoir. To the block *D* are fastened springs *I* and *J*, and to the top and bottom of the board are fastened contacts *C* and *C'*. At the top a bell is placed connected to batteries *B*. The gage is graduated in feet and inches and is so marked that the reading corresponds with the height of water in the reservoir.



Indicator and Alarm

When the reservoir is full, the spring *I* on the block makes contact with *C* at the top, completing the circuit and ringing the bell, and at the bottom a similar contact is made when the water is low. The wiring is concealed behind the gage board, and a switch can be used to cut out the bell.

The gage is located in the most convenient place and wired so that the bell may be placed where the operators are most likely to hear it.

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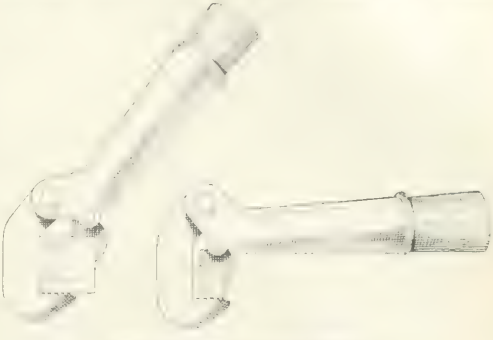
*Benson, Minn.

Dumping Hopper Cars

The dumping of hopper cars [illegible] and smelters is not infrequently accompanied by some danger and is usually accompanied by considerable trouble and discomfort. A new wrench for operating the dumping doors of these hopper cars has been put on the market by the [illegible] Adamson Manufacturing Co., of [illegible], Ill. [illegible] offers many advantages over the old type generally used and removes some of the danger coincident with this job. This wrench, as shown in the illustration, protects the operator by its instantaneous self-releasing action when the door falls. The jaws are so constructed that the harder the pull on the lever the tighter is the grip on the squared end of the shaft. It would seem as though this wrench had a fertile field in the mining and smelting industry.

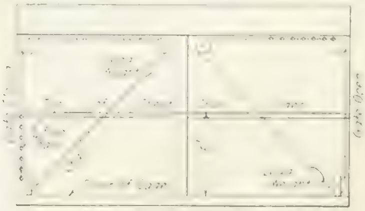


Self-Adjusting Car Wrench

Sliding Chain Gates on a Cage

By F. H. Armstrong*

For a safe yet easily handled gate for a cage, bars of ¾-in. pipe fastened to two chains are used. The chains run over pulleys set at the corners of a triangle, as shown in the accompanying drawing. On the hypotenuse of the triangle is a lead counterbalance to offset the weight of the bars. When the gate is open, the bars are on the horizontal part of the chain along the roof of the cage and the weight is near the bottom of the cage. When the bars are down—gate closed—the weight is near the top of the cage. This appliance is simple, reliable and easily operated.



Chain Gates for Cage

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*Mechanical engineer, Vulcan, Mich.

Details of Milling and Smelting

Furnace Operation at Mt. Lyell

Some interesting details of the later practice at Mt. Lyell, Tasmania, were given by Robert C. Sticht during his visit in America. At the December meeting of the New York Section of the American Institute of Mining Engineers Mr. Sticht, in responding to numerous inquiries, touched upon many points of furnace operation not previously covered in such detail.

The furnaces used at present are 210 in. long, 54 ft. wide and about 18 ft. high, the limitations in regard to height being largely that imposed by the furnace building. From 1200 to 1300 long tons are smelted per day in a little more than two furnaces, the capacity of the works exceeding that of the mines. When smelting was begun at Mt. Lyell the metallurgist had a nearly pure pyrite ore and used barren quartzite and sandstone for siliceous flux. The gangue matter in the Mt. Lyell ore at that time amounted to only 8%. It has since gone up to 12 or 14%, and as the Mt. Lyell ores have grown poorer, the more siliceous North Lyell ore, carrying about 6% copper, has been substituted, so that now, with the Mt. Lyell pyrites averaging about 0.5%, the furnace charge averages from 2.15 to 2.25% Cu, and from this a 45 to 50% matte is obtained in one smelting.

The Mt. Lyell ore instead of having 42 to 44% of iron now has only 35%, and while the coke on charge was as low as 0.1% for a six months' period at one time, it now ranges from 3.5 to 5%. The composition of the slag has likewise altered; instead of running 30 to 32% SiO_2 it now goes 36 to 38%, and the iron instead of being 52% FeO is now 45%. The limestone on the charge is not varied, and hence the lime in the slag changes but little. Alumina amounts to about 7%. The copper content ranges from 0.35 to 0.45%, in a high-concentration smelting of about 20:1. Mr. Sticht remarked that while this copper content in the slag might be a little higher than it would be in the double-smelting process, the management has not yet assured itself that it really is. The slag stream runs over forehearths for 50 to 60 ft. before it is discarded into the granulating launder, and a little matte is caught in each compartment.

Siliceous Skeleton the Groundwork of the Blowing-In Charge

In answer to a question by Arthur S. Dwight in regard to the method of blowing in the blast furnaces at Mt. Lyell, Mr. Sticht stated that instead of the usual fusible blowing-in charge, such as is used in ordinary smelting, only siliceous material is added to the fuel at the start. After the usual bed of fuel for heating and ignition purposes, several loads of quartz are put in up to about where the focus begins—perhaps a layer of quartz 4 or 5 ft. high—and then on top of this siliceous "skeleton" regular charges are started immediately.

The charges contain about 10% of fines (smaller than 1½ in.), but at times may be nearly 100% fines. On account of this and other local conditions some classification is made of the ore as it comes from the mines. Coarse ore is thus available when the furnace charge requires correction. The materials to be smelted are brought to the furnaces by hand in charging carts, and are emptied out of the end of the carts in a long string on the charging plate close to the edge of the furnace opening. The coke is brought first and pushed in. Then all the iron pyrites is dumped and shoved into the furnace, the siliceous ore is put in on top of it, then limestone and finally slag, flue dust and cleanings.

Feeding is done from both sides of the furnace, and it is absolutely necessary to have the greatest elasticity in the delivery of the materials to it. The success in attaining a high-concentration ratio and avoiding double smelting depends on this elasticity in the delivery of materials and the proper feeding of the furnace. Conveying appliances from bins to furnaces cannot do what the feeders have to do—use judgment in the selection and placing of the materials at the furnace. The question of charging and feeding has been exhaustively studied, and it is not considered that the work would be either cheapened or improved by substituting mechanical delivery and charging for the trained wheelers and feeders. A self-dumping charge car was tried for a long period, but finally proved to be a mistake.

The only mechanical device used in feeding is an "iron man," which pushes the materials off the inner edge of the charging plate into the furnace. With increased blast pressure the work of feeding became so hot that it was necessary to increase the number of feeders, and so the iron man was invented. This consists of a framework embracing each long side of the furnace. It slides and rolls on the charging plates in such a manner that a line of hinged pusher plates in front and parallel to the whole length of the charge opening simply shoves the material over the furnace edge, the same as the feeder's shovel used to do. The charges or any ingredient thereof may be placed wherever desired in the furnace by having the wheelers dump it at the spot indicated. Thus blowholes or unequal descent of the top may be promptly attended to.

The inner edge of the charging plates projects into the furnace with a certain overhang. This distance was the subject of much discussion, 9, 10 and 15 in. being advocated. It was decided to use a movable charging plate to meet the conditions. Generally speaking, it does seem necessary to let the charge fall 10 in. from the wall. The relative distribution of coarse and fine ore on top of the column depends on the height of drop and the amount of overhang of the charging plates. The practice at Mt. Lyell, modified by many conditions, is to feed so that the center line of the furnace is porous and the blast does not come up prominently on the jacket, but rises out of the column evenly.

In feeding the furnace no attempt is made to break up large pieces unless it happens to be a piece of schisty ore which is broken on the charging plate; otherwise anything a man can lift or that will go through an ore gate is fed into the furnace. Flue dust is still watered and returned to the furnaces, although other methods of disposition and preparation have been considered, but found too expensive or inexpedient for other reasons.

NO FURNACE-CHARGE CALCULATIONS MADE

The charges are not calculated, as the calculation is of no special use for immediate running purposes, since the furnaces have to be manipulated according to the grade of matte which falls. This is tested at intervals by the furnace foremen, who have been taught to make a quick, rough determination by the cyanide method. The quantities of pyrites and of limestone are kept constant on the charge. The siliceous ore and coke are varied as required, but the variation is mainly in the amount of siliceous ore used. When the matte is below grade, more siliceous ore is put on. This is speaking generally.

The coke is fed evenly along the length of the furnace, but is not distributed over the whole surface of the charge, the aim being to get it on the walls of the furnace. The coke used is made by the Mt. Lyell company at its Port Kembla works in New South Wales. It arrives at the smelting works in Tasmania containing at least 10% water and 16% ash. It is hard and dense, however, and while it does not get down to the focus of the furnace it serves the purpose of heating the upper portion of the charge. A very low coke percentage was achieved during the hot-blast régime when it was for periods as low as 0.1%. One ton of Mt. Lyell pyrites was then charged with as little as 500 lb. of quartz, or else concentrated first matte, so that there was a superabundance of iron and sulphur as compared with present conditions, which require from 3.5 to 5% of coke.

The tuyeres are methodically punched several times a day and should show no fire. Bright tuyeres are avoided. A light in a tuyere means that some matte is pocketed in that vicinity and when this tuyere is punched the matte is likely to run out into the tuyere box, even though the tuyere is inclined inward. The tuyeres on the Mt. Lyell furnaces are not circular, but long and oval, like a wide mouth, thus approximating a continuous tuyere opening all along the furnace sides. The old tuyere connections are retained, although no valves are placed on the tuyere pipe and no elaborate peek holes are provided, simply a wooden plug in the tuyere box, which of course has a slag escape in the bottom.

The 17½-ft. furnaces receive 20,000 cu.ft. of air per minute at about 64-oz. pressure. The blowers are run at practically constant speed. When the furnace pressure increases abruptly, the furnace has usually grown too tight and would eventually come to an automatic stop after slowing up, accompanied by an excessively high matte, up to 60 or even 70% in copper. To prevent this, the furnace is loosened up with coarse ore instead of with slag charges, as would perhaps be the case in ordinary smelting.

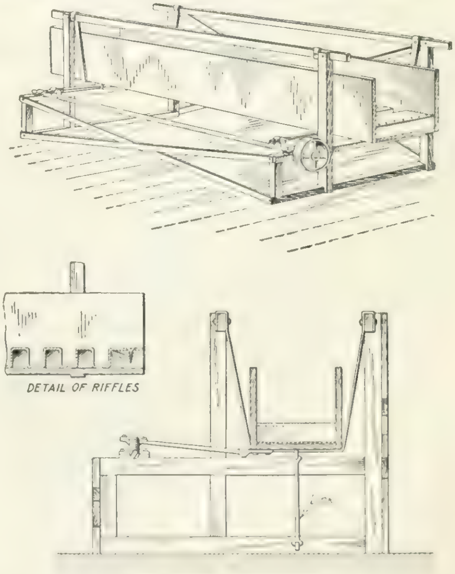
The introduction of turbo-blowers has permitted an increase in the height of the ore column without scaffolding difficulties. With little blast, too high a column tends to scaffolding. The height of the column has gradually been increased to about 18 ft. At present the company is arranging for facilities to increase the blast pressure by means of multistage turbo-blowers, so that a maximum pressure of 8 lb. may be obtained if desired. There appears to be little change in the bessemerizing action in the high column, provided sufficient air pressure is maintained. The height of the ore column is regarded as a question to be decided between the sticking quality of the ore charged and the blowing [illegible]. It is considered that in the matter of height of the ore column finality has not yet been reached.

The furnace campaigns, which used to be short, are now six months or more in length, and are usually ended by water getting inside the furnace from leaky jackets or because a forehearth may need repairs. Difficulties with excess of silica which would not scorify were formerly experienced, but these "silica sows"—not true sows, by the way—are now more rare. Ordinarily from 95 to 96% of the iron is oxidized, and the oxygen efficiency of the furnace is placed at 100%. At least, Mr. Sticht said, 2 or 3% of oxygen does not escape, as has been suggested.

⁂

A Concentrating Sluicebox

A new sluicebox designed to assist in separating the fines from broken or granular material and to recover gold has been devised by Henry W. Fry, of California. The box (U. S. pat. 1,117,828) is hung in a timber framework and is arranged to receive a rocking motion from a crankshaft by means of connecting-rods. The bottom of the box contains sheet-metal riffles bent into form. All of these details are clearly shown in the accompanying illustration.



SHAKING SLUICEBOX

In the operation of the box, the ore is fed into it along with a supply of water. Power is then applied to the shaft, causing the box to rock. A link connected with the bottom of the box causes the latter to swing from its center upon an arc of which the link is the radius, thus giving the box, as it is rocked, a slightly curved motion, and assisting in the settling of the fines, or concentrates.

The construction and use of this device are made evident through a study of the drawing.

The Cost of Doing Things

Milling Costs at the Goldfield Consolidated Plant

The report of the Goldfield Consolidated Mines Co. for the year ended Dec. 31, 1914, is exceptionally full of detail and shows the amount of supplies used, their costs and the percentage each bears to the total cost. These details are of considerable interest to the operating engineer and for that reason are reproduced here at length.

DETAILS OF MILLING EXPENSE

Year Ended Dec. 31, 1914

Item	Quantity	Price per Unit	Total Cost	Quantity per Ton	Cost per Ton	Pct Total Cost
Cyanide	623,713 lb.	$0.17105	$106,688.43	1.87 lb.	$0.321	19.99
Zinc dust	152,455 lb.	.08417	12,831.92	46 lb.	.039	2.43
Lime	4,920,210 lb.	.00733	36,297.02	14.79 lb.	.109	6.79
Lead acetate	280,994 lb.	.09161	25,740.53	84 lb.	.077	4.79
Muriatic acid	70,040 lb.	.04891	3,411.82	.21 lb.	.010	62
Water, gal	76,837,267 gal	2238	17,197.83	230.92 gal.	.052	3.24
Belting	. . .		4,910.32		.015	.93
Lubrication	. .		2,473.62		.007	.44
Borax	19,890 lb.	.1205	2,396.36	06 lb.	.007	44
Litharge	43,368 lb.	.07499	3,252.10	.13 lb.	.010	.62
Pig lead	15,390 lb.	.0637	979.57	05 lb.	.003	19
Shoes and dies	160,033 lb.	.04904	7,848.11	48 lb.	.024	1.50
Pebbles	1,761,210 lb.	.01653	29,115.73	5.29 lb.	.088	5.48
Tube-mill linings	88,513 lb.	.0568	5,031.13	.27 lb.	.015	93
Chilean steel	134,338 lb.	06057	8,136.38	40 lb	.024	1.50
Machinery and repairs	. . . . . .		4,143.64		.012	.75
Screens	. . . .		1,509.64		.005	31
Office supplies	. . . .		611.95		.002	.12
Filter cloth	. . . .		2,436.36		.007	44
Iron and steel	. . . . .		2,039.13		006	37
Assaying	. . . . . .		5,860.14		.018	1.12
Hose and fittings	. . .		426.81		.001	06
Pipe and fittings			746.40		.002	12
Lumber			925.71		.003	19
Crusher parts			2,306.45		.007	44
Coal	64 tons	15.46	989.23	.39 lb.	.003	19
Coke	164,700 lb.	.00726	1,196.39	.49 lb.	004	25
Slag	53,586 lb	.00751	402.21	.16 lb.	001	06
Pump parts			1,442.89		.004	25
Waste	5,639 lb.	.1175	662.29	.02 lb.	.002	12
Electrical operation and repair			4,734.89		.014	87
General stores			5,046.05		.015	93
Fuel oil	422 bbl	1.64	691.70	.001 bbl.	002	12
Total supplies			$302,512.75		$0.909	56.60
Operating labor	19,491 shifts	4.585	89,358.57	059	.269	16.75
Repair labor	5,984 shifts	4.594	27,490.30	018	.082	5.11
Power	1,599 hp	72.00	115,153.95	1.780	.346	21.54
Totals			$534,515.57		$1.606	100.00

DETAILS OF CONCENTRATES-TREATMENT EXPENSE

Year Ended Dec. 31, 1914

Item	Quantity	Price per Unit	Total Cost	Quantity per Ton Concentrate	Cost per Ton Concentrate	Pct Total Cost
Cyanide	124,870 lb	$0.17105	$21,409.12	5.70 lb.	$0.979	21.59
Zinc dust	16,940 lb	08417	1,428.20	84 lb.	.071	1.57
Lime	660,000 lb	.00733	5,000.40	30.47 lb.	231	5.10
Lead acetate	13,820 lb.	.09161	1,268.57	68 lb.	.063	1.39
Water	33,627,365 gal	2045	6,879.00	1498.68 gal	307	6.77
Fuel oil	6,490 bbl.	1.64	10,642.83	12.14 gal.	.474	10.45
Sulphuric acid	273,600 lb.	.02410	6,594.03	12.19 lb.	.294	6.48
Muriatic acid	3,151 lb.	04891	153.13	.14 lb.	007	15
Assaying			1,341.23		066	1.45
Roaster parts			1,029.80		.046	1.02
Machinery and repairs			394.12		.019	42
Belting			393.77		.019	42
Lubrication			28.58		.001	02
Borax	2,209 lb.	1205	266.24	11 lb.	.013	29
Litharge	4,699 lb.	07499	352.39	23 lb.	.017	38
Coke	18,300 lb.	00726	132.94	[illegible] lb.	.007	15
Pig lead	1,720 lb.	.0637	109.96	08 lb	.005	11
Slag	5,854 lb.	00751	43.64	29 lb.	.002	04
Filter cloth			619.23		031	68
Pipe and fittings			297.77		.013	29
General stores			1,107.29		.052	1.15
Pump parts			482.69		023	51
Total supplies			$59,974.93		$2.740	60.43
Operating labor	4,260 shifts	4.318	18,393.09	198	855	18.86
Repair labor	470 shifts	4.504	2,116.98	019	098	2.16
Power	257 hp.	72.00	18,317.33	4.040 hp.	841	18.55
			*$98,802.33		$4.534	100.00

* During 1914 the production of concentrates was 20,256 tons; all of these concentrates, together with 2182 tons from reserve dump, were treated. The cost of treating 2182 tons from dump was $7608.22, which is included in foregoing total

During the year the property produced 338,192 tons of ore, of which 332,750 tons, of an average gross value of $12.57, was milled and 5442 tons, of an average gross value of $29.01, was shipped. The gross value of this tonnage was $4,340,787. Deducting metallurgical losses, smelter discounts and the cost of tonnage purchased, an aggregate of $114,438, it is found that the value realized from the year's operations was $3,926,349. The expenses of the year, including mining, milling, transportation, construction, taxation and general expenses, were $2,091,-

125, leaving a net realization from operation of $1,835,221.

Milling costs rose slightly during the summer, when a large percentage of dump ore was being treated. The cost per ton for treatment of concentrates was lower, thereby reducing total milling costs 9c. per ton.

The equipment for rehandling mill tailings is now practically complete, and will be available when needed. Its cost, which is up to date $91,672, amounts to slightly less than 5c. per ton for the tailings now available for re treatment; and in view of the low operating expense which will result from its use, it is believed that this initial expenditure will be fully justified. The accompanying tables show in detail the milling and concentrates-treatment costs which make this company report a contribution to technical literature.

GOLDFIELD CONSOLIDATED MILLING COSTS

Per Ton of Ore Milled During Year Ended Dec. 31, 1914

Department	Labor	Supplies	Power	Total	Per Total
Crushing and conveying	$0.020	$0.018	$0.008	$0.046	2.87
Stamping	.028	.030	.066	.124	7.72
Chilian Milling	.020	.036	.047	.103	6.41
Elevating and classifying	.010	.004	.006	.020	1.25
Tube milling	.022	.109	.111	.242	15.07
Concentration	.029	.007	.016	.052	3.24
Neutralizing	.006	.055		.061	3.80
Settling	.014	.055		.069	4.30
Dissolution	.019	.406	.036	.461	28.76
Filtering	.032	.016	.014	.062	3.86
Tailings expense	.002			.002	.12
Assaying	.002	.017		.019	1.18
Precipitation	.007	.043	.012	.062	3.86
Refining	.018	.028		.046	2.87
Water		.052		.052	3.24
Surface and plant	.003	.002		.005	.31
Steam heating		.001		.001	.06
Storehouse and office	.010	.003		.013	.81
Stable	.001	.001		.002	.12
Watchmen	.022			.022	1.37
Superintendence and foremen	.045	..		.045	2.80
Lighting	.002	.001	.015	.018	1.12
General expense	.002	.005		.007	.44
Mill tools	.001	.002		.003	.19
Electrical department	.004	.014		.018	1.12
Pumping battery water	.008	.002	.015	.025	1.56
Experimental	.001	.001		.002	.12
Clean-up	.023	.001		.024	1.49
Totals	$0.351	$0.909	$0.346	$1.606	100.00
Per cent. of total cost of milling	21.86	56.60	21.54	100.00	
Per cent. of combined cost of milling and concentrates treatment	18.44	47.77	18.18	84.39	

CONCENTRATES-TREATMENT COSTS

Per Ton of Concentrates Treated During Year Ended Dec. 31, 1914

Department	Labor	Supplies	Power	Total	Pet Total
Raw cyanidation	$0.080	$0.416	$0.199	$0.695	15.33
Filtering and conveying	.250	.049	.046	.345	7.61
Roasting	.256	.528	.124	.908	20.03
Acid treatment	.073	.323	.240	.636	14.03
Cyanidation of roasted product	.072	.874	.198	1.144	25.23
Assaying	.014	.064		.078	1.72
Precipitation of copper	.068	.015		.083	1.83
Precipitation	.012	.081	.022	.115	2.54
Refining	.033	.051		.084	1.85
Disposal of tailings	.027	.013	.010	.050	1.10
General expense	.010	.016		.026	0.57
Handling dump	.058	.003	.002	.063	1.39
Water		.307		.307	6.77
Totals per ton of concentrates	$0.953	$2.740	$0.841	$4.534	100.00
Totals per ton of ore	.062	.180	.055	.297	
Per cent. of total cost of concentrates treatment	21.02	60.43	18.55	100.00	
Per cent. of combined cost of milling and concentrates treatment	3.26	9.46	2.89	15.61	

⁂

Surface Prospecting at Nipissing

The following costs are taken from the last annual report of the Nipissing Mines Co., of Cobalt, Ont., and apply to the stripping of soil from the rock formation by means of hydraulicking. During the period the number of acres washed was 95.55 and the average depth of soil removed was 3.13 ft. The cost per acre was $199.47 and the cost per cubic yard of material moved was 9.01c., made up of labor, 4.99c.; power, 3.20c., and supplies, 0.82c. There were 153 set-ups made, 33,768 ft. of 16-in. pipe laid down, 31,540 ft. of pipe taken up, and 18,730 ft. of roads were built. The average pressure at the nozzle was 138 lb., and the pump ran 79% of possible running time.

Incidentally, the results of the prospecting were not so good as expected. The only vein of importance found was what is known as H-52, from the outcrop of which 10,000 oz. of silver in high-grade ore was taken. The vein will be prospected the coming summer.

⁂

Regrinding Costs at Winona

The figures given herewith, taken from the 1914 report of the Winona Copper Co., Winona, Mich., give the results of regrinding by Hardinge mills at the company's mill. From May on, owing to a larger output, the power costs were materially lower, regrinding costs being below 15c. per ton.

REGRINDING COSTS AT WINONA

	Total	Cost per Ton Reground	Per Cent.	Units Per Ton Reground
Power @ 1.054c. per kw.-hr.	$8,116.05	13.64	79.22	12.94 kw.-hr.
Labor	384.70	.65	3.75	
Supplies				
Pebbles @ .8c. per lb.	1,237.12	2.08	12.07	2.600 lb.
Silex lining @ 1.456c. per lb.	57.18	.09	.56	.070 lb.
Steel lining @ 5.242c. per lb.	197.40	.33	1.93	.063 lb.
Incidentals	252.91	.43	2.47	
Totals	$10,245.66	17.22	100.00	

Tons stamped	123,339.15
Copper by assay from Hardinge mineral	265,518 lb.
Copper from Hardinge mineral per ton stamped	2.1527 lb.
Tons reground	59,500
Copper per ton reground	4.462 lb.
Regrinding cost per lb. of copper contained	3.859c.
Regrinding cost per ton stamped	8.306c.

⁂

Cost of Constructing a Short Transmission Line

With the extension of central-station service into rural territory the construction expense of moderate voltage transmission lines becomes of interest, says the *Electrical World*. The accompanying cost data are taken from the construction sheets of a Massachusetts central station, which recently built an 11,000-volt single-phase transmission line across a portion of Cape Cod 8.1 miles long, pole location rights being secured from real-estate owners en route:

539 35-ft. poles, at $6	$3,234.00
1204 Victor insulators, at 20c.	240.80
439 pairs braces, at 26c. each	114.14
11,843 lb. bare copper wire, No. 4, at 16.75c.	1,983.70
Carting poles	676.00
130 guys, at $1.14	148.20
424 lb. No. 6 bare wire, at 18c.	76.32
1095 two-pin cross-arms, at 40c.	438.00
2190 1½-in. by 12-in. locust pins, at 4c.	87.60
2 transformer towers	348.00
5 11,000-volt lightning arresters, at $43.50	217.50
2 11,000-volt air-break switches, at $100	200.00
1 2300-volt oil switch	89.20
Right of way	345.00
Freight	183.00
Labor	4,800.00
Total	$13,181.46
Per mile of line	$1,620.00

The company obtained the permits for running the wires and also for the pole locations, the erection work being by contract. The contractor trimmed all poles, which averaged 125 ft. in spacing. Poles were head-guyed every half-mile, all guys being provided with porcelain insulators, and every twelfth pole was double-armed. Tree trimming was done by the contractor.

⁂

The Monarch Pittsburg Mining Co., Tonopah, Nev., reports a balance of $4619 for 1914 after an expenditure of $32,342. Assessments collected during the year amounted to $27,150. There were 1491 ft. of development work performed at a cost of $9.95 per ft. Details of costs show that the average cost of drifts was at $10.90 per ft., crosscuts, $9.36; winzes, $20.11 and work through caved ground, $7.37 per ft. It is thought that the Murray vein of the Tonopah Extension Co. extends into the Monarch ground.

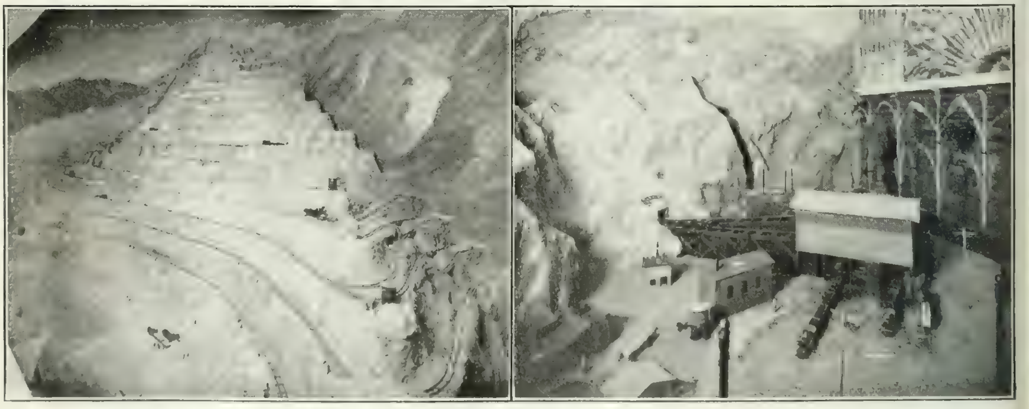
Photographs from the Field

A Panorama of San Dimas, Durango, a Famous Old Mining Center

This is apparently the view referred to by Bill McGinty (see p. 1041)

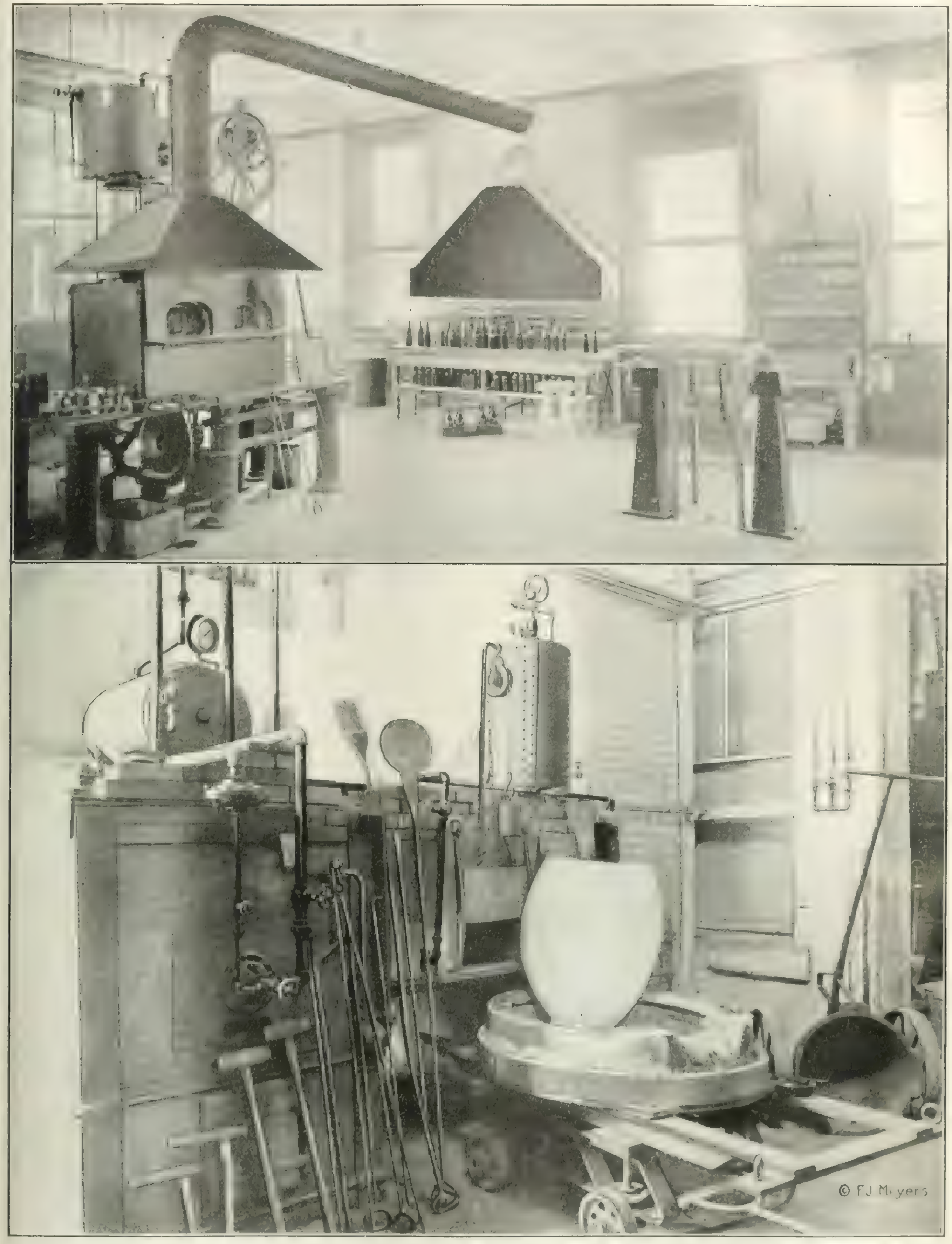
Arizona Copper Co.'s Metcalf Mine, Metcalf, Ariz.

Showing the Metcalf and Wilson inclines. The former is 1700 ft. and the latter 1200 ft. long



Mining Exhibits from Utah

The left-hand view is a model of the Utah Copper Co.'s mine, complete in every detail. The other is one of the Utah coal mines. They are both in the Utah State pavilion at San Francisco



NEW LABORATORY AND CUPEL FURNACE AT THE HOMESTAKE

The new assay laboratory has been equipped with all the best and most modern appliances. In the lower view a gold bottom, lifted from its bed, is seen standing in the cupel in which it was made. The furnace and tools used are also shown.

Correspondence and Discussion

Why Is the Patent Mania?

Referring to Mr. Croasdale's article in the Journal of Apr. 24, 1915, it is true that my position on patent matters differs radically from the opinions expressed in his article. This difference is based rather on personal experience than extended literary investigation.

I cannot agree with Mr. Croasdale that the court investigation should come at the time an application is filed, instead of later; nor can I agree with Mr. Hoover that the Government should, after a stated definite period, protect the patentee; nor can I agree with Mr. Hyde that patent applications should be published.

Wrongfully to withhold a patent from an applicant is quite as great an injustice as wrongfully to grant a patent. What constitutes patentability? Mr. Croasdale is right when he says that I confuse "improvement" with "patentability." Or, rather, a better way to put it would be to say that the dividing line between a patentable improvement and an unpatentable improvement is by no means clearly defined and is no doubt the cause of the greatest amount of patent litigation. The applicant who comes before the patent office and states under oath that he believes himself to be the original, first and sole inventor cannot, without adequate evidence, be accused of being mistaken of being a thief, a liar, or a perjurer.

If a technical court were to pass on all applications, it would necessitate a separate court for each division in the patent office. It is difficult to see why a technical judge who is expert on musical instruments should be any more competent to pass on a complicated electrical application than lawyer-judges are at present on passing on all applications. Then, too, who is to present the evidence? The applicant would doubtless present the evidence for himself, but who would present the evidence for the Government? Certainly the interested party, if the application is allowed. But who is the interested party? Doubtless the one who has the pioneer patent.

Now let us take the flotation patents, mentioned by Mr. Croasdale, and assume one to be the pioneer patent. Should it, then, be incumbent for the pioneer patentee to prosecute at least 140 patent litigations in the patent office to protect his own patent? A greater injustice cannot be imagined, and if he does not take a hand in the litigation, what assurance has he, any more than now, that his interests will be properly protected?

Then, too, what would it cost the Government to adjudicate all applications; what would it cost the applicant to defend his application, and what would it cost the pioneer patentee to protect his patent? All this cost would be chargeable to some one, and the result would be that where it now costs approximately $100 to prosecute an *ex-parte* patent application, including the Government fee of $35, it would probably, under Mr. Croasdale's suggestion, cost several thousand dollars. Every patent would have to be litigated, whether it was worth litigating or not, and no one can say what applications would be worth litigating. Probably some years ago the flotation patents would not have been considered worth litigating, while now they are. My contention is that at the time of applying for a patent few applicants are in a position to judge as to the ultimate worth and scope of the patent if allowed, and it is doubtless for this reason that the courts have given wide interpretations to pioneer patents in any art; and this is as it should be.

It is difficult to see how the Government could protect a patentee after, say, six months, as suggested by Mr. Hoover. For the Government to assume responsibility would be to require thorough investigation and litigation before the patent is issued, and only then could the Government presume to assume responsibility. But such a procedure would be necessary on all patents, and all patent applications would come under its scope. Why put every applicant to this useless litigation, when at the present time a patentee is quite as safe if the courts have passed on the merits of his case? Surely the Government would not assume responsibility, to the extent of giving a guarantee, on the 140 flotation patents, without investigation and litigation of conflicting interests, before the patents are allowed. And after patents are allowed with a Government guarantee, would there be any assurance that the different patents so allowed would never conflict? They doubtless would. Then what would be the position of the Government if two patentees claimed conflicting interests? The only answer is: More litigation.

To publish patent applications would involve the greatest injustice imaginable. How many applicants can define the scope of their invention, its possibilities, and its best method of application at the time the application is filed? Probably none. At the time of filing an application an invention is usually begun, but probably never completed.

The Government requires diligence in patent matters, and priority rests on reduction to practice, and reduction to practice is usually determined by the filing date of the application. If, then, an application is published before the inventor desires to give publicity to his invention, he would have all kinds of interferences to litigate in the Patent Office; and others, taking up the essence of his invention, would so surround him as to make his patent worthless. The premature publication of an application would be a severe blow to the individual and practically put him out of business, while it would be the greatest boon for the large corporate interests and wealthy individuals. The individual would simply go down and out through deliberately enforced Patent-Office interferences, brought about by premature publicity, which is forced on the applicant to maintain his priority. Patent pirates would thrive as never before and no inventor's interests could be regarded as secure in a patent application.

Personally, I feel that the United States patent system is the best in the world, all things considered. This does not mean that it cannot be improved. The improvements that to me seem most essential are:

1. That the term of the patent should be extended for a period of not less than 20 years, and that the time of operativeness should date from the time the application is filed. The applications should not be published.

2. That an alleged infringer, if threatened with litigation by one who claims his inventions were infringed upon, should have the right to initiate litigation. As at present constituted a patentee can threaten litigation indefinitely and never bring action, while the alleged infringer cannot initiate litigation to clear the situation. To threaten litigation for alleged infringment indefinitely, without action, to retard or ruin another's prospects, can only be regarded as blackmailing.

3. That a technical court should be established to hear patent cases, and that litigation should be expedited as much as possible. Only one appeal should be allowed.

Referring to the matter of a working clause in the patent laws, it is true that the present proposed legislation is directed to certain chemical processes. If such a law is passed, either it will be declared unconstitutional as discriminatory legislation or, if upheld, will establish a precedent for all other patents. Then what would happen to the poor inventor, who, with all his other multitudinous troubles, would be continually harassed by expensive litigation to show that his invention was in *bona-fide* operation, when he has not the means to put such operation beyond the shadow of a doubt?

The Government might reserve the right, in order to avoid oppressive monopolies, to say what reasonable compensation should be allowed a patentee by others for the use of his invention, and this might not be a bad idea; but this right should not be exercised unless the Government shall also have the right to fix the price of the products of such inventions. As this practically includes everything manufactured, such an arrangement would be far-reaching in its scope.

William E. Greenawalt.

Denver, Colo., May 5, 1915.

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Ancient Gold Mining in East Africa

The historian Diodorus the Sicilian, who wrote about 60 B. C., gives an account of gold mining and milling in Egypt and Ethiopia, which may stand quotation as unfamiliar to most mining men. The Journal's recent references to slave and captive labor seem to render them pertinent. The following is from Booth's translation (1814) of Diodorus. His account of the sociological conditions under convict labor makes one think of the coal mines in our Southern States.

"We shall now speak a little of those [Ethiopians] inhabiting the southern parts and toward the Red Sea. But it is fit first that we say something of the making of gold in these parts.

"In the confines of Egypt and in the neighboring countries of Arabia and Ethiopia there is a place full of rich gold mines, out of which, with much cost and pains of many laborers, gold is dug. The soil here is naturally black, but in the body of the earth run many white veins, shining with white marble, and glistering with all sorts of other bright metals; out of which laborious mines those appointed overseers cause the gold to be dug up by the labor of a vast multitude of people. For the kings of Egypt condemn to these mines notorious criminals, captives taken in war, persons sometimes falsely accused, or such against whom the king is incensed; and that not only they themselves, but sometimes all their kindred and relations together with them, are sent to work here, both to punish them and by their labor to advance the profit and gain of the king. There are infinite numbers upon these accounts thrust down into these mines, all bound in fetters, where they work continually, without being admitted any rest night or day, and so strictly guarded that there is no possibility or any way left to make an escape. For they set over them barbarians, soldiers of various and strange languages, so that it is not possible to corrupt any of the guard, by discoursing one with another, or by the gaining insinuations of a familiar converse.

"The earth which is hardest and full of gold they soften by putting fire under it, and then work it out with their hands: the rocks thus softened, and made more pliant and yielding, several thousands of profligate wretches break it in pieces with hammers and pickaxes. There is one artist that is overseer of the whole work, who marks out the stone, and shows the laborers the way and manner how he would have it done. Those that are the strongest among them that are appointed to this slavery, provided with sharp iron pickaxes, cleave the marble-shining rock, by mere force and strength, and not by art or slight of hand. They undermine not the rock in a direct line, but follow the bright shining vein of the mine.

"They carry lamps fastened to their foreheads to give them light, being otherways in perfect darkness in the various windings and turnings wrought in the mine; and having their bodies appearing sometimes of one color and sometimes of another (according to the nature of the mine where they work) they throw the lumps and pieces of the stone cut out of the rock upon the floor. And thus they are employed continually, without intermission, at the very nod of the overseer or tax-master, who lashes them severely besides. And there are little boys that attend upon the laborers in the mine, and with great labor and toil gather up the lumps and pieces hewed out of the rock as they are cast upon the ground, and carry them forth and lay them upon the bank. Those that are about 30 years of age take a piece of the rock of such a certain quantity, and pound it in a stone mortar with iron pestles till it be as small as a vetch, then those little stones so pounded are taken from them by women and older men, who cast them into mills that stand together there near at hand in a long row, and, two or three of them being employed at one mill, they grind it so long till it be as small as fine meal, according to the pattern given them. No care at all is taken of the bodies of these poor creatures, so that they have not a rag so much as to cover their nakedness, and no man that sees them can choose but must commiserate their sad and miserable condition. For though they are sick, maimed or lame, no rest, no intermission in the least, is allowed them; neither the weakness of old age nor women's infirmities are any plea to excuse them: but all are driven to their work with blows and cudgeling, till at length, overborn with the intolerable weight of their misery, they drop down dead in the midst of their insufferable labors; so that these miserable creatures always expect worse to come than that which they then at present endure, and therefore long for death, as far more desirable than life.

"At length the masters of the work take the stone thus ground to powder, and carry it away in order to the perfecting of it. They spread the mineral so ground upon a broad board, somewhat hollow and lying shelving, and, pouring water upon it, rub it and cleanse it, and so all the earthy and drossy part being separated from the rest by the water, it runs off the board, and the gold, by reason of its weight, remains behind. Then washing it several times again, they first rub it lightly with their hands; afterward they draw up the earthy and drossy matter with slender sponges gently applied to the powdered dust, till it be clean pure gold. At last other workmen take it away by weight and measure, and these put it into earthen urns, and, according to the quantity of gold in every urn, they mix it with some lead, grains of salt, a little tin, and barley bran. Then covering every pot close, and carefully daubing them over with clay, they put them in a furnace, where they abide five days and nights together; then, after they have stood to cool a convenient time, nothing of the other matter is to be found in the pots, but only pure refined gold, some little thing diminished in the weight.

"And thus is gold prepared in the borders of Egypt, and perfected and completed with so great toils and vexations. And therefore I cannot but conclude that nature itself teaches us that as gold is got with labor and toil, so it is kept with difficulty, creates everywhere the greatest cares, and the use of it mixed both with pleasure and sorrow.

"Yet the invention of those metals is very ancient, being found out and made use of by the ancient kings."

A. B. Coli.

New York, May 8, 1915.

Bill McGinty, Prospector—IV

Misther Editor—Havin' disposed av the geology av sidimintary volcanics in a satisfact'ry manner, we will now pass on—that is to say, we will now pass over the edge av thim an' luk down. We will also skip gaily past the usual 9000- to 15,000-word ixplanatory chapter on the Ginisis av the ore-dayposits. Some fellies buck on Ginisis theories, an' want to know what has the Bible to do with minin' in Mexico. 'Tis full av it, but I am too busy to tell ye av the Exodus, av Numbers, av Joshuas an' Judges, or the lost Jobs an' the Lamentations. The Acts spake for thimsilves an' so should the Hebrews. 'Tis the Rivilayshuns that int'rest prospectors, an' they always come at the last.

As I was sayin', now an' then ye get a glimpse av the Bacis valley. 'Tis int'restin' to luk down an' see wan ridge after another, with deep gashes in between, knowin' that in each gash there may be dozens or hundreds av veins waitin' to be opened up. Then yer mule stops, an' ye discover a train av freight mules comin' uphill an' wantin' to pass ye. So ye dismiss the Bacis territory for the time bein', as the river av Quien Sabe, which is Mexican for Rio Teodoro. Ye can hear all kinds av tales av rich but lost mines in the in-accessyble headwaters, where the old Spaniards are said to have built trails along the face av cliffs by usin' iron brackets, injinuity, an' Injin slave labor.

By an' by 'twas dark an' we had not arrived annywheres. So we kept on, an' about the time we decided to hunt water an' camp we struck a flat place. In a little while a voice called out av the dark: "How do you do? Come inside the gate. I am pleased to see you an' will have *comida* leady pletty soon. My name is Mar Tom an' I am fl'end of the Glingos." Well, it was fine to see a white man, even if he was a Chinee.

Puentecillas is said to be in the watershed av the Rio Verde; but, like the felly that went through algebry, 'twas night an' we didn't get to see much av the place. We set out early in the mornin' among the clouds, not seein' more than the trail, an' very little av that. It winds around sharp ridges, dips down to cross little torrents, an' then up again. 'Tis difficult to say offhand how much change in illivayshun ye've covered whin ye walk down wan hill an' ride the mule up the next wan. Finally we got on top av wan av Adam's rivers, in a place called Otates, because they grow there as well as in other places. An *otate* is a kind av long reed cane, suitable for fishpoles, ceiling brooms, an' first-aid to window thieves. We rode along through the bushes an' canes for a while, an' all at wance Rodrigo dismounts an' motions ivery wan to do the same. Then he beckons an' whispers: "El Cumbre." A tourist wud ask: "Does it bite?" But the word manes peak av a mountain or, sometimes, greatest height av favor. 'Tis both in this place. To the west ye can see the glorious Pacific Ocean. From there, around to southwest, south, southeast an' east lays a grand bird's-eye pannyrammy, with territory that wud take ye years an' years to begin to explore, not to mention prospectin'. Down in a wrinkle near by lays a little speck; an' when yer eyes get the focus ye begin to see houses. It luks as if ye cud throw a rock down an' hit the blue dome av the little church next to the speck av green which is the orange grove av the Plaza. A ridge which luks tiny compared with all the rest has an illyvayshun av 6000 ft. above sea-level, an' the town av San Dimas (*El Santo Ladrone,* or sainted thief who repented on the cross), in the wrinkle below, it is about 2500 ft. The difference av 3500 ft. is but the depth av a plow furrow as ye luk down from the Cumbre.

From the Cumbre 'twas downhill, zigzag, then along the trail cut out av the face av a cliff, an' down to Carboneras. After lunch by the brook that furnishes water for power at the Guamuchil mill av the Candelaria mine, we zigzagged down to San Dimas itself, in time for the regular Sunday dance an' concert in the Plaza. The Candelaria mine has been a fine producer, an' is well worth fightin' for.

Whin I go back an' take another luk at that cave I'll tell ye all about it.

Bill McGinty.

Brooklyn, N. Y., May 22, 1915.

(That's all of this series, anyway.)

More Unemployment

The California press has become excited over a new vacuum smelting process developed by a student at the state university during the preparation of a thesis. This process eliminates sulphur fumes and substitutes oil for coke in the blast furnace—both problems on which the practical smelters have been engaged for years. What are the old men in the field going to do now? And what will the students do after graduation if they solve all these problems before leaving the universities?

Fundidor.

Coram, Calif., June 3, 1915.

Tentative Mine-Safety Rules in California

By Lewis H. Eddy*

The tentative mine-safety rules prepared by a committee of mining men at the request of the California Industrial Accident Commission are here summarized for the benefit of readers who may not have a copy of the complete rules at hand:

These rules shall apply to all mines operated in California except where the chief mine inspector is of the opinion that the enforcement of any rule would not materially increase the safety of the employees or would work an undue hardship on the operator. The exemptions must be in writing to be effective and may be revoked after reasonable notice is given in writing. (Sec. 1.)

Operators must make yearly reports of dangerous conditions to the inspection department, and immediate reports of conditions that may become instantly dangerous. Operators shall designate and appoint persons on whom all notices respecting these rules may be observed. (Sec. 2 and 3.)

Artificial breathing apparatus must be kept at each mine employing more than 30 men underground, and the men must be trained in the use of this apparatus. (Sec. 5.)

Mine maps shall yearly be brought up to date. (Sec. 6.)

Whenever dangerous conditions from any cause designated in these rules shall be found by the inspectors, a notice shall be served in writing upon the operator or his representative. If necessary changes have not been made within the time specified in the notice, the Industrial Accident Commission shall be notified and take such steps as are provided in the Workmen's Compensation, Insurance and Safety Act. All fatal accidents shall be reported by telephone or telegraph, and inspection made by the inspector when necessary. (Sec. 7 and 8.)

Boys working underground shall not be under 16 years. (Sec. 9.)

Appointments of superintendent and mine foreman are provided for, and their duties described in relation to these rules. (Sec. 10, 11 and 12.)

No liquor is allowed underground, or in any building connected with the operation of the mines, except for the purpose of administering to injured persons; no intoxicated person is allowed on the premises. Wages shall not be paid on any premises where liquor is sold. (Sec. 13 and 15.)

Personal accidents to employees must be reported by them to the superintendent or the foreman. Operators must take reasonable precautions to protect employees; dangerous places must be fenced off. Solitary employment is forbidden. Strangers and visitors shall not be permitted underground unless accompanied by officials. Miners shall be made acquainted with the rules applicable to them. (Sec. 14 and 15.)

Miscellaneous rules for underground men are separately set forth covering the following subjects: The use and care of explosives; getting on and off cage, skip or bucket; signaling; riding on loaded skips and tops of cages; closing of gates or bars at stations; dropping of material or tools; necessity for lights underground; reporting dangerous conditions; avoiding danger of loose ore over raise or chute; reporting defects in ladderways and use of danger signals; warning of fellow workmen; familiarity with exits; prohibiting smoking, or lighting lamps or candles when loading holes; care of caps and powder, and return of explosives to proper places; tamping powder in drill holes; blasting of boulders; lights in preparation for blasting; prohibiting the deepening of holes previously charged; lowering of tools in manway; prohibiting the extraction of explosives from missed holes; reporting accidents and injuries; regarding fires in powder magazines; inspection of fuse; use of crimpers only, picking down loose rock; necessary timbering; reporting strained or broken timbers; method of placing and loading holes to save timbers; reporting unusual conditions underground; forbidding short-cut travel through dangerous workings; regarding lights in powder magazine; regarding candle or lamp underground, warnings by bosses or shot firers; counting of number of explosions; use of electricity in firing shots; closing of chutes; guarding chutes to skip pockets, covering holes opening in chutes; removal and replacing of flooring, lagging or timber; replacing of tools on going off shift; seeking refuge when cars approach; placing of refuse in receptacles; prohibiting improper use of electricity; reporting defects, damage or injury to timbering, apparatus and equipment; forbidding fighting and wrestling, removing exposed spikes or nails, regulating the splitting of fuses, regulating the placing of steel, timber and other material and drilling machines, keeping lights [illegible] leaving cars, careful handling of cars. (Sec. 16.)

Abandoned shafts and openings [illegible] fenced or covered. Moving machinery, stairs, trestles [illegible] provided with guards and hand-rails. (Sec. 17 and 18.)

Steam boilers shall be inspected [illegible] results reported to the inspection department. [illegible]

Closets must be provided underground, where men cannot go to the surface. Good quality of drinking [illegible] provided. Change houses shall be equipped [illegible] baths, hot and cold water. Employees must use sanitary appliances, and refuse from lunch buckets must be [illegible] of. (Sec. 20.)

Escapeways must be provided from lowest working level to the surface. One escapeway may be through a neighboring mine. Mines less than 300 ft. deep, where the shaft is 200 ft. deep and there is but one outlet, must maintain a ladderway compartment in the shaft. (Sec. 21 and 24.)

Inflammable structures shall not be erected over mine outlets and shafts. Outlets new covered by inflammable structures shall be protected by fire- and gas-proof doors of the type approved by the inspection department. Ample ventilation shall be provided, and in no case shall men be permitted to work where the oxygen contained in the air is less than 19½%. (Sec. 25 and 26.)

Special permit is required when stoping must be done within 20 ft. of a shaft for hoisting men or materials. Special inspection underground is required when workings are untimbered. Loose rock must be removed from timbers in manways which are in daily use. Heavily timbered stopes must be inspected for fire at the end of each shift. Working places must be amply timbered when necessary, and sufficient timber furnished by the operator. Miners shall not work when sufficient timber is not supplied. (Sec. 27 and 31.)

Tops of winzes and raises must be protected, and drifts must be fenced off when there is danger of falling material. Guard-rails or gates must be provided at shaft stations and collars. Hatches must be provided where buckets are used, passageways around shaft at level stations. Shafts must be thoroughly inspected once each week. When two repair crews are working in a shaft where the inclination is greater than 35 deg., strong bulkheads must be placed between the crews. Bulkheads are also required when shaft sinking is in progress. (Sec. 32, 33 and 56.)

When mechanical haulage is used, places of refuge 2½ ft. in width between the car and the side of the haulageway shall be provided and kept clear. When workings are advancing toward dangerous accumulations of water, bore holes shall be kept well in advance. Sumps must be covered or fenced off. Working floors of square-set stopes shall be securely lagged over, openings being protected by railings. Crossheads and guides are required when sinking a shaft which is more than 300 ft. deep. (Sec. 34 and 39.)

Ladderways must be provided from the surface to the lowest working of the mine, equipped with platforms not less than 20 ft. apart, and ladders projecting at least 3 ft. above each platform. Extension ladders are required at the shaft bottom when sinking is in progress. Stairways may be substituted for ladders when feasible. Sign boards pointing the way to exits and escapeways must be maintained. (Sec. 40.)

Dust from drilling or chutes must be allayed; the necessary devices and appliances being furnished, and miners shall use such devices and appliances. (Sec. 41.)

Candles and lamps must be extinguished on leaving the mine at the end of a shift. Stationary lights are required at shaft stations and in pumping rooms. Candles used as stationary lights must be placed in approved metal sconces. (Sec. 42.)

Special noninflammable houses are required for storage of oil and other inflammable materials, situated at least 100 ft. from mine openings and 300 ft. from powder magazines. Only one day's supply of explosive shall be taken into the mine in one day. Only one day's supply of oil shall be taken from a storage place at one time. Three days' supply of oil and small quantities of gasoline are allowed underground. Waste timber must be removed from the mine, and no timber or other inflammable material shall be stored within 100 ft. from the magazine opening. Surface magazines for storage of explosives must be fire-proof, and have fire- and bullet-proof doors. No caps or electrical detonators shall be stored in the same magazine with other explosives. Explosives underground shall be kept in locked boxes or magazines, which must be clean and dry and contain no naked lights. Caps must not be kept with powder underground. All primers and capped fuses shall be exploded within 24 hr. after making. Fuses shall not be stored underground longer than 72 hr. Boxes of explosives shall not be opened within a magazine underground or above ground, and in no case shall metallic instruments be used to open such boxes. Necessary thawing of dynamite must be done in specially provided places, by steam bath, hot-water device, manure or electric current, and in no case shall explosives be exposed to heat of more than 80° F. Explosives put up in cartridge form for use in mines must be covered with bright red wrappers or wrapping paper. Fire-fighting equipment shall be provided near powder magazine. Combustible substances, oil, etc., shall not be kept near a powder magazine. No explosive that evolves more noxious gas than gelatine dynamite shall be used underground. (Sec. 43 and 45.)

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*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

Notice of the rate of burning fuse, not faster than 1 ft. in 30 sec. or slower than 1 ft. in 55 sec., shall be posted at the entrance of the mine, and the superintendent is responsible for carrying out the rule. Use of oil or grease to waterproof joints between caps and fuses is forbidden. In capping fuse, at least 1 in. shall be cut from the end of each length of fuse to prevent damp ends getting into the cap. Only a crimper shall be used for attaching a fuse to blasting cap; the use of knife or teeth is forbidden. The use of hammered or injured fuse is forbidden. In cold weather, fuse must be slightly warmed before uncoiling. Bosses must take charge of blasting, and only wooden tamping rods shall be used. Missed holes must be reported, and explosives shall not be extracted from them. (Sec. 46 and 47.)

The superintendent shall establish a rate of speed of cages, etc., when men are being handled, and determine the number of men to ride at one time. Cagers or skip tenders must be employed where there are more than 50 underground men. Wooden rails shall not be used as skidways, or tracks in inclined shafts. Open hooks shall not be used with bucket, skip or cage. When hoisting men, the hoist engineer must be over 21 yr. of age and able to read English readily. Duties of hoisting engineers are set fourth in 15 paragraphs. The same rules are now generally enforced. Safeguards against overwinding are required. Metal hoisting ropes are required and must be of a factor of safety of not less than five. Regular inspection of hoisting rope is required, and worn ropes must be immediately discarded. Two turns of hoisting rope must always remain on the drum, and ropes must be dressed once a month. Bonneted cages with safety catches are required in vertical shafts when men are being handled. Other conventional rules applied to hoisting are adopted, including the oiling of cage safety catches, and hoisting while sinking shafts. (Sec. 48 and 55.)

Telephones are required in mines more than 500 ft. deep. Signaling devices are required in shafts. California Mine Bell Signals law must be adopted as far as applicable or necessary. Special signal boards are required at shaft stations. (Sec. 57 and 60.)

Electrical rules cover the following subjects: Definitions, care of equipment, standard practices, grounding, voltage, ground detectors, switchboards, danger signals, fire protection, emergency lights, plan of electric system, report of defective system, notice of new installation, underground stations and transformer rooms, transmission lines and cables and high-voltage wires, support of cables and wires, overhead lines above ground, buried cables, protection of circuits leading underground, branch circuits, lighting circuits, underground trolley, protection of trolley wires, power wires and cables in shafts, cables in main roads, protection of cables during blasting, cables entering fittings, joints in conductors, joints in cables, fuses, circuit breakers, switches, stationary motors and electric lighting. (Sec. 61 and 68.)

Beatty Wins Decision

In 1913 Justice Gerard of the New York Supreme Court rendered a decision in favor of the defendant in the case of A. Chester Beatty vs. the Guggenheim Exploration Co., to recover $54,000 in cash, 23,000 shares of the Yukon Gold Co. and certain damages for nondelivery of said stock. The Appelate Division of the Supreme Court of New York last week reversed Justice Gerard's ruling and handed down a decision in favor of Beatty. It is understood that the attorneys for the Guggenheim Exploration Co. will take an appeal to the Court of Appeals of the State of New York at Albany.

It will be recalled that the Yukon Gold Co. negotiations could not be put through on the original basis, being unacceptable to A. N. C. Treadgold. Mr. Treadgold, however, required money at an early date to hold certain options. Mr. Beatty and Mr. Perry, but mainly the former, advanced personally certain sums of money preventing the disintegration of the Treadgold properties, and in return Mr. Perry received an interest, a portion of which he held for Mr. Beatty. The latter acquainted his chief, John Hays Hammond, with these facts, and Daniel Guggenheim also knew of Mr. Beatty's personal participation. The company, however, claimed that this was a secret profit which Mr. Beatty's contract prohibited.

Chronology of Mining for May, 1915

May 1—Crushing plant of Oliver Iron Mining Co., at Escanaba, Mich., started operations. Lake Superior Hematite property of Oliver Iron Mining Co., Ishpeming, closed down and abandoned. Calumet & Hecla company granted increase of 10% in wages of surface and underground men. Decision by Judge Bourquin of the Federal Court in suit against the Anaconda company provides that the Alice mining property, sold some time ago to the defendant, shall again be offered for sale.

May 3—Stamp mill at White Pine mine, Ontanagon, Mich., started regular operation. Alaska coal lands case nol-prossed at the request of the Attorney General; said to be on account of lack of evidence. Bullwhacker Copper Co., Butte, started operations after a long shutdown.

May 4—H. L. & S. concentrating mill at Lawson, Kan., lost as the result of a cave-in; loss, $10,000. Work at Alice mine suspended by Anaconda company as a result of adverse decision in suit over its purchase.

May 7—Lusitania sunk by torpedo off coast of Ireland; many American mining men among 1500 persons lost.

May 10—Decision rendered by U. S. Supreme Court in favor of the State of Georgia in its suit against the Ducktown Sulphur, Copper & Iron Co. for an injunction to prevent the company from allowing fumes to diffuse over the state border.

May 14—Head frame at Iron Mountain mine, Minnesota, tipped over by railroad accident.

May 15—Announcement of merging of Tonopah Extension, Tonopah Merger and Tonopah Victor mining companies; not yet ratified by the several companies. Section 47 miles long of 170-mile oil pipe-line from Coalinga to Martinez put in successful operation.

May 17—New Washoe acid plant of Anaconda company put in commission. No. 1 reverberatory at International smeltery, Miami, filled with calcines for first time. Shaft house at Chambers-Fernald mine, Cobalt, destroyed by fire.

May 18—Chile Exploration Co.'s plant at Chuquicamata started operations. New record established at Duluth docks by loading 10 boats with 86,000 tons of ore in one 10-hr. shift.

May 20—Bishop Creek mill, Inyo County, Calif., started operations.

May 22—Mount Lassen, California, broke into eruption.

May 23—Italy declared war on Austria-Hungary.

May 26—Shift boss at Utah Apex mine, Bingham, murdered by discharged employee.

May 28—Utah, Nevada, Ray and Chino declared dividends; all raising rates except Ray, which was a return to the rate paid before passing its dividends.

May 30—Violent eruption of Mount Lassen; first eruption May 30, 1914.

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Port Pirie, Australia, Smelting Plant

Meetings of the North Broken Hill and Broken Hill South Mining companies were held in Melbourne, Apr. 29. These companies adopted the proposal to form a new company, in conjunction with the Broken Hill Proprietary Co., to take over the Port Pirie (S. A.) smelting works, Bellambi coke works and other assets and contracts of the Proprietary, according to the *Australian Statesman and Mining Standard.* The nominal capital of the new company will be £750,000, of which £600,000 will be issued at once. The Proprietary company will be paid £450,000, £200,000 being in fully paid shares in the new company and the balance in cash. The North and South companies each take up £200,000 in shares, making up the £600,000 now being issued. It is thought that some of the other companies will wish to participate, in which case the reserve shares will be drawn upon.

According to the statement made by the chairman, W. M. Hyndman, at the North Broken Hill meeting, the three contracting companies will enter into agreements whereby the whole output of lead concentrates produced at Broken Hill for 50 years will be disposed of to the smelting company. The new company will take over the works on June 2. In order to maintain the strength of the company's financial position, £250,000 worth of 6% debentures will be issued, of which £200,000 will be available immediately.

The new company will be entirely British. The directors are Messrs. Bowes Kelly, Duncan McBryde, F. C. Howard, W. L. Baillieu, M. L. C., and W. C. Robinson.

It was later officially announced that the directors of the Zinc Corporation have accepted a participation of £100,000 in the Broken Hill Associated Smelters Proprietary, Ltd. This is the lead-smelting combination formed by the Broken Hill Proprietary, North Broken Hill and Broken Hill South to acquire the Port Pirie smelteries of the Broken Hill Proprietary. From the wording of the official notice, it may be inferred that the Zinc Corporation was asked to put up a large sum of money; but whether the participation of the other three companies is reduced in favor of the Zinc Corporation or whether the corporation buys reserve shares is not clear, says the *Financial News* of London. Possibly there is some connection between this participation and the refusal of the Treasury to allow shareholders on the London register of the three Broken Hill companies interested to subscribe. Or it may be that the Zinc Corporation had a hand in the scheme some time ago, and has only just announced the fact. The matter will doubtless be elucidated in the forthcoming annual report of the corporation.

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Improvements at Mt. Lyell

The Mount Lyell Mining & Ry. Co. has decided to proceed with the installation of a flotation plant at Mt. Lyell, Tasmania, according to the *Financial Times* of May 19, 1915. It is also intended to remodel the converter plant, which was resolved on two years ago. Inconvenience having been caused in past summers by shortage of water for smelting purposes through the exceptionally long spells of dry weather, it has been decided to build another large reservoir adjoining the two already constructed on the western branch of the Queen River, which will increase the present storage by several million gallons.

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Platinum in California

Special Correspondence

The presence of a strange metal in the ores of the Long Tom mine, near Bakersfield, Calif., was noticed in April during the retorting of a batch of amalgam. The retort residue had about the appearance of babbitt metal, and an investigation was begun to explain its presence. A second batch of quicksilver from the mill-trap was retorted with the same result. The presence of platinum and of palladium was suspected, but the latter was eliminated after several tests. The presence of platinum, however, is believed by those who made the tests to be satisfactorily established.

The tests for platinum being somewhat unusual, the experimenters followed the outline given by Lodge, of the Massachusetts Institute of Technology. Isolating some of the particles which were under suspicion, they appeared as a grayish white metal heavier than iron and other sulphides, and occurring in diamond shape as well as in cubes, and also in smaller flat and granular particles. The isolated material was dissolved in *aqua regia*, the nitric acid dispelled by using hydrochloric, and the solution evaporated to a sirup. Taking up this sirup with a drop or two of distilled water and cooling, portions were taken and treated with a drop of concentrated potassium-iodide solution. The deep wine-red color, as noted by Lodge, was obtained in each instance and, upon reheating the solution, disappeared. Another portion of the water solution was tested with a solution of ammonium chloride and allowed to stand over 24 hr., when the yellow crystals of ammonium chloroplatinate came down. The test was again confirmed, as in the previous case, by operations with specimens of pure platinum. The experiments were made, both together and independently, by Ward M. Mills, of the Bakersfield (Calif.) High School, and Ralph W. Bender, metallurgist of the Long Tom mine.

[The assay for platinum, or even its qualitative determination, is unusual and extremely difficult to perform without special experience. In proving the occurrence of this unusual element it would be necessary to leave no stone unturned to be sure that the metal was not introduced in some accidental manner. Tests upon the material used for making the assays would be important, particularly in the case of quicksilver, and perhaps some of the materials used for assay. Again, tests should be made on different portions of ore or concentrate, and the samples should be retaken, checked and rechecked to avoid any possibility for error. When all of this has been done by one experienced in the detection of the Pt group of metals the presence of platinum might be announced with justification. For instance, in the present case, the iodine reaction shows only some metal which is being reduced from higher to lower valence. Ferric chloride will give this reaction. As to the formation of an $(NH_4)_2PtCl_6$ precipitate, not enough is told of the conditions to judge of the work. There may be platinum there, but its existence is not proved by this testimony.—Editor.]

Decision in the Steel Corporation Case

The general points in the decision of the U. S. Circuit Court in the anti-trust prosecution against the Steel Trust are reviewed on the editorial pages. The Court's remarks concerning the so-called Gary dinners and the conclusions of the judges are printed below.

These meetings, it is stated, were attended by some 45% of the steel industry, in addition to representatives of the Steel Corporation, in all 90 to 95% of the steel industry of the country. The testimony as to what happened at these meetings is cited, and the court then states:

To our minds, the testimony taken as a whole makes the conclusion inevitable that the result of these meetings was an understanding about prices that was equivalent to an agreement.

Certainly there was no positive and expressed obligation. No formal words of contract were used. Most of those that took part in these meetings went away intending to do what they pleased, but many, probably most of the participants, understood and assented to the view that they were under some kind of an obligation to adhere to the prices that had been announced or declared as the general sense of the meeting, and feeling bound to maintain them until they saw good reason to do otherwise, and until they had signified to their associates their intention to make a change.

We cannot doubt that such an arrangement, or understanding, or moral obligation, whatever name may be the most appropriate, amounts to a combination or common action forbidden by law. The final test, we think, is the object and effect of the arrangement, and both the object and the effect were to maintain prices, at least to a considerable degree.

The testimony quoted will make it abundantly clear, we think, that even prices formally assented to at these meetings were not regarded at all by many manufacturers, for it is plain that the consumers who testified had no difficulty in buying at rates sensibly below the prices thus referred to.

It is only fair to add that, in our opinion, the participants in this movement did not intend to act illegally. No doubt they did intend to exercise their full legal rights, but of course they could not be wrong in so doing, and they believed they had succeeded in keeping within the proper limits.

For the reasons given, we think they were mistaken, but we acquit them of trickiness or attempted evasion.

But the period of coöperation had passed away before the bill was filed, and, as far as we can see, it is not likely to be repeated.

We do not think the Gary movement would justify us in imposing so drastic a penalty as the dissolution of the corporation, but we will, if the Government moves for such action, retain the bill for the purpose of restraining any similar movement by the defendants that might be contemplated hereafter.

We may perhaps suggest that, under recent legislation, Congress may have provided a sufficiently active remedy for any future action that might have for its object the adoption or the maintenance of unreasonable prices.

Conclusions

In brief, the conclusions of the court are these:

As to some of the defendants it is apparent the bill should be dismissed

Concerning the principal relief sought against the corporation and its subsidiaries, we are of opinion that the Government has not made out a case that should be followed by a decree of dissolution, and we are also of opinion that sufficient reasons have not been afforded to justify us in now awarding an injunction.

But, as already stated, if the Government so desires, the court will retain jurisdiction of the cause for the purposes above outlined.

All of the four judges concur in the final result, and are in entire agreement as to the decree to be entered, although Judge Woolley in his separate opinion, which is concurred in by Judge Hunt, shows that his conclusions are based upon somewhat different grounds than those of the other two judges referred to at length above.

The four points discussed by Judge Woolley and his reasoning thereon may be summarized as follows:

First. Was the direct and necessary effect of the organization of the Steel Corporation unduly to restrain trade or to create a monopoly?

(a) Regarding its control over raw materials, the corporation has not been guilty of monopoly, and the bill is dismissed as against the defendants, Rockefeller, who were alleged to have combined with the corporation in restraining trade in iron ores.

(b) Regarding the charge of monopoly growing out of the Steel Corporation's control over finished products, it is found that the corporation does not dominate the industry, and that its size and consequent power are not sufficient to retard the growth of efficient competition. In distinguishing the power of the corporation from the intent with which it was formed, and its conduct subsequent to its organization, it is held that in its inherent nature the corporation is not a monopoly, and that the direct and necessary effect of its organization is not to unduly restrain trade.

Second. Was an intent to monopolize or unduly restrain trade shown by the circumstances which led up to and surrounded the organization of the corporation?

On this branch of the case it is found that the object of the formation of the corporation was to eliminate competition, but that, notwithstanding the intent of its organizers, and its size, it happened that the corporation, after its organization, was confronted by forces beyond its control, and was affected by trade laws and conditions which had been either forgotten or ignored, and that in competing with others who entered the field against its subsidiaries supplied with ample resources, equipped with modern plants and unencumbered with obsolete and dismantled properties, it was without power alone to do what its organizers expected of it; that it lacked the power of monopoly, and was immediately forced to resort to old devices of pools in order to control the price of its products.

Third. Was intent to monopolize or restrain trade shown by the after conduct of the corporation?

After stating that the corporation did not resort to the usual methods to restrain trade, such as receiving rebates, opposing labor, deteriorating the quality of its products, creating an artificial scarcity of raw or finished materials, oppressing or coercing its competitors, the opinion says that the only conduct of the corporation violating the statute consisted in coöperating with competitors by other means and at different times in fixing and maintaining prices.

Fourth. In 1911 and prior to the filing of the bill, the corporation, it is found, had entirely ceased to coöperate with its competitors in fixing or regulating prices.

Alaska Mines Combination

The Morgan-Guggenheim syndicate has combined the valuable copper mines in the syndicate's Alaska holdings into the Kennecott Copper Corporation. J. P. Morgan & Co. has purchased an issue of $10,000,000 of 10-year 6% bonds of the new company and placed them with investors privately.

The syndicate's principal investments are in these mines and in the Copper River & Northwestern Ry. It is said that the Kennecott financing is for the purpose of reimbursing the syndicate for sums expended upon development work and for the provision of capital for the acquisition of additional properties.

The Kennecott Copper Corporation was organized recently in New York with issued capital stock of 672,000 shares without par value. There will be issued an additional 400,000 shares to provide for conversion of the bonds, the holders of the latter having the right after two years to convert them into stock at the rate of 40 shares for each $1000 bond. The bonds are redeemable on June 1, 1917, and on any subsequent interest day at 105. The mortgage securing the bonds provides for an annual sinking-fund payment equal to at least 50% of the net earnings of the corporation. A certificate increasing the capital stock from $500 to $6,000,000 was filed at Albany on Saturday, and the corporation tax of $36,000 paid.

The new corporation has also taken over the stock of the Beatson Copper Co. Control of the new company through the stock will remain with the Morgan-Guggenheim interests.

Supreme Court Decides Against Ducktown Company

On May 10, 1915, the Supreme Court handed down a decision outlining the conditions under which the Ducktown Copper, Sulphur & Iron Co. might operate its smelting plant and acid works at Isabella, Tenn.

The decision is the outcome of a proceeding begun in 1905 by the State of Georgia vs. the Tennessee Copper Co. and the Ducktown Copper, Sulphur & Iron Co., which were smelting copper ores in Polk County, Tennessee, near the Georgia line. The works of the former company is about one-half mile from the boundary, and that of the Ducktown company is about 2½ mi. from the Georgia line. The state claimed damage to vegetation within its borders from noxious gases of the smelting works, and the case was determined in its favor in May, 1907. The time for entering the decree of injunction, however, was postponed to permit the defendants to complete the acid works they were then constructing in an endeavor to eliminate the objectionable gases.

The Tennessee Copper Co. and the State of Georgia finally entered into a stipulation whereby the company undertook to supply a fund to compensate those injured by fumes from its works, to conduct its plant subject to inspection in specified ways, and between Apr. 10 and Oct. 1 not to "operate more green-ore furnaces than it finds necessary to permit of operating its sulphuric-acid plant at normal capacity." The state agreed to refrain from asking for an injunction prior to October, 1916, if the stipulation were fully observed. Thus the Tennessee company is not directly concerned with the recent decision, although it is named as one of the defendants.

The Ducktown company and the State of Georgia were unable to reach an agreement, and in February, 1914, the state asked for a perpetual injunction. The company maintained that conditions had changed materially since 1907, and leave was granted to present "additional testimony to relate solely to the changed conditions" which had arisen since the case was decided. After considering the new evidence submitted, the court declares that insufficient data were presented to judge of the results attained and prescribes the conditions under which the Ducktown company's works may be operated. The decision so far as it relates to the operations of the Ducktown Copper, Sulphur & Iron Co. is as follows:

> The Ducktown company has spent large sums—$600,000 and more—since the former opinion in constructing purifying works (acid plant), and a much smaller proportion of the sulphur contained in the ores now escapes into the air as sulphur dioxide—possibly only 41½% as against 85½% under former conditions. Similar improvements have been installed by the Tennessee company at great expense, but we are without adequate information concerning the effect produced by them. As it asked and was granted opportunity to show material changes, the burden is upon the Ducktown company. A full and complete disclosure of the improvements installed by it and the results continuously obtained have not been presented.
>
> Counsel maintain that escaping sulphur fumes now produce no substantial damage in Georgia, and further that if any such damage is being done the Tennessee company alone is responsible therefor. We think the proof fails to support either branch of the defense, and the state should have a decree adequate to diminish materially the present probability of damage to its citizens.
>
> The evidence does not disclose with accuracy the volume or true character of the fumes which are now driven off daily from the works of either company. Estimates may not be relied on with confidence, since the suspension of operation for a single week or day might destroy their accuracy to a large extent, while the emission of great quantities of fumes during a short period would affect but slightly the average for a month or year.
>
> It appears that in 1913 the total ores smelted by the Ducktown company amounted to 152,249 tons, or 484 tons per day; 20% sulphur; total matte shipped was 12,537,000 lb., about 4% of the ore; the total sulphur in the smelted ores not accounted for and which escaped into the air in the form of dioxide was 13,102 tons, or 26,204,000 lb.—over 2 lb. of sulphur for each pound of matte and an average of more than 35 tons per day.
>
> During July, 1913, the total matte shipped (approximately the production) was 846,000 lb.—more was shipped in June and less in August. The July production was thus approximately 7% of the year's total. The sulphur in the fumes generated in connection with the production for this month, not redeemed by the acid plant and emitted into the air, may be fairly estimated as not less than 7% of 13,102 or 917 tons—substantially 30 tons per day. This amount produced harmful results and must be diminished.
>
> It is impossible from the record to ascertain with certainty the reduction in the sulphur content of emitted gases necessary to render the territory of Georgia immune from injury therefrom; but adequate relief, we are disposed to think, will follow a decree restraining the Ducktown company from continuing to operate its plant otherwise than upon the terms and conditions following:
>
> (1) It shall keep daily records showing fully and in detail the course and result of the operations.
>
> (2) A competent inspector to be appointed by this court shall have access to all the books and records of the company, shall make frequent careful observations of the conditions—at least once each fortnight—during the next six months, and at the end of that time shall make full report with appropriate recommendations. An adequate sum to cover the necessary costs and expenses must be deposited with the clerk by the company.
>
> (3) It shall not permit the escape into the air of fumes carrying more than 45% of the sulphur contained in the green ore subjected to smelting.
>
> (4) It shall not permit escape into the air of gases the total sulphur content of which shall exceed 20 tons during one day from Apr. 10 to Oct. 1 of each year or exceed 40 tons in one day during any other season.
>
> The cause will be retained for further action and either party may apply hereafter for appropriate relief. Within 10 days either side may present a decree in conformity herewith, together with such suggestions as seem desirable.

Justice Hughes dissented from the decision, saying: "I do not think that the evidence justifies the decree limiting production as stated." The Chief Justice and Justice Holmes joined in this dissent.

The Anaconda Improvements

Section 1 of the Washoe concentrator, with the new flotation process, is now in operation. The capacity of this section is 2000 tons of ore per day. The new leaching plant (with a capacity of 2000 tons per day) and the acid plant (with a capacity of 100 tons of acid daily) were put in operation about a fortnight ago and are working satisfactorily.

Duration of Michigan Leases

The clause of the Michigan Constitution which forbids a lease of agricultural lands for a longer period than 12 years under a single lease does not invalidate a lease of agricultural land for mining ore for 50 years, although the contract excludes any right in the lessee to utilize the land for agricultural purposes. This is the holding of the Michigan Supreme Court in the recent case of De Grasse *vs.* Verona Mining Co., 152 *Northwestern Reporter*, 212.

Editorials

The Steel Decision

The decision of the United States Circuit Court at Trenton, June 3, in the long-pending case of the Government versus the U. S. Steel Corporation for dissolution of the latter on the ground of its alleged violation of the Anti-Trust Law cleared the atmosphere of business. The case has, of course, been appealed to the Supreme Court by the Government, but in view of the unanimity in the decision rendered by the judges of the Circuit Court and the common sense of that decision, there is little concern about a possible reversal by the Supreme Court.

Judge Buffington and his associates decided that the evidence showed that the U. S. Steel Corporation had not throttled competition. They found, on the contrary, that since the organization of the corporation the business of its competitors had increased proportionately more than its own. This was merely an establishment of fact, and was exactly in line with the opinion expressed by unprejudiced persons acquainted with the conditions of the iron and steel industry ever since the Government's suit was brought.

With respect to matters of opinion the important things in the judgment of the court were the transactions involving the purchase of the Tennessee Coal & Iron Co. in 1907, the bigness of the U. S. Steel Corporation, and the Gary dinners. The Court decided that the Tennessee transaction was a proper one, thus settling a political controversy that has been constantly cropping up.

The most important thing in the decision, however, is the pronouncement that mere bigness in corporate business is not a crime. Our country has been growing big, and our corporations, our business interests, have been growing big along with it. Some of our fellow citizens would have it that this was a crime. In the Trenton decision it is said flatly that it is no crime. The big corporation must do something illegal before it can be held to be criminal.

In the price fixing through the medium of the famous Gary dinners the U. S. Steel Corporation did something that was illegal in the opinion of the Court, but the Steel Corporation had abolished that practice before the Government brought its dissolution suit, and therefore no charge could be maintained against the corporation on that score. The corporation had been guilty of an improper practice inadvertently, but upon its own discovery thereof voluntarily discontinued it. Indeed, everybody of intelligence knows that from the beginning of the anti-trust movement the directors of the U. S. Steel Corporation searched themselves and their affairs with minuteness for the purpose of purging their company of everything about which there was the least suspicion of illegality.

We know now from the Trenton decision that there is nothing illegal in the organization and operation of a big company. We know moreover that there must not be any collusion in fixing prices. These set up two important and unmistakable guide posts for the direction of business and the enthusiastic public response shows that they are satisfactory.

Equally satisfactory is the indication of a favorable change in public sentiment respecting the big business interests of this country, a disappearance of the trust-baiting fury, and the passing into obsolescence of the disgraceful demagogues who did so much to stir it up.

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The Situation in Lead

During the last fortnight lead, ordinarily the most quiet of the major metals, has experienced an advance in price nothing less than spectacular. Wall Street early had the tip that it was going promptly to 6c. and speculators had visions of a repetition of the performances in spelter. Recent events have taught that anything is possible in the metal markets during this time of war. With regard to the situation in lead and the conditions that started the advance, certain things stand out as facts, but other things are shrouded in mystery.

The lead market had been strong for a considerable time while the leading interest was maintaining its price at 4.20c., as was shown by a higher price being realized by independent producers, buyers being willing to pay what they asked. The Missouri producers had increased their output to the rate of a year ago, or nearly thereto. On the other hand the producers of the Cœur d'Alene and of Utah and Colorado had failed to increase their production to the former rate.

A reason assigned for the first advance in price from the level of 4.20c. was the desire to stimulate the production of the mines, an increased demand for lead in the second half of 1915 being foreseen. In order to do that, however, no such advance as 1c. per lb. within 10 days was necessary. The advance of a mere fraction thereof would have done all the stimulating that would have been desirable. Upon the advance a large volume of business was done. The increases that were made from day to day were in conformity with the orders received.

The buying orders were to a considerable extent from the manufacturers of ammunition, and to a considerable extent were ostensibly orders for export. In some of the latter buying, however, it was thought that there could be detected the hand of a speculative pool that was contemplating the same kind of an operation which was so successfully conducted in the early days of the advance in copper.

The probability is that the advance was started by the buying for ammunition and that some speculative interests intervened, producing a competition that enabled sellers to make their own terms. A matter of much interest in this connection is the quantity of accumulated stocks in the hands of the lead producers. This is ever a subject of mystery for reasons that we have frequently stated. For a long series of years the position of lead stocks has been nothing but surmise and guess in so far as the public is concerned and indeed the independent producers themselves. At the present time there is no doubt some unsold stock of lead on hand. Certain persons of good information believe it to be rather large; others of equally good information believe it to be rather small. The extremes of the two views might be represented by the figures of 35,000 to 85,000 tons. We have no idea whether either of those figures is anywhere near the truth. We are inclined to believe, however, that the lead stock is not very large.

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The Liquidation of Stratton's Independence

The liquidation of Stratton's Independence, Ltd., which is now being executed, following a meeting of the stockholders last month, will terminate an interesting British investment in a Colorado mine. The output of the mine to the present time has been about $23,573,500, of which Mr. Stratton obtained $3,985,440, the old Stratton's Independence Co., $15,064,320, and the present company, which was a reconstruction of the first British company, $4,523,740. The old Stratton's company paid $4,748,989 in dividends, which was 31.5% of the gross value of the ore produced. In 1906 Philip Argall was appointed to take charge of the property, at a time when the mine was regarded as approaching its end. Mr. Argall recommended the erection of a mill of 120,000 tons annual capacity for the purpose of treating the ore in the dump, and by a reconstruction of the company about $250,000 was raised for the completion of the mill.

The subsequent record of this company, under the direction of Mr. Argall, is one of the brilliant achievements of modern mining and metallurgical engineering. The first unit of the mill was put in operation in April, 1909. The second unit, paid for out of profits, was put in operation in March, 1911, bringing the milling capacity up to about 130,000 tons per annum. The sampling of the dump by employees of the old company had led to the expectation of an average grade of $3.60 per ton. In fact it turned out to be only about $3 per ton. Nevertheless, the estimated profit of $1 per ton was nearly realized, for the reason that Mr. Argall's estimated cost of $1.52 per ton milled—a cost for mining and milling this dump ore which many said would never be attained—was bettered by 14c., and the promised gold extraction of 70% was gradually raised to the neighborhood of 80%. As things have turned out, the estimated profits, figured in 1908, have been realized within 2% of the prediction, and that 2% was in favor of the stockholders.

To the management it was ever an irritating feature that when the mine was exhausted and the dump of low-grade ore was milled, the excellent reduction plant would probably become valueless, notwithstanding that this was contemplated in the original plans. As is so often the case, fortune once more favored the brave, and Stratton's Independence had an opportunity to sell its property, especially its mill, to the Portland Gold Mining Co. for about $300,000. This transaction was consummated in May, and Stratton's Independence now finds itself with cash resources of about $450,000, the disposition of which has not yet been determined. Having learned what mining and milling are when conducted upon a sound basis, most of the stockholders in this company appear to be desirous of continuing in the business. The engineers for the company will therefore probably be looking for a new mine to develop, though for the moment the affairs of the company are [illegible] by legal matters attending the conclusion of its Cripple Creek enterprise.

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New Alaska Mining Law

The Territorial Legislature has passed a new mining code supplementing the mining laws of the United States in Alaska which repeals the so-called Roden Bill, passed in 1913, which has caused such widespread discussion and dissatisfaction. That portion of the code which relates to the location, etc., of lode claims is the direct result of the earnest effort of the Alaska Mining & Engineering Society, which consists of about 60 of the best known resident engineers of the territory, including the members of the staffs of the Treadwell, Gastineau, Juneau, Ebner and other prominent companies. A committee drew up a tentative act which was submitted to the society for general discussion at two sessions. At these meetings the Mines and Mining Committee of the Territorial Senate and House were present and a full discussion was had and better understanding of some of the more technical provisions was arrived at than could have been secured otherwise.

With certain small amendments, the act was duly passed by both houses and approved by the governor in substantially the form in which it was drawn by the society, and it may therefore be said to be a legitimate child of the engineering profession.

Two points seem noteworthy in this connection. First, while it is conceded that the act is not altogether free from defects, it will serve a useful purpose, having been drawn by experienced, not to say talented, engineers. Second, the rounding out of this act was done by the Engineering Society and the joint Legislative Committee at *meetings of the society* where the atmosphere, for psychological reasons, if no others, is much more conducive to thorough technical deliberation and discussion than are the legislative chambers. The ideal way to frame practical legislation is on lines similar to those which brought to successful fruition these efforts of the Alaska Mining & Engineering Society.

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Cobalt to be Produced in the United States

It is understood that the American Smelting & Refining Co. is about to begin the recovery of cobalt and cobalt oxide at its plant at Maurer, N. J., presumably from the Cobalt ores treated now for their silver content.

Cobalt is of growing importance among the metals, largely through the work of Elwood Haynes in developing non-corrosive and high-speed cutting cobalt alloys, and through the work of Doctor Kalmus for the Canadian Government in working out formulas for cobalt-plating baths which seem faster in operation and easier to keep in condition than are nickel baths, while the resulting plate is equally satisfactory.

This new move of the Smelting Company seems to be the logical outcome of the progressive research work on byproducts which it has been prosecuting for the last several years.

BY THE WAY

The rise in the value of zinc ore at Joplin, Mo., occurred with music. The event was thus described by the Joplin *Globe*: "Enthusiasts in Joplin circulated a subscription list to engage the Carthage band to play on Main Street, Friday night, June 4, in celebration of the arrival of $100 zinc. By the time the band had been engaged, the price had gone to $102 a ton. By the time the uniformed players, instruments in hand, arrived in Joplin it was learned $105 had been paid. By the end of the second selection it was $106. When the program was half over it was reported $110 had been paid, and before the closing march it was learned on reliable authority that a base price of $112 had been paid for local zinc ore."

*

The British appear to be wasting a large percentage of their best human material in their process of "muddling along" in the war, but occasionally their eyes are opened. There are many in this country who know Walter Gardner, son of Henry Gardner, managing director of Henry R. Merton & Co. Young Gardner studied mining engineering at Freiberg and later at Columbia. Soon after the outbreak of the war he enlisted in the British army, and went to the front. It is told of him that after serving as a private in the trenches for about six months, some sapping plans were inaugurated at the point where he was. Therein his mining experience played a useful part, of course, and attracted the attention of his superiors, who obtained the idea that such knowledge could be employed better than in the ranks. Consequently young Gardner was sent home for a little training in military engineering, after which he was returned to the front with a commission.

*

Our old New Mexican friend Alum Mountain is again in the limelight, its inexhaustible deposits greatly enriched by metasomatic infiltration during its two years' absence. "Standing near the headwaters of the Gila River in New Mexico there is a mountain 1000 ft. high and 2 square miles in area which is devoid of all vegetation except cactus and agave, and which is believed to be one of the most highly mineralized masses of rock in existence. This is known as the Alum Mountain and it is owned by one man," states *Popular Mechanics*. "One of the minerals which form a large proportion of the mountain's billions of tons of rock is so rich in aluminum that it is expected to afford an inexhaustible supply after the bauxite deposits of the East are used up. The peak is of volcanic origin, and it is thought that almost pure aluminum, as well as large deposits of gold, will ultimately be found in it. Beautiful imitation rubies, emeralds, topazes and diamonds have been made from its minerals. It is also expected to prove a valuable source of sulphuric acid, which is in great demand as a reducer of phosphate rock for fertilizer." Al_2O_3—Al, 53.3%; O, 46.7%—nearly pure aluminum! Why gold, why not gallium or samarium, if we are just supposing? Why sulphuric acid? What's the use, anyhow? But possibly the newspaper that claims to have taken this from *Popular Mechanics* has butchered it in transmission.

The *Marion County News*, a yeller of Yellville, Ark., emitted the following yell:

> The "Engineering and Mining Journal" recently published an editorial under the caption, "Don't Buy Zinc Mines Now." The burden of its argument in support of such strange advice, is because of the unusually high price of ore and the temptation to float worthless mining stocks and properties on the public, thus assuming that the investor in such enterprises is not capable of looking into the merit of what is offered for sale.
>
> To be sure the war is doubtless having something to do with the unprecedented price of spelter, which will, in all probability, decline when peace is made. But spelter can decline in price very materially without necessarily affecting the price of ore, if the past ratio of values are to be respected in the future.
>
> We wonder what influence stimulated that publication to volunteer such counsel to the public without charge, just at a time when conditions are most peculiarly favorable to the opening up of new fields, where mining investments can be made to better advantage than ever before.
>
> Can it be possible that some great power behind the throne, such as the smelter trust, had anything to do with inspiring this piece of sage advice, in order to discourage investors and give the public cold feet on zinc mining investments, while the smelters and their allies gobble up and get a corner on the zinc mines of the country?

This is reminiscent of the allegations respecting the British gold of the Cobden Club which for so many years was imagined to be working against the disinterested citizens of this country who wanted to maintain a high tariff. Why smelters whose business is smelting ore should desire to discourage the production of ore deponent saith not. But, nay, we overlooked the possibility that the smelters may want to gobble up and corner the zinc mines of the country. The owners of zinc mines would best watch out lest the bogy man get him.

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Decision Against Southern Pacific in Oil-Land Case

A telegram of June 8 from the United States district attorney at Los Angeles announces a decision favorable to the Government in the six suits pending in the district court for the return of oil lands now held by the Southern Pacific Co. The Department of Justice at Washington has issued the following announcement:

> The patents for these lands were issued more than six years prior to the institution of the suits, and the railroad company filed motions to dismiss the Government's bills upon the ground that the suits were barred by the statute of limitations, the act of Mar. 2, 1896, providing that no suit should be brought to cancel patents after six years after the date of their issue. The Government contended that the patents were secured by fraudulent representations of the railroad company's agents that the lands were not mineral, when in fact they were mineral and were known to be so at the time of their selection and at the time of the issue of the patents; that the railroad company had devised a scheme whereby its fraud in securing the patents was concealed and that such fraud did not become known until a comparatively short time before the bills were filed.
>
> The railroad company also contended that the Government's bills did not sufficiently show that the lands were valuable for their mineral contents.
>
> The decision of the court upholds the Government's bills in every particular and constitutes a sweeping victory for the Government.

The Southern Pacific won its case on these lands in the Supreme Court. The court ruled, however, that the Government could bring another suit if it alleged fraud. This the Government did two days before the limitation of time within which the suit could be filed. Local officials of the Southern Pacific believe that the present decision is merely a denial of a preliminary motion of the company to dismiss the suit.

PERSONALS

C. W. Merrill, of San Francisco, is visiting New York.

Otto Wartenweiler has been in Pioche, Nev. He will design a mill for Yuba Leasing Co. there.

R. B. Brinsmade spent May examining gold and copper mines near Jalapa in the state of Vera Cruz, Mexico.

John T. Reid, of Lovelock, Nev., is at the Herald Square Hotel, New York. He will return to Nevada next week.

W. H. Howard, of the A. S. & R. Co., whose headquarters are in Salt Lake, Utah, is in New York for a couple of weeks.

F. W. Bradley, of San Francisco, who has been ill for some weeks, intends to go to Honolulu and remain there until the end of July.

J. B. Tyrrell, of Toronto, Ont., was elected president of the Geological Section of the Royal Society of Canada at the annual meeting, May 27, in Ottawa.

John D. Ryan has been elected president of the Anaconda Copper Mining Co., B. B. Thayer becoming vice-persident. C. F. Kelly, of Butte, Mont., is also a vice-president.

Frank H. Probert has given up his offices at Los Angeles and has removed to Berkeley, Calif., where his address is 28 Oak Vale Ave. He expects to open offices in San Francisco later.

Henry M. Payne is now at Dawson, Yukon Territory, engaged on professional work. About the end of this month he will return to San Francisco, whence he will sail for Siberia.

John W. Mackenzie, of San Francisco, is to go to Juneau, Alaska, as managing director of the Alaska-Juneau Gold Mining Co. to supervise the opening of the mine in a more extensive way.

A party including President A. M. Hay, Sir Henry Pellatt; I. J. R. Muirling, C. B. Flynn, M. P. Vandervoort of New York and B. W. McKinnon Chicago left Toronto, Ont., for Porcupine June 4 to inspect the McIntyre Mine.

The Houghton National Bank celebrated its fiftieth anniversary on June 9, with capital of $200,000 and surplus of $470,117. "A half century of uninterrupted service and successful achievement, spanning the history of the Copper Country since the Civil War."

George O. Bradley, Charles E. Bruff and Jules Labarthe announce the opening of offices in the Hobart Building, San Francisco, under the firm name of Bradley, Bruff & Labarthe, designing and construction engineers for mining, milling, smelting, power and metallurgical installations.

Messmore Kendall tendered a dinner at the Lotos Club, New York, on May 27, to William Braden, the organizer and founder of the Braden Copper Co., who has been spending the better part of his life in the past 10 years in Chile, and who is returning there to continue the development of important copper properties.

Huan-Yi Liang, president of the Sue Kow Shan Government lead mine, of Hunan, China, is a member of the Chinese Trade Commission that has been visiting New York. Mr. Liang, who studied at Berkeley, Calif., and later at the Royal School of Mines, London, became very successful in developing antimony mines in China and is now one of the largest producers of antimony.

OBITUARY

Daniel Mahoney died at Pueblo, Colo., June 1, aged 53 years. He had been at the smelting plant at Pueblo for a number of years and for eight years had been chief engineer at the works.

William O'Neill died at Butte, Mont., May 29, aged 34 years. He was born at Clifton Springs, N. Y., but had lived for 16 years in Colorado and Montana, where he was widely known as a mining man.

Patrick Clark, one of the best known mining men in the Northwest, died at his home in Spokane, Wash., June 7, aged 65 years. He began active life as a miner in the Butte district and was for a number of years with Marcus Daly there. His first successful independent venture was with the War Eagle Mine in British Columbia, and later he was with Le Roi and other mines in the Rossland district. He was also concerned in several mines at the Cœur d' Alenes, and gradually acquired a large property. He operated to some extent in Nevada, at the [illegible]water and other mines. His latest venture was in the [illegible]shucker Mine, of which he was chief owner. For a number of years past he had made his headquarters at Spokane.

SOCIETIES

American Chemical Society—With regard to the coming annual meeting, a late circular says that the [illegible] received at the secretary's office being overwhelmingly in favor of the Great Northern R.R., which stops at Glacier National Park, arrangements have been made with this road for the party to leave Chicago on Thursday, Aug. 26. One and one-half days will be spent at Glacier National Park, and Seattle will be reached Aug. 30. Aug. 31, Sept. 1 and 2 will be spent at Seattle, and on the evening of Sept. 2 the party will take a special train to Mt. Ranier National Park, where it will remain on Friday, Sept. 3, leaving there that evening and arriving at Portland the following morning; spending the day in Portland as the guests of the Oregon Section, leaving Portland Saturday night, passing through the Mt. Shasta and Mt. Lassen region on Sunday and arriving in San Francisco Sunday evening. At San Francisco the party will break up, returning by any route desired.

American Iron & Steel Association—At the annual meeting in New York, May 28, at the morning session, Andrew E. Maccoun, superintendent of the Edgar Thompson blast furnaces, Carnegie Steel Co., spoke upon "Blast Furnace Advancement." Jerome R. George, chief engineer of the Morgan Construction Co., read a paper upon "Merchant Rolling Mills." At the afternoon meeting Edward F. Kenney, metallurgical engineer of the Cambria Steel Co., spoke upon the "Commercial Production of Sound and Homogeneous Steel." Charles J. Bacon, steam engineer of the Illinois Steel Co., delivered an address upon "Waste-Heat Boilers." "Recent Progress in Corrosion Resistance" was the subject of a talk by Daniel M. Buck, metallurgical engineer of the American Sheet & Tin Plate Co. After each of the addresses an informal discussion followed under the five-minute rule.

At the dinner in the evening President E. H. Gary delivered his annual address which was generally optimistic in its tone with regard to future business. He was followed by Charles M. Schwab, James H. Hoyt of Cleveland, John A. Penton, also of Cleveland, Willis L. King, of the Jones & Laughlin Steel Co., Joseph G. Butler, Jr., of the Brier Hill Steel Co., and Mr. Haeger, of the Haeger Cement Co. Dr. Lloyd Noland spoke upon the "Welfare Work of the Tennessee Coal, Iron & R.R. Co." His address was accompanied by stereopticon slides showing the actual conditions established.

INDUSTRIAL NEWS

The Arizona Copper Mining Co., Clifton, Ariz., is installing two 48-in. Symons disk crushers.

International High Speed Steel Co., announces that its new address is the Bennett Bldg., 99 Nassau St., New York.

A meter which gives a direct reading of air consumption has been placed on the market by the New Jersey Meter Co. of Plainfield, N. J.

Sullivan Machinery Co. announces that its Juneau office has moved from the New Brunswick Bldg., to the Forest Bldg. Burt B. Brewster is manager.

The Washita Lead & Zinc Co., of Davis, Okla., is installing a 5x7-ft. Chalmers & Williams adjustable quick-discharge tube mill and a Wood's type wet screen.

A new locomotive headlight which permits the use of a tungsten filament with a mirrored glass reflector has been brought out by the Esterline Co., of Indianapolis, Ind.

The Dayton Steel Foundry Co. of Dayton, Ohio, has recently placed an order for a one-ton Snyder electric furnace. This furnace will melt and refine cold scrap on a basic lining, producing steel castings.

The Powell Valve Co., Cincinnati, Ohio, has just placed a new valve, the "Irenew" on the market. With this valve there is no necessity for disconnecting the valve from the pipe for regrinding. The seat and valve are ground in place.

The Terry Steam Turbine Co. announces the appointment of Merton A. Pocock as district sales manager for the territory in the states of Minnesota, North and South Dakota. His office is 400 Endicott Bldg., St. Paul. Also the Hawkins-Hamilton Co., People's National Bank Bldg., Lynchburg, Va., for its representatives in Virginia.

The business of the Wells Light Manufacturing Co., Jersey City, N. J., has been acquired by the Alexander Milburn Co., of Baltimore, Md.; manufacturers of high power portable lights, and oxy-acetylene welding apparatus. Repair parts for outstanding Wells Lights will be manufactured and supplied in the future by the Alexander Milburn Co. from its Baltimore factory, and complete Wells oil lights will also be furnished where desired, in conjunction with the standard Milburn acetylene lights. The manufacture of Wells oil preheating burner outfits will be continued by the Milburn company and sold in connection with Milburn oxy-acetylene apparatus.

TRADE CATALOGS

The Deming Co., Salem, Ohio. Catalog J. Power Pumps. 19 pp., illus., 7x9 inches.

Dodge Sales & Engineering Co., Mishawaka, Ind. Catalog. Gearing. 126 pp., illus., 6x9 inches.

Hanna Engineering Works, Chicago, Ill. Catalog No. 3. Pneumatic Riveters. 64 pp., illus., 6x9 inches.

Kerr Turbine Co., Wellsville, N. Y. Bulletin No. 52. Economy Turbo-pumps. 24 pp., illus., 6x9 inches.

Hazard Mfg. Co., Wilkes-Barre, Penn. Price List. Oil and Gas Well Wire Lines. 12 pp., illus., 3½x6 inches.

The Holt Mfg. Co., Stockton, Calif. Bulletin A 60-108. Holt Caterpillar "45", 32 pp., illus., 7x10 inches.

Chalmers & Williams, Inc., Chicago Heights, Ill. Catalog N. Tube and Ball Mills. 36 pp., illus., 7x9 inches.

Cresson-Morris Co., Philadelphia, Penn. Form No. 1001. Barometric Condensers. 28 pp., illus., 9x12 inches.

The C. D. Pruden Co., Baltimore, Md. Loose Leaf Catalog. Portable Steel Buildings. Illus., 8x11 inches.

Scranton Pump Co., Scranton, Penn. Bulletin No. 102. Duplex Plunger Pumps. 12 pp., illus., 6x9 inches.

The Jeffrey Mfg. Co., Columbus, Ohio. Bulletin No. 141. Single Roll Coal Crusher. 32 pp., illus., 6x9 inches.

Denver Engineering Works Denver, Colo. Bulletin No. 1072. Isbell concentrator. illus., 8½x11 inches.

The Marion Steam Shovel Co., Marion, Ohio. Catalog No. 93. Marion Reliability and Your Profits. 48 pp., illus., 5½x8 inches.

Link-Belt Co., Philadelphia, Penn. Wagon and Truck Loaders for Coal, Coke, Stone, Sand, etc. 48 pp., illus., 6x9 inches.

Link-Belt Co., Philadelphia, Penn. Bulletin No. 221. Circular Storage System for Storing Coal, etc. 4 pp., illus., 6x9 inches.

The Statistics Bureau, 5 E. 42d St., New York. Catalog Materials for the Graphic Presentation of Facts. 20 pp., illus., 6x9 inches.

Turbo-Gear Co., Industrial Building, Baltimore, Md. Catalog A. Turbo-gear. Speed Reducing or Speed Increasing Gear. Illustrated.

Myers-Whaley Co., Knoxville, Tenn. Catalog No. 5. Shoveling Machines for Underground and Surface Work. 28 pp., illus., 8½x10 inches.

Kennedy-Stroh Corp., 120 Broadway, New York. Catalog Section B. Ore Milling, Cyaniding and Smelting Machinery. 86 pp., illus., 6x9 inches.

Chalmers & Williams, Inc., Chicago Heights, Ill. Bulletin, Section T. Modern Crushing Machinery. 16 pp., illus., 7x9 in. Section R. Symons Disk Crusher. 24 pp., illus., 7x9 inches.

Byron Jackson Iron Works, Inc., San Francisco, Calif. Bulletin No. [illegible] Exposition Edition. Useful Engineering Data Pertaining to Pumping Problems. 48 pp., illus., 6x9 inches.

W. A. Butchart, Denver, Colo. Bulletin No. 1. Butchart Riffle System. 16 pp., illus., 6½x9½ in. Bulletin No. 2. Butchart Concentrating Table. 18 pp., illus., 6½x9½ inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 34-U. Instructions for Installing and Operating Class N-SO Fuel Oil Driven Compressors. 24 pp., illus., 6x9 inches.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill. Bulletin No. 66-G. Air-feed Stoping Drills. 12 pp., illus., 6x9 inches. Blue Booklet No. 115. Air compressors. 32 pp., illus., 3x5½ inches.

Campbell Magnetic Separating Co., 141 Milk St., Boston, Mass. Catalog. The Campbell System of Magnetic Separation for the Treatment of Zinc, Iron Sulfid Ores and Table Middlings. 8 pp., illus; 6x9 inches.

Spray Engineering Co., 93 Federal St., Boston, Mass. Bulletin No. 101. Sprays for Cooling Condensing Water. 14 pp., illus., 6x9 in. Bulletin No. 151. Washing and Cooling Air for Steam Turbine Generators. 8 pp., illus., 6x9 inches.

The Jeffrey Mfg. Co., Columbus, Ohio. Bulletin No. 165. Wagon and Truck Loaders for Crushed Stone, Sand, etc. 16 pp., illus., 6x9 in. Bulletin No. 166. Wagon and Truck Loaders for Bituminous and Anthracite coal. 24 pp., illus., 6x9 inches.

The Lidgerwood Manufacturing Co. has just issued a leaflet describing a small mine hoist which stands only 2 ft. 3 in. high, although the drum holds 1000 ft. of ⅜-in. rope or 800 ft. of ½-in. rope. It is equipped with a 5-hp. motor, for either a.-c. or d.-c. current, as ordered.

Sullivan Machinery Co., Bulletin 65-C. Sullivan Diamond Core Drills. 36 pp., illus., 6x9 in. This bulletin gives not only information relating to Sullivan core drills but also general advice on diamond drilling that should be of value to anyone contemplating such work. The bulletin gives detailed lists of equipment comprising a wide range of diamond-drilling outfits, together with prices for the complete outfits and for the various parts.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CLASSIFIER and Dewaterer. Walker J. Boudwin, Salt Lake City, Utah. (U. S. No. 1,140,793; May 25, 1915.)

CLASSIFIER—Rotary Classifier. Charles O. Michaelsen, Omaha, Neb. (U. S. No. 1,140,700; May 25, 1915.)

CONCENTRATOR. Charles F. Paige, Oakland, Calif., assignor of one-third to Adolph W. Jones, Oakland, Calif. (U. S. No. 1,140,764; May 25, 1915.)

COPPER—Process of Extracting Copper from a Sulphate Solution. Noak Victor Hybinette, Christiansand, Norway. (U. S. No. 1,140,682; May 25, 1915.)

DRILL—Hand Drill. Joseph Buscavage, Tamaqua, Penn. Filed Nov. 18, 1914. (U. S. No. 1,140,572; May 25, 1915.)

DRILL BITS—Machine for Making and Sharpening Drill Bits. Samuel V. Rawlings, Calumet, Mich. (U. S. No. 1,140,396; May 25, 1915.)

FLOTATION of Minerals. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,140,865 and 1,140,866; May 25, 1915.)

FUEL—Furnace Stoker for Feeding Coal-Dust or Other Comminuted Fuels. Charles L. Heisler, Schenectady, N. Y. (U. S. No. 1,140,817; May 25, 1915.)

FUEL—Process for Converting Fine Coal Into a Marketable Fuel. John Evans, Melbourne, Victoria, Australia. (U. S. No. 1,140,735; May 25, 1915.)

GALVANIZING—Method of Galvanizing. William Gibson, Sr., Vandergrift, and Robert Skemp, Scottdale, Penn., assignors to American Sheet & Tin Plate Co., Pittsburgh, Penn. (U. S. No. 1,140,898; May 25, 1915.)

HARDENING IRON—Process of Hardening Iron. Santiago Luis Brown, New York, N. Y. (U. S. No. 1,140,568; May 25, 1915.)

ORE CAR. William C. Carr, Buffalo, N. Y. (U. S. No. 1,140,497; May 25, 1915.)

ORE-POCKET DOOR. Charles G. Baumgartner, Chicago, Ill. (U. S. No. 1,140,436; May 25, 1915.)

PHOSPHATE ROCK—Apparatus for Washing Phosphate Rock. George L. Davison, Mountpleasant, Tenn., assignor to Ruhm Phosphate Mining Co., Mountpleasant, Tenn. (U. S. No. 1,140,962; May 25, 1915.)

PYROMETERS—Protecting Hood for Thermo-Couples. Andrew F. Mitchell, Homestead, Penn. (U. S. No. 1,140,701; May 25, 1915.)

SINTERING—Apparatus for Sintering Ores. Albert F. Plock, Pittsburgh, Penn., assignor to the Pittsburgh Metallurgical Co., Inc., Pittsburgh, Penn. (U. S. No. 1,140,710; May 25, 1915.)

STEEL—Process for Making Steel. George E. Weissenburger, Berlin, Germany, assignor of one-half to Otis Elevator Co., New York, N. Y. (U. S. No. 1,140,550; May 25, 1915.)

TIN—Apparatus for Detinning Tin Scrap, Boxes, or the Like. Hans Goldschmidt, Essen-on-the-Ruhr, Germany, assignor by mesne assignments to Goldschmidt Detinning Co., New York, N. Y. (U. S. No. 1,139,410; May 11, 1915.)

TUNNELING MACHINE. Walter W. Giggey, Netherland, Colo. (U. S. No. 1,140,673; May 25, 1915.)

WELDING—Art of Welding. Marshall Burns Lloyd, Menominee, Mich., assignor, by mesne assignments, to the Elyria Iron & Steel Co. (U. S. No. 1,141,068; May 25, 1915.)

VENTILATION—Safety Means for Humidity-Regulating Apparatus. Willis H. Carrier, Buffalo, N. Y., assignor to Buffalo Forge Co., Buffalo, N. Y. (U. S. No. 1,138,084; May 4, 1915.)

WIRE ROPE. Telford Clarence Batchelor, Hay Mills, near Birmingham, England. (U. S. No. 1,137,690; Apr. 27, 1915.)

Editorial Correspondence

SAN FRANCISCO—June 2

Eruptions of Mud from Mt. Lassen have given rise to reports that lava is flowing from the "crater." There is no crater and no lava. The fissure which was widened last summer by the eruptions that attracted a large amount of unscientific and a small amount of scientific interest, has continued to widen as the result of numerous blowouts until the walls, softened by melting snows and rains, have become masses of mud. The extraordinary weather in May included Mt. Lassen in its unwelcome visits, and the big peak has imitated some of its small neighbors by developing into a mud spring, though on much larger scale. The large amount of mud blown out from the fissure has endangered the lives of the stock in the vicinity and scared some of the farmers stiff. Congressman Raker may now cease from his strenuous labor to have created a national park, including Mt. Lassen. Mud springs are only good for rheumatism. Not at all attractive to tourists.

The Brown Bear Leasers, who for several years industriously worked this once famous mine, have gone and the Deadwood post office has been removed to Lewiston. Deadwood was once one of the livest camps in Trinity County. The Brown Bear was a large producer down to the 450-ft. level, being variously credited with from $5,000,000 to $9,000,000. The gold in the top was free, but at the lower levels was refractory, and while some concentrates were saved a large amount of metal was washed away in the tailing from the 15-stamp mill. About 15 years ago a new development tunnel was driven 500 ft. lower than the old workings and a new mill installed before the new ore was developed. Various efforts were made to bring the old mine back to its former productive capacity. The old work was completed and the new work begun about the time that cyanidation was introduced in Shasta and Trinity Counties by Almarin B. Paul. It was difficult to persuade managers of such mines as the Brown Bear that cyanidation could save their values; and in many cases, as in the case of the Brown Bear, they were so wedded to the stamp mill and concentration tables that they believed no other method, except perhaps smelting, could give them better returns. They were of the old school of superintendents whose relics and wrecks are scattered over a large territory. The five families remaining are the relics and the Brown Bear mine will soon be the wreck that Deadwood contributes to the long list. Here is an opportunity for some live young mining engineer to do a little prospecting from which he can at least gain experience, and stand a possible chance of introducing investors who are not afraid of experimenting with modern metallurgical methods.

Resumption of Copper Mining at the Balaklala Mine, Shasta County, is probable. Whether smelting at Coram will be resumed or the ore shipped to Tacoma and Kennett is at present not known. Frank M. Leland, manager of the Balaklala and the Trinity mines, recently visited Coram and is reported to have stated that mining would be immediately resumed, but gave out no particulars. There was, some months ago, a prospect that the Heslewood hydro-vacuum process would be tried out at the smeltery. But at present nothing definite has developed. During the time that Mr. Leland was at Coram and San Francisco it was reported that the Mammoth Copper Co. was considering the purchase of the Balaklala and the Trinity mines. The present holdings of the Mammoth almost wholly surround the Balaklala and part of the Trinity. The original Mammoth mine was situated on the south side of Little Backbone Creek, about four miles west of Kennett and seven miles northeast of Iron Mountain mines of the Mountain Copper Co. The Mammoth has steadily increased its holdings and in 1914 acquired several large properties more or less developed. In the present year other properties have been added and still others are said to be contemplated. Should the Balaklala and the Trinity be taken over by the Mammoth it would be but a short time before the entire developed and prospected properties in the west side copper belt of Shasta County, with the exception of the Mountain Copper Co. holdings, would come into possession of the Mammoth. Such accumulation of copper mines would form an ideal opportunity for the mining and smelting of copper on an immense scale. Whether the Mammoth is "out of the woods" in its relation to the farmers of Shasta County or not, the situation at present is sufficiently assuring to warrant the advancement that has marked the conduct of the company in the past few years. At any rate the Mammoth has shown that it is in a better position than any other of the copper mining companies who undertake the smelting of ores in Shasta County. Even with the acquisition of the properties in question and the enlargement of smelting facilities on a scale made possible by this probable advancement, it is not believable that the farmers will entirely refrain from further annoyance; but from both legal and industrial points of view the Mammoth Copper Co. would be in a stronger position to withstand such attacks than it has ever been.

DENVER—June 3

Tungsten Ore or Concentrate running 60% WO_3 is now worth $540 per ton. On June 2, the Primos Chemical Co. announced at Boulder that it would pay $9 per unit for this grade of material. Tungsten miners are "getting busy."

There Will Be Paid Approximately $484,700 during the next three years as indemnities to employees in metalliferous mines of this state, according to estimates based upon statistics of mine accidents durng past three years, by Fred Carroll, new state commissioner of mines, as a result of the new provisions of the workmen's compensation act passed at the last session of legislature.

Zinc—American Smelting & Refining Co. is adding a new furnace to its zinc-smelting plant at Blende, near Pueblo, thereby making a total battery of nine furnaces with an aggregate daily capacity of 110 tons ore. Company is also adding six furnaces to its plant at Sand Springs, Okla. New Jersey Zinc Co., probably largest purchaser of zinc ore in Colorado, working its smelteries at full capacity. Average settlement price in this state last week was on basis of $13.42 for spelter, but this represented very limited tonnage. Smelting concerns claim they are overstocked with ore, the Empire company stating that its own mines produce all the ore the plants can smelt.

Two Interesting Lawsuits were tried last week in the district court at Leadville. One, involving the Hellena mine in Iowa gulch, was brought by numerous creditors who pooled their interests and were represented by a local hardware company. Evidence showed that the Hellena company spent about $45,000 in development and pumping while marketing $16,000 worth of ore. This is an instance of wrecking a promising mining enterprise through lavish expenditures by an ignorant, tenderfoot management sent from Eastern headquarters, in this case, Pittsburgh, Penn. The other case was brought by parties who were former partners in a lease on the M. N. claim, a fractional tract on Breece Hill surrounded by the Ibex group otherwise known as the Little Jonny. These parties left Leadville in 1897, subsequently writing that they did not care to be counted as partners in a renewal of the lease and declining to stand their pro rata of expenses in dead work. But, the presiding judge remarked this suit was "an after thought" consequent on the M. N. lease having developed into a profitable mine. The decision was given against the "quitters."

BUTTE—June 2

The First Prize of $750 offered by the Anaconda company to the foreman of the mine that made the best showing in accident records for the year ended Mar. 31, 1915, went to Thomas McGrath of the West Gray Rock mine. The second prize was awarded to John Peters of the Poulin mine. The total number of accidents in all of the Anaconda company's Butte mines during the year was 185.

Following the Dissolution of the Amalgamated Copper Co. and the taking over of the Amalgamated holdings by the Anaconda company, the organization has been adjusted so as to include those who were active in the management of both. John D. Ryan, former president of the Amalgamated, becomes the president of the Anaconda company. B. B. Thayer, who was president of the Anaconda company, becomes one of its vice presidents. C. F. Kelley remains as vice-president and managing director. The duties of Messrs. Ryan, Thayer and Kelley will be practically the same as they were under the dual company arrangement. Mr. Ryan will remain at the head of the affairs in New York and Mr. Thayer will be practically the managing head of the operating department of the Anaconda company with Mr. Kelley in direct charge and with headquarters in Butte.

The Balance of the Electrification of the Chicago, Milwaukee & St. Paul Railway from Deer Lodge, Mont., to Avery, Idaho, will be started by Aug. 15, and will complete the work for which an appropriation of $13,000,000 has been made by the road for the greatest electrical construction work in the world. Announcement was made of the decision after a visit over the line by C. A. Goodnow, assistant to President A. J. Earling. Several crews have been put to work in the field west of Deer Lodge to survey for the transmission lines that will carry the power from the main feeder lines to the sub-stations that are to be put in. The sites for the substations have already been selected; there will be seven between Deer Lodge and Avery. A similar number are now under construction on the first section of the electrification, between Harlowtown and Deer Lodge. The first section of 238½ miles will be completed by the end of the present year, if the present rate of progress in the work is maintained. The second section of the work will cover 212 miles more, making a total of 450½ miles. Alberton, a station midway between Deer Lodge and Avery, will be the pivotal point in the new district, and from there power will be supplied from the Thompson Falls plant of the Montana Power Co., which is now also nearing completion.

SALT LAKE CITY—June 4

The Salt Lake Stock & Mining Exchange during May traded in 1,136,301 shares of stock valued at $279,838.59 compared with 2,040,603 shares at $463,655.65 during April and 1,890,690 shares at $303,051 during March.

University of Utah Muddle—The committee of 25, appointed by the Alumni association of the University of Utah to investigate the university trouble, decided that in its opinion the only solution to the problem is for the majority of the board of regents of the institution and President Kingsbury to tender their resignations forthwith.

SEATTLE—June 1

Survey Coal Fields. Frank M. Johnson, supervisor of surveys for the U. S. Land Office states that the department will have 16 parties in the field in Alaska this summer making surveys of the Nenana, Matanuska and Bering River coal fields, the first two parties under his direction having sailed from Seattle for the north the latter part of May. One party consists of 19 men and the other of 10. They will go down the Yukon River to Fairbanks and thence to the Nenana fields. Other parties will leave later to make surveys of the other fields.

A New Gold Creek is being opened on the Upper Yukon according to the news brought out from Kirkman Creek where 60 prospectors getting out small dumps all last winter have just cleaned up since the thaw. Since spring has enabled work to proceed, a pay streak of good dimensions has been exposed. Many of the operators are so well satisfied with the creek that they have made their way to Dawson for outfits and several boilers are now on the way into the district. The ground runs about 4c. to the pan though Turner, Smith & Bell on the Cooly association took out $110 in four days' sluicing.

Eight Hours for Placer Miners has now been written into the Alaska mining laws by the passage by the legislature of a bill recently when they receded from the amendment to the eight-hour quartz bill whereby placer miners were excluded from the workings of the eight-hour law and the bill as passed and signed by the governor applies to mining of every description. The placer-mine owners made a great fight to have their properties excluded from the bill, claiming that the season was too short, and the difficulties so great in many sections of Alaska, that it would have the effect of putting them out of business and for a time a majority of the members of the house were inclined to make an exception in their favor. The law provides severe penalties for infringement and involves both fine and imprisonment for all mine owners who work or attempt to work their men more than eight hours per day. The law became effective on the signing of the bill.

The Removal of Federal Mine Inspector and the retention of the territorial mine inspector, at an increased salary, by the legislature has caused severe criticism in Alaska. Many of the operators maintain that it is more advantageous for many reasons to retain the federal mine inspector who is no expense to the territory and dispense with the services of the territorial mine inspector. As it is now the territory has two mine inspectors who do practically the same work in the same territory. Last year for example the Fairbanks district was visited by two inspectors, one in the employ of the federal government, under the jurisdiction of the Bureau of Mines, and the other the territorial mine inspector. The two officials went over the creeks together, gathering data and informing operators of the requirements of the law under which the mines are inspected. It is maintained that one official could have done the work, and it would have been done without expense to Alaskans. It is claimed that the work by the federal department is far more satisfactory, being carried on by a more experienced body than that of the territory.

Activities in the Tolovana District have disclosed pay that establishes the district as a paying camp which has been in doubt since the first reports of the discovery of gold. Ester Creek, Olive Creek, Tolovana, Wilbur Creek and others have now well defined pay streaks and the future of the camp is assured though just what the district will develop will not be known until later in the summer when much of the ground will be uncovered. On Olive Creek a paystreak more than 200 ft. wide has been located and extends along the creek a distance of about 1000 ft. Bedrock is 20 ft. from the surface and the pay runs about $3 to the foot. On Ester Creek which empties into Livengood on which a pay streak of $2 value has been uncovered, there is considerable work being done and pay averaging $1.50 to the foot is being taken out. On Livengood Creek on the left limit from 9 and 10 Above to 4 Below, pay that will average from $1.25 to $1.50 to the foot has been located. Bedrock in some places shows 6 ft. of gravel running 3c. to the pan. On Wilbur Creek, on Discovery claim, the ground is good enough to work judging by the number of outfits that are busy sluicing dirt. On 4 Below Mike Hess Creek, Hans Larson struck pay running 2c. to the pan of which there is a well defined streak averaging about 7 ft. in depth. The distance to bedrock is about 50 ft. That the district is well considered by operators in the north is proved by the fact that several options have been taken up and paid; the most notable change of property being that to Pierson & Johnson of the Hidden Treasure and Baltic association claims for $10,000. They are located on the right limit of Livengood creek. The Deep Channel association claim owned by Cascaden & McCord has been optioned by Harry Patterson.

TORONTO—June 5

The Tonnage of Ore Milled at Cobalt during 1914 was 80,000 tons greater than during 1913, according to A. A. Cole in his review of the mining industry of Northern Ontario. Seventeen mills treated 743,531 tons of ore; total concentrates shipped 12,682 tons; total bullion, 3,847,806 ounces.

The Draining of Cobalt Lake by the Cobalt Lake Mining Co. which owns the Cobalt Lake property is under way. Cobalt Lake has an area of 57 acres and contains 500,000,000 gallons of water. The town of Cobalt used the water in the lake for fire purposes; the N. O. L. & P. Co. electric plant used the water for cooling its transformers, etc.; while, about 3000 gallons per min. were being pumped to supply four concentrating mills. It was arranged between the interested parties to discharge the water into a gully which would carry it to Farr Creek and thence to Lake Timiskaming. The scheme of dewatering the lake presupposed the conservation of all the run-off in the water shed of Pickerel Lakes and Bass Lake, to the south, and comprising 970 acres, and to pipe and flume it to a reservoir where it could be carried to the various mills. To this end a pumping station was built on the North shore of Bass Lake, discharging into South Pickerel Lake. The discharge is through 1260 ft. of 16-in. wire-wound wood-stave pipe. In order to lift the conserved water from the Pickerel water shed, a pumping plant, similar to that at Bass Lake, was placed on a scow at the north end. The discharge, working against a 55-ft. head, is through 1270 ft. of 16-in. wood-stave pipe, and carries the water to the highest points between Pickerel and Brief Lakes, and from thence the water flows through a 2-sq.ft. flume for 1560 ft., to Brief Lake, which is in the Cobalt Lake watershed, and from Brief Lake the water flows by gravity through an opencut, 1600 ft. long, to Short Lake, 22 ft. below the level of Brief Lake. This latter lake is used as a storage reservoir and distributing point for the water-supply of the various concentrating mills. Cobalt Lake is drained by two centrifugal pumps, mounted on a scow, anchored in the deepest part of the lake, near the northern shore. These pumps have a capacity of 3500 gal. per min. against a 100-ft. head. The discharge is through two 20-in. flexible joints, one on the scow, and one on a crib at the shore, permitting an angle of movement of 20 deg., into a 20-in. wood-stave pipe, 3500-ft. long. The whole work is expected to be completed this month.

The Mining News

ALASKA

ALASKA UNITED (Treadwell)—In month of April crushed 43,799 tons ore. Estimated gross value, $88,507; yield per ton ore milled, $2.

ALASKA TREADWELL (Treadwell)—In month of April crushed 75,212 tons ore. Estimated gross value, $140,278.77; yield per ton ore milled, $1.86.

ALASKA MEXICAN (Treadwell)—In month of April, operating 29½ days, crushed 18,830 tons ore. Estimated gross value, $33,932.31; yield per ton ore milled, $1.80.

ARIZONA

Gila County

GIBSON (Miami)—George Zapp and Lou Riddle, lessees, recently shipped 40 tons of 39.18% copper ore to smeltery. They also shipped similar quantity of low-grade silver-ore to El Paso plant and are preparing to continue these shipments regularly.

ARIZONA COMMERCIAL (Globe)—Will ship most of its ore to Douglas instead of Old Dominion smeltery because latter cannot treat more sulphides than its own mines produce. Copper Queen plant will treat 120 tons and Old Dominion about 50 tons per day.

IRON CAP (Globe)—Stope on 800 level has reached Arizona Commercial property line on east, where it is still in ore of good grade, and stoping upward is now proceeding all along the orebody, 500 ft. in extent. Drifting on 1300 level of western group of Arizona Commercial is making toward old workings on Iron Cap, where flow of water formerly proved more than they could cope with. Manager Woodward of Iron Cap believes this work of Arizona Commercial will reveal ore up to side lines of his company's property.

Mohave County

BLACK RANGE GOLD (Kingman)—Company was recently reorganized and will install new machinery at its mines.

UNION BASIN (Golconda)—N. L. Amster and associates have purchased Golconda zinc mine and will enlarge concentrator and add to equipment of property. Ore will be shipped to zinc smeltery at Bartlesville, Okla.

WALKOVER (Kingman)—Has been optioned to A. F. Frazer and associates by Messrs. Carney and Jepper, the prospective purchase price being $50,000. Considerable ore has been shipped to smelteries during last three years.

Yavapai County

MINICA (Kirkland Valley)—Debenture Units Mining Co. of Los Angeles has repaired 20-stamp mill at Minica mine near Kirkland Valley and will soon begin development operations on large scale.

CALIFORNIA

Amador County

MONTE DE ORO (Plymouth)—T. Jenkins has concluded arrangements with Levaggi Estate Co., owners, to operate this mine on royalty.

Butte County

VAN WINKLE (Oroville)—J. J. Riley, of Reno, Nev., reported to have sold one-fourth interest in this mine on north fork Feather River to Eastern men. Will develop with compressed air drills.

Calaveras County

PEREIRA (Jamestown)—Mrs. C. W. Miller, owner, has bonded the mine to men who propose extensive development.

Eldorado County

BLUE ROCK (Georgetown)—James Flynn is preparing to install 10-stamp mill.

BEEBE (Georgetown)—Mine will be unwatered and development work prosecuted. Shaft is down 180 ft. J. H. Robinson of San Francisco is owner.

PACIFIC (Placerville)—One of leases reported to have been sold to J. E. Oliver, said to be connected with an English company operating in South Africa. New oreshoot disclosed on the 500 level. Development is in progress.

Inyo County

WILSHIRE BISHOP CREEK (Bishop)—Assays reported to run from $14 to $50 per ton for high-grade and $14 for low-grade. Veins run from 8 in. to 5 ft.

NEW COSO (Coso)—Property known as Lucky Jim mine was sold at Independence by sheriff to satisfy judgment held by Inyo County Bank, Charles A. Collins and Walter B. Young. Mr. Young bought the property for $16,000.

CASA DIABLO (Bishop)—The 10-stamp mill is being overhauled and rebuilt. Cyanide plant will also be operated in connection with stamps. Ore is being extracted from several tunnels. Small amount of rich ore has been developed. Average will be about $40 per ton. John Taylor is operating under lease.

Kern County

YELLOW ASTER (Randsburg)—Action for control has been brought in the Superior Court at Los Angeles by Mrs. de Pauw, formerly Mrs. John Singleton. Mrs. de Pauw wishes to oust Ward Chapman from position of executor of Singleton estate and to have her husband, Count Cornelius G. A. M. de Pauw, of Holland, made president and general manager. Since death of Mr. Burcham about two years ago and death of Mr. Singleton about a year ago, Dr. Rose L. Bu[illegible] aged financial department of Yellow Aster, [illegible] continued prosperous. Placing property under [illegible] Count is not desired by those who have contributed [illegible] success.

Modoc County

VERAVALE (Cedarville)—Reported that new mill is to be installed. Experiments with ores in this district said to have proved that Call method is successful in handling refractory high-grade ores.

Nevada County

BRUNSWICK (Grass Valley)—In addition to installation of 20-stamp mill and steel headframe, small cyanide plant is contemplated.

CALIFORNIA (Grass Valley)—Surface plant, including mill, hoist and headframe, destroyed by fire. Believed to have been incendiary. E. S. de Golyer, San Francisco, manager.

NORAMBAGUA (Grass Valley)—Property reopened after being idle several years. Will require about two weeks to unwater shaft. George Campbell of San Francisco is owner.

MAJOR (Nevada)—Expected this gravel mine on Cement Hill will be reopened in June. Company has secured permit from "blue sky" commission to dispose of stock to be used for development. J. B. Proctor of Grass Valley is president and manager.

WILLOW VALLEY MINING CO. (Nevada City)—Three properties, Willow Valley, Montana, and Northern Montana, have been consolidated and will be operated by this company. Stamp mill is in operation but high-grade refractory ores are shipped to smeltery. Reported that assays show from $21 to $58 per ton. C. W. Hornick, J. L. M. Shetterley, W. E. Wright and Arthur W. Hoge are the principal members of the company.

PENNSYLVANIA CONSOLIDATED (Grass Valley)—Payments of $3 per share made to stockholders who sold mine to Pennsylvania Mines Syndicate, who are also owners of the Empire mine. The amount distributed exceeds $200,000, and about one-half of this goes to local residents. They have previously been paid about $60,000. Balance due on property is about $240,000, which is to be paid by May, 1916.

Placer County

HERMAN (Westville)—Installation of electric power plant is contemplated. Mine formerly known as Barton. Pennsylvania Gold Mining Co., owner.

RIP VAN WINKLE (Auburn)—Installation of small stamp mill this summer is contemplated by B. S. Buckman, owner.

BLACK OAK (Weimar)—Mine being reopened. Machinery will be installed as soon as retimbering is completed. E. Bell of Auburn is superintendent.

FEDERAL (Dutch Flat)—Machinery and material are being brought in for driving tunnel under town, starting at point near old brewery. Practically all owners of surface property in the town have agreed to proposition made by company. This company is also operating Gray, Cedar Creek, and Uren mines.

Plumas County

LAFAYETTE DRIFT GRAVEL MINING CO. (Marysville)—Incorporation with capital stock of $50,000. The directors are L. J. Williams, F. J. Shields, F. W. Loehne, Byron Jakes of Marysville, and F. J. Savage of Vallejo. Company organized to operate drift mines which have been worked for last two years by Shields and Williams.

ENGELS COPPER (San Francisco)—Report to stockholders states that mill has produced to April 30, 1915, 1446.87 tons concentrates, of which 56.50 tons has been marketed. Copper content averaged 36%; gold and silver approximated $5.50 per ton. Net balance of indebtedness Apr. 30, $21,153, reduced from $104,728. Value of concentrates on hand estimated to be equal to present indebtedness. Mine is situated near Taylorsville.

SENECA CONSOLIDATED (Seneca)—J. J. Riley, who has been operating Del Monte, White Lily, and other claims in consolidation, has sold one-fourth interest to Eastern men and first payment of $20,000 is said to have been made. Power drills will be installed and 1000 ft. of tunnel driven. Shaft is contemplated below the level of north fork of Feather River on White Lily claim. This property has 10-stamp mill in operation. M. S. Brandt of Boulder is superintendent.

Santa Barbara County

LOMPOC DIATOMACEOUS EARTH quarries near Miguelito Cañon will be opened up by C. D. Armstrong, Jr., J. M. Salsbury and Thomas Mathews, members of the Armstrong Cork Co. of Pittsburgh. The property comprises 300 acres in the Oliver tract, which is called the John Starr place. The material will be shipped to Pittsburgh for treatment.

Shasta County

VICTOR POWER & DEVELOPMENT (Knob)—Preparations reported for installation of hydro-electric power plant to operate Midas mines in Harrison Gulch district.

Siskiyou County

HOMESTAKE (Etna)—Operation resumed after idleness of nearly two years. Installation of milling plant this summer is contemplated. John Boyle is superintendent.

VICTOR GOLD (Etna)—Reported that order has been placed at Los Angeles for new 50-ton mill including tube mill, concentrators, rock breaker and Challenge feeder. John Nefroney is superintendent.

BLUE JEANS (Etna)—Face of 130-ft. tunnel is in good ore; vein stands nearly vertical. If further development warrants, 10-stamp mill will be installed. There is abundant water for milling. Siskiyou Syndicate is owner.

INDIAN GIRL AND NIGGER BOY (Hornbrook)—Frank Rose, representing Canadians, has taken options on these properties on Ash Creek, and Ash Creek Mining Co. has been formed to develop them. Indian Girl is noted pocket mine, having produced approximately $200,000. The 6-stamp mill is in operation. Air compressors and drills will be installed.

COLORADO

Boulder County

HERALD (Sugar Loaf)—Boulder business men have taken lease from John Yates and struck 2-ft. vein of rich gold-silver ore.

GOLD HILL (Gold Hill)—Has struck 5-ft. shoot of $50 ore in blind vein at 2200 ft. from portal of adit. Now probable that mill built prematurely on this property by promoters of company will find use.

Clear Creek County

ONEIDA (Idaho Springs)—Mill running past month on $4 ore broken during development. Has opened 30-in. shoot of ore running about 1 oz. gold and 3 oz. silver.

NEW ERA (Idaho Springs)—While development is being pushed in three different parts of mine, dump is being milled and shows an average gross value of about $6 per ton.

VINDICATOR (Idaho Springs)—Gold Standard Leasing Co. is taking over properties and has let contract for 50 ft. of drifting in the Tom Tuck vein. Casper, Wyo., and San Francisco persons comprise the new company.

STANLEY (Idaho Springs)—James Myers, of Golden, is drifting on bedrock under the alluvial deposit close to and under Clear Creek immediately below the mine dumps. He recently cleaned up nearly 20 oz. of gold in a five days' run. He is sinking another shaft and is using a 3-in. centrifugal pump to handle seepage.

Dolores County

SILVER SWAN (Rico)—Day & Arms are storing complex lead-zinc ore that requires mill separation before shipment.

CATSKILL (Rico)—J. W. Burns, owner, in driving crosscut adit, encountered vein assaying 20% copper, 8 oz. silver and 0.10 oz. gold.

EMMA (Rico)—This old and at one time splendidly equipped mine, property of A. E. Reynolds of Denver, after idleness for number of years, is being reopened by leasers. Mill should be remodeled and reasonable amount of capital expended in exploring strong vein.

Gilpin County

WEST BAKER (Central City)—Electric cables have been strung down from surface of Quartz Hill through old stopes to hoist just installed on San Juan tunnel level at depth of 225 ft. Winze being sunk in ore.

IRON CITY MILL (Black Hawk)—Is closed down during remodeling and enlargement of equipment that will increase capacity to 100 tons daily. New stamps, tables and regrinding apparatus will be installed under contract by Peter McFarlane.

Lake County

DOCTOR (Aspen)—Leasers, in 25-ft. prospect hole, have struck abundance of 30% zinc ore and are making arrangements to market it.

LITTLE CHIEF (Leadville)—Austin Blakey has struck another large body of zinc carbonate and has made first shipment—100 tons—to local smeltery.

PONSARDINE (Leadville)—Leasers ship about 50 tons per week of carbonate ore running 20 to 26% zinc. In an old drift recently unwatered by Penrose pumping project, leasers found large body of galena and sphalerite exposed by caving of old walls.

BIG FOUR (Leadville)—Contracts have been secured whereby this mine can be developed and operated through Yak tunnel. A 700-ft. lateral will be driven through Ibex ground and will cut Big Four at about 1000-ft. depth. Upraise will then connect with present shaft.

San Juan County

AMERICAN OIL FLOTATION CO. (Silverton)—Force of men remodeling Silver Lake mill and installing flotation apparatus. S. A. Rodgers is repairing and putting into commission long flume from Animas River and old electric-light plant in order that this company may generate its own power. Both mill and power plant should be ready for service within a month. Mine Superintendent Louis Schafer is pushing development in Champion mine near town and in the Mayflower mine, Arastra Gulch, hoping to provide ore supply to mill.

KANSAS

MIKE GRUMLY who has lease on Schmidt Bros.' 40 acres northeast of Galena is installing pumps to drain ground, which he expects will take about two months; in meantime he will conduct a drilling campaign to test out some ground on this 40 that has never been developed, but is thought to be rich in mineral. Grumly stated he would remodel mill and put in new sand tables.

PROUTY & CO. (Galena)—On Promoter land is sinking new shaft on head of one of drifts and when completed will move its steam hoist and other machinery to it in order to avoid running its dirt so far.

PROMOTER (Galena)—Remodeling mill and installing two new sludge tables and fine screen to handle sand that runs off in waste water. It expects recovery of about 10% from this sand which formerly was lost. Mill will be down for about two weeks.

GEORGE McCOLLOUGH (Galena)—Has taken lease on Owl tract west of Galena, and has installed steam pumps to drain ground. He will lease to miners on royalty basis, and run their ore over his mill on Duck Pond lease which joins that of Owl.

GRAY CAT (Galena)—On Wyandotte land south of Galena, has opened up mine from which it is making car load of zinc concentrate per week. Mr. A. Cutright, superintendent of mine, stated that mine was in good condition and that more ore was blocked out than ever before in history of mine. He expects to make some repairs on mill in few weeks and enlarge jig capacity.

MINNESOTA

MAY ORE SHIPMENTS—Total shipments of iron ore for May, 1915, from head of Lakes aggregate 3,939,456 tons as against 1,595,341 for same period last year. Thus far, 1915 leads 1914 by 2,653,502 tons. New 55c. ore rate which went into effect recently should result in increased production on part of independent operators. Great Northern Properties are sending out about 50,000 tons daily. Duluth, Missabe & Northern road is handling about 60,000 tons per day. Mahoning, Leetonia, Grace, Aura and Commodore are putting out 800 car loads every day.

Cuyuna Range

BARROWS (Barrows)—N. P. Ry. constructing spur to shaft site. Sinking will start soon.

BRAINERD-CUYUNA (Brainerd)—Sixteen hundred-gallon electric pump being installed. Crosscutting from shaft well under way and management plans to begin hoisting ore by June 20.

CUYUNA-SULTANA (Ironton)—Three and one-half acres from southern part of property leased to Mahnomen Mining Co. and will be stripped in conjunction with orebody of latter company. Acreage leased is an extension of Mahnomen deposit and is not main deposit of Cuyuna-Sultana Co., which is in northerly part of property.

Mesabi Range

QUINN-HARRISON (Nashwauk)—Great Northern Power Co. has completed electrification of this mine except shovels operating in pit.

HULL RUST (Hibbing)—This large mine of Oliver company is sending out nine train loads of ore per day from pit. This is more than was moved daily last year.

DEAN (Buhl)—Shipments were started from here June 1. It is hoped to get out 300,000 tons this year. Property was recently electrified throughout.

CORSICA (Gilbert)—Wooden shaft destroyed by fire last fall has been replaced by steel shaft. New power plant has been installed and other buildings erected preparatory to resuming operations after idleness of more than year.

ROWE (Riverton)—Washing plant now under construction expected to start operating by Aug. 1. Capacity will be 100,000 tons washed ore monthly. In essentials plant will be similar to those operating on sandy ores of Western Mesabi Range. Two units of hydraulic operation are at work. Is stated that these two will remove 100,000 yd. of material each month.

MONTANA

Broadwater County

COMBINATION KEATING (Radersburg)—Suit of this company against R. L. Clinton and H. Gysbert Klenze, to recover title to mining properties in Broadwater County valued at $50,000, on trial in Federal Court, came to conclusion May 29, when by stipulation of parties Clinton was given title to mines, but agrees to transfer them to plaintiff upon payment to him of $5000 paid within year. Otherwise his title is to be confirmed in perpetuity. Four claims are involved which Clinton bid in at sheriff's sale, under judgment secured by the Combination Keating company. While he claims that he bought them for himself, company declared he acted for it and took title in trust for its benefit.

KEATING GOLD (Radersburg)—According to annual report, situation at company's properties is more promising now than it has been at any previous time. During last year main shaft has been sunk to depth of 1200 ft. The 1000 level has been driven north about 1160 ft., exposing values fully as good as on 800 level. Station cut at 1150 level disclosed values in gold and copper better than those on 800 level. A body of ore between the 800 and 1000 ft. levels, 900 ft. long and 200 ft. high has been blocked out. In addition to gold, the company is producing from 90,000 to 100,000 pounds of copper per month. There are on dumps about 120,000 tons of ore of gross value of $5 per ton that can be concentrated and directors are planning to install a plant suitable for this purpose. There is promise of railroad from mine to Northern Pacific line. Preliminary surveys have been completed and work of construction will commence within month.

Granite County

BROOKLYN (Maxville)—Deal for taking over this mine by syndicate of Minneapolis, St. Paul and Toronto capitalists has just been completed. Directors of new company have announced that first thing to be done will be construction of concentrating plant at the mine and the advancing of lower tunnel, which is below workings, distance of about 400 ft. Concentrator will be finished and lower tunnel completed by Aug. 1 and the entire mine put into operation by Aug. 15. C. W. Beckley, of Butte, is one of directors of new company.

Silver Bow County

NORTH BUTTE (Butte)—New electric hoist at Granite Mountain shaft now in full operation and ore is being hoisted steadily through that shaft instead of old Speculator shaft. Development work on 3000 level is promising and indicates presence of orebodies similar to those opened up on 2800 level.

NEVADA

Clark County

DUPLEX MINE (Searchlight)—This property sold by George R. Colton, G. F. Colton and Sarah J. Gill to Duplex Mining Co. for consideration stated to be $500,000.

Esmeralda County

MERGER MINES (Goldfield)—Work resumed May 25 in raise above 1260 level in effort to find continuation of Jumbo Extension oreshoot.

JUMBO EXTENSION (Goldfield)—Shoot of high-grade ore opened in raise from 952 level, this is downward extension of shoot developed on 880-ft. level. Drift 524 on 880 level is in ore assaying $121 per ton. On 1017 level ore struck in south drift.

NEW EMPIRE-GOLDFIELD MINES (Goldfield)—Company purchased four claims in Goldfield district upon which it held lease and bond for three months. New equipment will be installed and 150 ft. of shaft will be sunk to 450 level. Expected contact-oreshoot will be cut at depth of 300 ft.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Shipment of bullion valued at $10,044 made recently from 10-day mill run.

Lincoln County

YUBA LEASING & DEVELOPMENT (Pioche)—Mill being built will also treat custom ores, greatly aiding leasers and small properties in district.

DAY-BRISTOL (Pioche)—Second payment of $26,000 made by George E. Bent and associates. Final payment must be made to receiver by June 13. Expected operation of mine will begin when final payment made, this will undoubtedly cause revival of mining in Bristol and Jack Rabbit mining districts.

Lyon County

WESTERN NEVADA (Mason)—Work at this mine controlled by Nevada-Douglas Copper Co. under way. Boarding and bunk houses repaired; new blacksmith shop built. Water supply will be obtained from mine. Some development work under way; force will be increased as soon as air is supplied. Mine opened by 300-ft. shaft and levels at 100, 200, and 300 ft. Good tonnage copper ore developed; ore contains chalcopyrite, cuprite and native copper.

Nye County

TONOPAH ORE PRODUCTION for week ended May 29 was 11,001 tons, estimated value $223,978, compared with 10,548 tons at $215,824 week previous. Producers were: Tonopah Belmont Co., 3671; Tonopah Mining, 2950; Tonopah Extension, 1900; West End, 862; Jim Butler, 1200; Tonopah Merger, 311; North Star, 54; and miscellaneous leasers 53 tons.

WORK AT NEW CAMP OF VOLCANO, 18 miles from Tonopah, is under way. On Glenn & Musser property, scene of original discovery, three leases let; one leaser has struck high-grade ore, indications on other leases favorable. Company shaft down 15 ft., high-grade shoot 15 in. wide and shoot milling-grade ore 8 ft. wide opened. On Weese property, 2 miles from Glenn & Musser strike, good-grade gold-silver ore opened. Four leases let.

LUCKY JIM (Tonopah)—This group of four claims at camp of Sylvanite being divided into 200x600-ft. blocks for leasing. One 200-ft. block will be developed on company account. Leases are let on royalty of 20% of net value of ore shipped and require 50-ft. shaft to be sunk.

Ormsby County

COMSTOCK TAILINGS in Carson River will be worked again this summer. Three companies, financed by Los Angeles and Eastern men, will operate between Empire and Dayton in Lyon County. Dredges, concentration and cyanide plants are being installed.

Washoe County

NEW TOWN OF LIMELIGHT being established on northern edge of Pyramid Lake, 2½ miles from Fernley-Lassen branch of Southern Pacific R.R., 50 miles north of Reno, by Nevada Industries Corporation. This company will develop immense deposit of limestone of remarkable purity. Deposit is three miles long; can be mined by quarrying. Samples assayed at University of Nevada ran 99.98% to 100% $CaCO_3$. First unit of plant being installed, other units to follow.

NEW MEXICO

Dona Ana County

VICTORIO (Cutter)—Property to be sold at public auction at Las Cruces, N. M. W. F. Jacoby named trustee in bankruptcy.

Grant County

EMPIRE ZINC (Pinos Altos)—Has begun concrete work for new mill.

WELCH & McKEE MINES (Hanover)—Company formed for operation of carbonate zinc claims adjoining Empire Zinc Co. Clyde M. Becker in charge. Development work being done.

ATWOOD (Lordsburg)—Company has begun shipments to Copper Queen reduction works at Douglas. Dumps being shipped. Active mining and development to begin soon. J. L. Wells in charge.

COPPER BASIN (Duncan, Ariz.)—Churn drilling being done on claims in New Mexico and Arizona. Small strike of gold ore made. Drilling has revealed good milling-grade copper ore. Messrs. White, McAllister & Phillips, of Tyrone, N. M., owners.

GOLD CROWN (Steeplerock)—Company being incorporated by E. A. Wayne, formerly of Ernestine, Mogollon, and associates. Will operate mines at Twin Peaks known as New Strike and Morris group. Two mills also included. Machinery received this week for equipping one of mills at Clear Lake. Davis Gough is metallurgist. Company has over 50 claims.

Sandoval County

COSSAK (Bland via Domingo)—Operating Lone Star mine and steadily treating 100 tons [illegible] with new stamp and cyanide mill consisting of [illegible], 20 stamps, 1050 lb., two 5x18-ft. tube mills, duplex Dorr classifier and seven-tank cyanide plant run on the [illegible], counter-current decantation system consisting of [illegible] agitators and five Dorr thickeners. Power supplied [illegible] steam plant mile distant. Power transmitted [illegible] three phase, 6600 volts. Individual induction [illegible] 12x14 air compressor at mine. Waugh drills used. Company making good recovery and shipping bullion.

Sante Fe County

SAN MIGUEL MICA CO. (Ribera)—[illegible] filed articles of incorporation. Capitalization, $50,000. Directors are Messrs. Anderson, Groth and Scott of Las [illegible], N. M.

UTAH

Juab County

TINTIC ORE SHIPMENTS for the week ended May 28 amounted to 119 cars as compared to 125 the week preceding. Shipments from Sioux mill dump have been reduced pending the construction of a spur.

EAGLE & BLUE BELL (Eureka)—High-grade ore has been followed for 50 ft. below the 1700 level by an inclined winze; vertical winze, started to mine this ore, is down 25 ft. New stope has been opened between 1700 and 1550.

Salt Lake County

OHIO COPPER (Lark)—Negotiations for leasing this company's mine and mill are reported to be under way.

ALTA CONSOLIDATED (Alta)—Ore hauling started June 1. East drift from main tunnel is following 12 to 18 in. of ore in Brain fissure. West No. 1 drift is being driven toward quartzite-limestone contact.

ALTA TUNNEL & TRANSPORTATION (Salt Lake)—West drift from tunnel is in 60 ft., following east-west fissure, and has cut 2 ft. of carbonate ore. Main tunnel is in 1200 ft., and is being advanced. Heavy flow of water has been encountered. F. V. Bodfish is manager.

EMMA COPPER (Alta)—Stringers of mineral have been opened in 250-ft. crosscut, being driven to contact of two kinds of limestone, where ore is expected to make at intersection of mineralizing fissures. Progress of 8 ft. daily being made with machine drills. Some adjoining ground has been purchased. A. O. Jacobson is general manager.

MONTANA-BINGHAM (Bingham)—First shipment of ore made May 25. Ore is heavy sulphide; pyrite, with some chalcopyrite and chalcocite, and is expected to bring about $14 per ton. Main tunnel which is being driven under contract is expected to reach the Congor vein in July, thus completing contract. Five different properties will be able to use tunnel, and several contracts have been signed.

Summit County

PARK CITY ORE SHIPMENTS for month of May amounted to 9474 tons, estimated value $378,000, compared with 6033 tons in April; 7831 in March; 8517 in February, and 7859 in January. Producers were: Silver King Coalition, 4057; Daly Judge, 3575; Daly West, 1259; Silver King Consolidated, 875; D. W. Quincy, 95; Daly, 50; Ontario, 40; American Flag, 23; others, estimated, 500 tons.

SILVER KING CONSOLIDATED (Park City)—Mine is able to ship 60 to 85 tons daily, as soon as roads are better. Ore held back by hauling conditions will be sold at an increased profit of from $4 to $5 a ton, owing to rise in price of lead.

Tooele County

SHIPMENTS FROM OPHIR are about 75 cars monthly. The Ophir Hill is shipping two cars a day, and the Cliff one car every other day.

MONTANA (Ophir)—Work being done by Kelly interests of Chicago, and 20 men are employed mining copper-silver ore. This property has been idle owing to litigation.

MONO DEVELOPMENT (Stockton)—Fifteen leasers are working on various parts of this property, which consists of 300 acres of patented ground in Dry Cañon. Silver-lead-copper ore is being mined on Ferguson & Wilson lease; strike of high-grade ore made recently on Fuller-Cavanaugh block.

CANADA

Ontario

COLEMAN DEVELOPMENT (Cobalt)—These claims in the southeastern section of the camp have been taken over by Adanac Silver Mines, Ltd., now being organized, with capitalization of $2,500,000, and operations will shortly be commenced with Andrew Grierson in charge.

BEAVER AND TIMISKAMING—A disagreement has arisen between management of these companies and Northern Ontario Light, Heat & Power Co., which has been supplying them with power. Contracts have expired and company has submitted new agreement raising price about 50% over old rate, which management refuses to accept. Power company threatens to discontinue supply if its terms are not accepted.

NORTH DOME (Porcupine)—This property, which has been in liquidation for several months, has been bought in by Timiskaming Mining Co. for $10,000, but as there was several thousand dollars owing Timiskaming by North Dome the actual cost was only about $2000. During days of Porcupine boom Timiskaming paid $250,000 for controlling interest in North Dome. It is understood that developments on property have always been unsatisfactory.

AFRICA

Rhodesia

GOLD PRODUCTION in April was 75,577 oz., an increase of 3811 oz. over March. For four months ended Apr. [illegible] total was 286,051 oz. Other production in April was 14,590 oz. silver, 282 tons copper, 1 tons lead, [illegible] tons asbestos, 790 tons chrome ore and 27,210 tons coal.

The Market Report

Metal Markets

NEW YORK—June 9

Copper has risen sharply and lead **jumped up** in a remarkable manner. The rise in spelter appears to have reached the climax—for the time being, anyway.

Copper, Tin, Lead and Zinc

Copper—About June 4 an active demand began to develop and the buying was of such magnitude as to start an advance in the price, there being about ¼c. difference between the opening and closing prices of each day for several days subsequently. By June 8 the market had reached the level of 19¾c., regular terms, or about 19.55c., cash, New York. After selling liberally at that price the principal producers raised their asking price to 20c., regular terms, and late Wednesday afternoon that price was reported as having been realized. However, there was rather a halt in the buying of Wednesday as compared with the previous day. The aggregate of business during the week was large. The manufacturers of brass for ammunition purposes were the principal buyers.

The Calumet & Hecla price for its Lake copper is 23c. There is understood to be somewhat less active demand at that price. Several users of Lake copper are now buying electrolytic and it looks as if the extraordinary differential between C. & H. copper and electrolytic is tending to contract.

The prices for electrolytic copper and standard in the London market are entirely out of joint for the reason that there is no longer a free market for standard inasmuch as no copper may be exported from England. Foreign refiners are therefore unable to buy warrants and accept delivery of the copper for shipment to their refineries.

Copper Sheets base price nominally 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire, 20@20½c. per lb. at mill, carload lots.

Copper Exports week ended May 22 are reported by the Department of Commerce at 15,183,075 lb. Principal items were 6,394,056 lb. to France, 4,213,731 lb. to Great Brtain and 2,804,214 lb. to Italy. Imports were 1,288,145 lb. metal and 581,773 lb. in ore and matte; 1,869,918 lb. in all, chiefly from Canada.

Visible Stocks of Copper in Europe May 30 are reported as follows: Great Britain, 20,312; France, 2430; afloat from Chile, 2025; afloat from Australia, 4200; total, 28,967 long tons, an increase of 1538 tons over the May 15 report.

Tin—This market has been active and strong. On June 7 there was a turnover that may almost be a record, the transactions of that day being estimated at 800 to 1000 tons. Subsequently the market was more quiet, but it continued to be very firm.

Visible Stocks of Tin on May 30 are reported as follows: London, 6523; Holland, 63; United States, excluding Pacific ports, 8060; total, 14,646 long tons, a decrease of 1139 tons during April. The stocks include tin afloat.

Lead—This metal has come to the center of the stage as the principal performer. Buyers—consumptive and speculative—took the bit in their teeth and ran away with the market, the A. S. & R. Co. completely losing control of it. The successive advances made from day to day by it were simply to catch up with the selling by the independent producers. The latter took the business of all comers and for all kinds of forward deliveries, realizing handsome premiums, while the principal producer supplied its regular customers on its regular terms, i. e., delivery during the next 30 days. In the aggregate a very large business was done, perhaps the largest of any week in recent history.

Spelter—At the end of our last week of record spelter was in a crazy position, and one that it was impossible to quote with accuracy. The same condition continued into the present week, but after the first two days the demand vanished and since that time the market has been uncertain and rather wabbly, with quotations scarcely more than nominal. Three producers reported no business done during the week, one reported a little in the early part, none in the latter part. One reported a fair business done right along. The total of transactions was light and far below what it was during the previous week. Ammunition makers appear to have satisfied their requirements, or are disposed to hold off and await developments, while as for the galvanizing business it has been simply paralyzed. Consumers have been offering spelter for resale, prompt delivery at 26c., without finding buyers, while producers were of course willing to meet that price. June-July spelter was offered at 25c. on June 9.

The British government has forbidden the use of spelter in Great Britain for any but military purposes except by its express permission.

Zinc Sheets are again higher; base price $33 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged.

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts per Lb	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
3	4 7831	49¼	18 50 @18 70	37½	5.00 @5.15	4 92½ @5 07½	23.00 @27 00
4	4.7838	49⅛	18 50 @18 80	38	5.20 @5.50	5 12½ @5.35	24.00 @27.00
5	4.7838	49¼	18.80 @19.05	39	5.20 @5.50	5.12½ @5 37½	24.00 @26.00
7	4.7831	49⅜	19.05 @19.30	39	5.50 @6 00	5.42½ @5.87½	24.00 @26.00
8	4 7838	49½	19.50 @19 60	40	5.75 @6 25	5.67½ @6 12½	24.00 @26.00
9	4 7838	49⅝	19 55 @19.80	40¼	6.00 @6.50	5.92½ @6.37½	24.00 @25.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts per Lb
3	23 5/16	80⅝	17.52	81⅝		159½	159	23 3/16	5.09	95	20.64
4	23¼	81½	17.63	82⅝		162¼	161¾	23⅝	5 07	95	20 64
5	23 5/16										
7	23⅜	83	18 03	84		164¼	163¾	24½	5 32	102½	22.17
8	23 7/16	82½	17.92	83½		166¼	165¼	25¾	5.59	105	22 81
9	23½	83	18 03	84		166½	165½	26⅝	5.78	105	22 81

*Not received.

The above table gives the closing quotations on London Metal Exchange All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb, with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4 80. £15 = 3 21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0 21¾c.

Other Metals

NEW YORK—June 9

Aluminum continues active and strong. The chief producer here is reluctant to quote except on contracts or to customers. Stocks of imported metal are small. Current quotations are rather nominal at 27@29c. per lb. for No. 1 ingots, New York. The latest London price reported is £105@110 per long ton—equal to 22.8@23.9c. per lb.—for ingots.—**Antimony** is again strong, though sales have not been large there is some inquiry. Ordinary brands range 35@38c. per lb. for spot. Some offers of Chinese at 33c. for future delivery are reported. Cookson's is altogether nominal, 46@48c. being named, with no sales.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is strong and rather excited. In New York $85 per flask of 75 lb. is quoted for large orders; for smaller parcels as high as $95@100 is named. San Francisco price is reported by telegraph at $75@80, with some sales up to $85 per flask. London price has advanced sharply, £15 per flask being quoted from first hands.

Gold, Silver and Platinum

NEW YORK—June 9

Gold sales from the U. S. Assay Office in New York in May were $2,560,570, being $43,647 less than in April. For the five months ended May 31 the total sales were $32,807,070 in 1914, and $13,109,898 in 1915; a decrease of $19,697,172 this year.

Some additional receipts of gold at New York from Ottawa are reported this week.

Gold in the United States June 1 is estimated by the Treasury Department as follows: In Treasury against gold certificates outstanding, $1,108,216,669; in Treasury current balances, $209,994,409; Federal Reserve banks against notes outstanding, $5,007,814; in bank and circulation, $591,567,104; total, $1,914,785,996, an increase of $25,643,531 during May.

Platinum is still quiet and unchanged, with prices inclined to be weak and sales small. Dealers ask $37@39 per oz. for refined platinum, and $41@44 per oz. for hard metal.

Our Russian correspondent reports that the market has improved. The demand at Petrograd continues both for small and large quantities. At Ekaterinburg speculators are buying up small lots notwithstanding the export prohibition. The market is supported by the small production of the year and by the expectation of a large demand after the close of the war. The current price at Ekaterinburg is 8.50 rubles per zolotnik—$31.96 per oz., at Petrograd 33,500 rubles per pood—$32.83 per oz.—both for crude metal, 83% platinum.

Silver has shown very little activity. The fluctuations for the week have been within ¾d. While there is no great pressure to sell, buyers are not eager. Inquiry from the Bazaars has been very moderate.

Coined silver in the United States June 1 is reported by the Treasury Department as follows: Standard dollars, $568,272,478; subsidiary coins, $185,293,471; total, $753,565,952. Of the dollars $495,177,000 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—June 5

The open market price for 60% zinc ore advanced this week to $87.50 per ton. The base price paid this week for 80% lead ore was $60 per ton.

SHIPMENTS, WEEK ENDED JUNE 5

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	1,259,030	60,000	836,780
Year	79,727,150	2,975,190	11,106,370

Shipped during week to separating plants, 1,993,320 lb. zinc ore.

JOPLIN, MO.—June 5.

Blende, high price $112, assay base per ton of 60% zinc, premium ore $110@100, medium grades $107@95, lower grades down to $85. Calamine base 40% zinc, per ton $80@70, average, all grades of zinc $95.46 per ton. Lead, high price $59, base $58 per ton of 80% metal content, average, all grades of lead, $57.12 per ton.

SHIPMENTS WEEK ENDED JUNE 5

	Blende	Calamine	Lead	Values
Totals this week...	13,803,860	1,099,600	2,574,800	$783,080
Totals this year....	251,597,890	22,635,460	37,599,930	$9,597,550

Blende value, the week, $678,070; 23 weeks, $8,126,150.

Calamine value, the week, $32,890; 23 weeks, $441,050.

Lead value, the week, $72,120; 23 weeks, $930,350.

Purchases of premium blende were made just after noon Thursday at $100, later the price was advanced to $102, then $105. Friday opened with [illegible] to $106, $107 and the day wound up with a sale of [illegible] at $110, and this for prime medium grade ore. Smelters [illegible] to believe more in at least a semblance of [illegible] to the market and, while there is an abundance [illegible] western ore around 50% to 54% zinc content [illegible] being for immediate delivery, the ore of this [illegible] converted into metal with so much greater rapidity that a price is being paid that will get it. The most [illegible] of the situation is the final shipment of all [illegible] stock, of which there was upward of 20,000 [illegible] months ago. One newly made bin of 1000 tons [illegible] the salable ore in the district now, aside from the weekly production. Instead of the production increasing, as would seem most probable with these stimulating prices, various circumstances have combined to reduce the output. Dissatisfaction where the wage scale was not advanced led some miners with families to leave for the berry fields where the wife and children could also earn some wages, and still others have gone or arranged to leave for the wheat harvest fields of Oklahoma and Kansas. Again, where wages are advanced less labor is the return. The single man will work four days a week and earn as much or more as formerly in one week and lay off. During the past three weeks the output dropped to below 5000 tons per week, having previously reached nearly 7000 tons in one week, and ranged around 6500 tons for six previous weeks. The opening of new mines is handicapped by the scarcity of labor, and prospecting and development work is retarded by the higher price commanded. Still another item effects the labor situation. Miners are forming companies of their own, leasing abandoned mines and prospecting for themselves.

Iron Trade Review

NEW YORK—June 9

There is little to be reported since last week. Domestic business shows a tendency to increase, and the general tone of the trade is good.

Foreign orders are still large. The main difficulty is the shipping, not only the high rates, but the difficulty of finding tonnage available.

Pig iron is more active and some large sales of basic iron are reported. Foundry orders for third quarter and second half are under discussion.

PITTSBURGH—June 8

While the steel trade at large, including independent steel interests as well as officials of the Steel Corporation itself, were rather confident that the famous steel suit would be decided in favor of the Corporation, the sweeping nature of the Federal court decision of June 3 has caused a decidedly cheerful feeling throughout the steel trade. There will be no change whatever in the attitude of steel sellers by reason of the decision, so far as can be observed, but it is believed the steel market will be greatly helped, partly through the stimulus the decision in favor of "big business" should give to business generally.

The steel trade, however, does not seem to be standing in need of fortuitous encouragement at this time, for the volume of actual shipping orders entered has continued to increase. Nearly all the mills have been able to increase their rolling schedules, as compared with a fortnight ago, while there is more tonnage in sight. Operations throughout the steel industry are easily at an average of more than 75% of the rated capacity, though given an ample labor supply and good weather conditions most of the mills would probably be able to exceed their regular ratings. Steel prices are showing a further firming up tendency.

Chemicals

NEW YORK—June 4

The general markets continue quiet with about the usual business forward, but no special activity.

Arsenic—Demand continues moderate and the market is generally quiet. The quotations are about $4 per 100 lb. for both spot and futures.

Copper Sulphate is steady and unchanged on a fair business. Quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is a little irregular but fairly strong. The current quotation is unchanged at 2.30c. per lb. for spot and all positions this year.

Pyrites—Imports at Baltimore for the week included 9321 tons pyrites from Huelva, Spain.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Ida., (post.)		July 1	[illegible]
Argenta, Ida.	May 10	June 10	0.001
Belcher, Nev., (post.)	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	[illegible]
Blue Star, Ida.	June 19	July 10	0.01
Carbonate, Ida.	July 23		[illegible]
Cash Boy, Nev.	May 17	June 17	0.01
Contact Copper, Mich	May 15		0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida	June 5	July 8	0.001
Glen Metal, Ida	May 11	July 1	0.002
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	[illegible]		1.00
Houghton, Mich.	[illegible]		1.00
Idora, Ida	[illegible]	July 2	0.005
Laclede, Ida	May 24	June 14	0.003
Majestic-Idol, Nev	[illegible] 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Mineral Range, Utah	May 24		0.003
Monarch Pitts., Nev	June 14	July 14	0.01
Mullan, Ida., (post.)		June 24	0.002
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich.	Dec. 1		0.50
North Bunker Hill, Ida	June 12	July 17	0.002
North Lake, Mich		June 15	1.00
Ophir, Nev	June 4	June 25	0.05
Overman, Nev.	May 19	June 8	0.05
Rainbow, Ida	July 7	Aug 7	0.002
Raymond-Illinois, Utah	May 24	June 9	0.005
Raven, Ida.	May 15	June 14	0.0006
Rhode Island, Ida	June 24	July 24	0.001
Royal, Ida.	June 1	July 6	0.0015
Selma, Utah	May 29	June 16	0.005
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida.	May 15	June 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Treasure, Calif			0.05
Union, Nev	June 18	July 9	0.05
United Tintic, Utah.	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Virginia, Ida., (post.)		June 29	0.02
West Tonopah Con., Nev	July 10	Aug 10	0.01
Wisconsin, Ida	May 15	June 15	0.003
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

Stock Quotations

The feature of the week on the stock exchanges was the sharp upturn on receipt of the Steel decision, followed by weakness on further consideration of the German situation. All lead stocks were remarkably strong.

COLO. SPRINGS June 8

Name of Comp.	Bid
Acacia	.04
Cripple Cr'k Con.	.01
C. K. & N.	03
Doctor Jack Pot	10⅞
Elkton Con.	38
El Paso	90
Findlay	04⅞
Gold Dollar	03
Gold Sovereign	05
Golden Cycle	1.77½
Isabella	17¾
Jack Pot	06½
Jennie Sample	02
Jerry Johnson	04
Lexington	‡ 008
Mary McKinney	35¼
Pharmacist	01
Portland	1.41
Raven B. H.	02½
Vindicator	1.63

SALT LAKE June 8

Name of Comp.	Bid.
Beck Tunnel	04
Black Jack	08½
Colorado Mining	.09
Crown Point	01¼
Daly-Judge	6 00
Gold Chain	10
Grand Central	56
Iron Blossom	67
Little Bell	14
Lower Mammoth	03
Mason Valley	2 50
May Day	14½
Opohongo	00¾
Prince Con	45½
Seven Troughs	01½
Silver King Coal'n	3.37½
Silver King Con.	‡1 87½
Sioux Con.	‡ 03
Uncle Sam	04
Yankee	01

TORONTO June 8

Bailey	02⅞	Dome Exten.	07
Coniagas	05	Foley O'Brien	30
Peterson Lake	22	Hollinger	25 50
Right of Way	03¼	Imperial	05
Seneca Superior	1 12½	Jupiter	09
Silver Queen	01	McIntyre	42
T. & Hudson Bay	18 50	Pearl Lake	01
Timiskaming	34	Porcu. Crown	.80
Wettlaufer-Lor	03	Preston E. D.	01½
Big Dome	14 37½	Rea	10

SAN FRANCISCO June 8

Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡ 01	Belmont	4 50
Andes	08	Jim Butler	80
Belcher	23	Lone Star	06
Best & Belcher	07	MacNamara	03
Caledonia	26	Midway	17
Challenge Con	[illegible]	Mont.-Tonopah	30
Confidence	07	North Star	.15
Con. Virginia	08	Rescue Eula	09
Gould & Curry	.03	West End Con	87
Hale & Norcross	03	Atlanta	32
Julia	‡ 01	Booth	52
Mexican	12	C. O. D. Con	04
Occidental	79	Comb. Frac.	09
Ophir	13	Jumbo Extension	1 50
Overman	06	Pitts.-Silver Peak	12
Potosi	‡ 01	Round Mountain	43
Savage	.02	Sandstorm Kendall	07½
Sierra Nevada	.08	Silver Pick	10
Union Con	.16	Central Eureka	.15
Yellow Jacket	.32	So. Eureka	‡2 25

N. Y. EXCH. June 8

Name of Comp.	Clg.
Amalgamated	73¾
Am.Sm.&Ref.,com.	75¾
Am. Sm. & Ref., pf.	106
Am. Sm. Sec., pf. B.	80
Anaconda	35¼
Batopilas Min	1⅞
Bethlehem Steel	159⅞
Bethlehem Steel, pf.	114¼
Chino	46⅛
Colo. Fuel & Iron.	30
Federal M. & S., pf.	50
Great Nor., ore., ctf.	34¼
Guggen. Exp.	63½
Homestake	118
Inspiration Con.	31½
Mex. Petroleum	76
Miami Copper.	26
Nat'l Lead, com.	65½
National Lead, pf.	110
Nev. Consol.	15⅝
Ontario Min	3¾
Quicksilver, pf.	¾
Ray Con.	24⅞
Republic I&S, com.	28⅞
Republic I&S, pf.	86
SlossSheff'd, com.	33
Tennessee Copper.	36
Utah Copper	68½
U. S. Steel, com.	58¾
U. S. Steel, pf.	110

BOSTON EXCH. June 8

Name of Comp.	Clg.
Adventure	3⅛
Ahmeek	385
Alaska Gold M.	35⅝
Algomah	3
Allouez	57⅛
Am. Zinc	55
Ariz. Com., ctfs.	8½
Bonanza	35
Butte-Ballaklava	3½
Butte & Superior	77¼
Calumet & Ariz.	63½
Calumet & Hecla	591
Centennial	20
Cliff	1½
Copper Range.	55¾
Daly West	3¼
East Butte.	12¼
Franklin	10½
Granby	85½
Hancock	21
Hedley	28
Helvetia	55
Indiana	7¼
Island Cr'k, com.	45
Island Cr'k, pfd.	89
Isle Royale	30½
Keweenaw	2½
Lake	14
La Salle.	7
Mass.	14
Mayflower	4⅞
Michigan.	1¼
Mohawk	75½
New Arcadian	11¼
North Butte	33
North Lake	2¼
Ojibway.	2
Old Colony	4½
Old Dominion	56
Osceola	85
Quincy.	88
Santa Fe	2¼
Shannon	9¼
Shattuck-Ariz.	28½
Superior	29½
Superior & Bost.	‡3⅞
Tamarack	36
Trinity	5½
Tuolumne.	43
U. S. Smelting	42
U. S. Smelt'g, pf.	46
Utah Apex	4⅞
Utah Con	14¼
Victoria	2¾
Winona	4¼
Wolverine.	62
Wyandot.	1½

N. Y. CURB June 5

Name of Comp.	Clg.
Alaska Juneau, w.i.	13¾
Alta Con	.69
Beaver Con	29
Big Four	‡ 07
Blue Bell	03
Braden Copper	7½
Buffalo Mines	‡$\frac{13}{16}$
Can. Cop. Corpn.	1$\frac{1}{16}$
Can. G. & S.	03
Caribou	.50
Cashboy	.07
Chambers Ferland.	15
Con. Ariz. Sm.	.81¼
Con. Coppermines.	2⅞
Davis-Daly	1⅞
Diam'field-Daisy	‡ 07
Dia. Black B.	08
Florence	54
Goldfield Con	1½
Goldfield Merger	25
Greene Cananea	35
Kerr Lake	4$\frac{11}{16}$
La Rose	.47
McKinley-Dar-Sa.	32
Mines of Am.	2 50
Nevada Hills	24
New Utah Bingham	3⅛
Nipissing Mines	5.75
Ohio Copper	.23
Oro	12
South Utah.	‡⅞
Stand'd Oil of N.J.	402
Standard S. L.	1$\frac{5}{16}$
Stewart	2$\frac{1}{16}$
Tonopah	7⅛
Tonopah Ex.	3⅞
Tonopah Merger	.41
Tribullion	⅞
Tularosa	½
West End Ex	04
Yukon Gold	2 62½

BOSTON CURB June 8

Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	09¼
Boston Ely	25
Butte & Lon'n Dev.	24
Calaveras	1⅞
Calumet-Corbin	.09
Chief Con	.82
Corbin	.90
Cortez	.30
Crown Reserve	.75
Eagle & Blue Bell	1$\frac{3}{16}$
First Nat. Cop.	2½
Houghton Copper	4⅞
Iron Cap Cop., pf.	5
Majestic	.55
Mexican Metals	.16
Nevada-Douglas	60
New Baltic	3¾
Oneco	2
Raven Copper	‡.10
Smokey Dev.	30
So. Lake	6¾
Tonopah Victor	‡ 31
Trethewey	14
United Verde Ext	4$\frac{1}{16}$

LONDON May 27

Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	15	0
Camp Bird	0	5	6
El Oro	0	7	3
Esperanza	0	7	9
Mexico Mines	3	12	6
Oroville	0	12	0
Santa Gert'dis	0	7	6
Tomboy	1	4	6
Tough Oakes	0	9	0

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603		61.336		66.274	......
July	13.223		60.540		64.955	......
August	*		‡		‡	......
September	*		‡		‡	......
October	*		‡		‡	......
November	11.739		53.227		*	......
December	12.801		56.841		*	......
Year	..				....	.

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577		138.321	......
July	31.707		142.517	.....
August	*		‡	......
September	32.675		‡	.....
October	30.284		‡	.....
November	33.304		139.391	......
December	33.601		147.102	....
Av. year	34.301		....	..

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	.	3.810	.	19.411	.....
July	3.891	.	3.738	...	19.051	......
August	3.875	....	3.715	....	‡	......
September	3.828	.	3.658	.	‡	......
October	3.528		3.384	..	‡	.....
November	3.683	....	3.585	..	18.500	......
December	3.800	...	3.662		19.097	.....
Year	3.862		3.737	..	.	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.965	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	..	4.850		21.345	.....
July	4.920	.	4.770		21.568	.....
August	5.568	.	5.418		‡	.....
September	5.380	.	5.230		‡	.....
October	4.909		4.750		‡	.....
November	5.112		4.962		25.016	....
December	5.592		5.430	.	27.369	...
Year	5.213	......	5.061		. .	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90		13.90		13.96	....
July	14.90		13.90		13.90	....
August	14.90		13.90		14.08	....
September	14.90		13.90		14.03	....
October	14.84		13.75		13.97	.....
November	14.59	.	13.43		13.83	.....
December	14.70		13.45		13.83	....
Year	$14.88		$13.78		$14.01	...

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Shaft-Rockhouse Practice in the Copper Country--I

By L. Hall Goodwin*

SYNOPSIS—The rockhouse is a coarse-crushing plant. Now usually combined with shafthouse and properly called shaft-rockhouse. Mining conditions govern shaft-rockhouse practice. Variety of work carried on in shaft-rockhouse. Steady improvements in design have produced modern structures, permanent, fireproof and convenient. Steel and concrete substituted for wood. Modern shaft-rockhouse consists of headframe and crushing structures over large steel bin, set at shaft collar. Blake crushers of improved design now used. Hand work reduced to minimum. A few structures over vertical shafts and a few detached rockhouses. Four structures of most advanced type just erected.

In the early days of copper mining in the Lake Superior copper country it became the practice to interpose between the mine headframe and the concentrating mill an intermediate building, known as a rockhouse, the function of which was to segregate the hoisted products and prepare them for the mill and the smelting plant respectively. Later this building was combined with the headframe to form one structure, the combination shaft-rockhouse, which is referred to prominently in the district as "shafthouse" or "rockhouse," although the latter is perhaps the more common designation. An intermediate step is exemplified by those headworks over some of the vertical shafts of the Tamarack, in which the two buildings are apparently made one, although they are in effect two separate structures on distinct foundations and separately framed and braced. Although in modern construction the two buildings are combined into one, the processes carried on in them are as distinctly separate as ever; and in this article I shall endeavor to be rather exact in nomenclature and refer all operations to the shafthouse, the rockhouse, or the shaft-rockhouse according as they properly belong to one of those buildings.

The modern shaft-rockhouse must handle a large tonnage of low-grade copper rock at a low unit cost, which necessitates the employment of every possible labor-saving device. Improvements in this line have been rapid, particularly during the last 10 years, and the operation of the modern shaft-rockhouse is highly efficient.

It is the purpose of this article briefly to review the shaft-rockhouse practice of the district as a whole. The aim will be to compare the operation of typical modern designs and to omit consideration of the older, the unusual and the inefficient methods. Here as in other places inefficient methods are in many cases still employed simply because the capital expenditures necessary for new and efficient equipment would not be amortized during the indicated probable life of the mine. The subject is broader than one might think, even with the elimination of much material; among over 75 operating shaft-rock

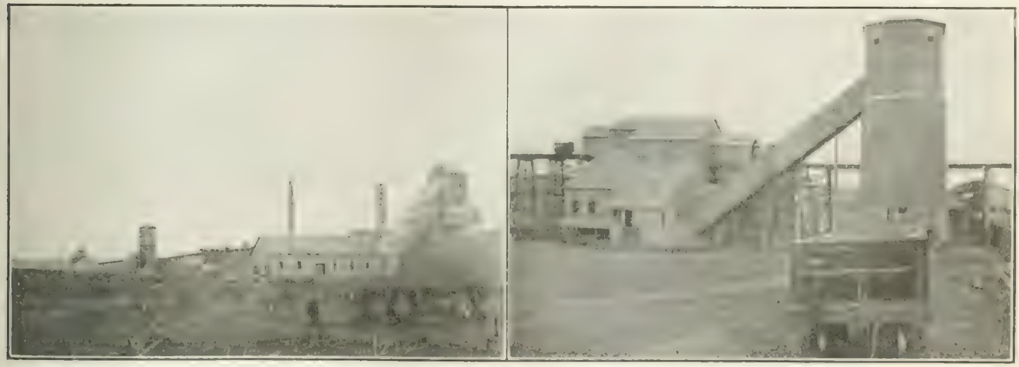

Fig. 1. Ahmeek Nos. 1 and 2; Shafthouses and Rockhouse Separate

houses in the district there are hardly any two between which interesting and profitable comparisons might not be drawn.

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Mining Conditions

The Lake Superior copper mines, without any exceptions which need be noted here, are located on inclined veins with roughly a north-south strike and a westerly dip. The lodes are comparatively narrow, the rock is of low grade, averaging only 19.53 lb.[1] per ton in 1912 for the seven mines which paid dividends in that year, and the shafts are deep. These conditions necessitate large outputs and high efficiency. The dip of the lodes at the surface varies at the different mines and in general increases as one passes southward from Calumet. Being 40° or less at the mines in and near Calumet, it increases to about 56° at the mines near Portage Lake and again increases to about 70° at the Copper Range Consolidated properties. Incline shafts are therefore the rule and vertical shafts exist only where the lode does not outcrop within the property limits.

Thus the typical Lake Superior rockhouse is set over an incline shaft, which has generally three compartments and in which two skips of from six to eight tons capacity hoist in balance. Exceptions to this rule are numerous, but are a small minority, and our attention will be largely confined to the type noted.

Uses of the Shaft-Rockhouse

The uses and requirements of a shaft-rockhouse are many and varied, as it must handle all men and materials entering or leaving the mine. Its principal function is to handle copper rock—to receive it, crush it to a size suitable to be fed to the mill stamps and to store it temporarily. Small tonnages of mass copper must be segregated from the copper rock and afterward prepared for smelting by being cleaned of adhering rock. Facilities must be provided for handling poor rock, either by tramming it over a trestle directly to the poor dump or by delivering it to main-line cars for transportation to the poor dump or by crushing and storing it for use about the mine or for selling. Storage capacity must be provided for the skips, man cars, and other conveyances and facilities furnished for easily and rapidly changing them on the hoisting rope.

Improvements in Design

The most important changes in design have been made possible by the substitution of steel and concrete for wood as materials of construction. In many cases this is extremely important from the standpoint of permanency alone. The fire risk, important in all mine headframes, has been eliminated by the erection of absolutely fireproof shaft-rockhouses. However, the most noteworthy progress has been made in the more effective arrangement of the various parts of the building, thus minimizing the amount of shoveling and of other hand labor.

In Fig. 2, *A*, *B* and *C* illustrate the development of shaft-rockhouse construction at the Quincy mine over a period of about 35 years and in a general way exemplify the progress of the district as a whole during that time. In *A* is shown the last shafthouse erected over No. 4 shaft, which was only recently torn down, although not used after 1908. This building was connected with the rockhouse, which in this case was 1100 ft. away, by a single-track trestle which entered through the small extension shown in the lower right-hand corner of the illustration.

The first shaft-rockhouse erected over No. 2 shaft is shown in *B*. I am told that this replaced a shafthouse exactly like that over No. 4 shaft. The present No. 2 shaft-rockhouse is shown in *C*, and this may be taken as typical in a general way of the uniform design to be discussed later. Thus the three pictures represent, in effect, three successive buildings erected over No. 2 shaft, the first a shafthouse, the other two shaft-rockhouses; they do not cover all of the headworks erected over that shaft, as there were at least one shafthouse and probably two houses of more primitive construction in the early days of the shaft.

The first shaft-rockhouse was built in 1894 and in 1906 was found to be unsafe because of decayed timbers, this rapid decay being caused by the updraft in No. 2 shaft. The former building offered no fire protection; the present one is as nearly fireproof as any building can be made. A better arrangement is evidenced by a comparison of the pictures and by the statement that the old building occupied 7400 sq.ft. of ground space, and had several large, widely separated, working spaces, whereas the present building occupies only 5100 sq.ft. and has, broadly speaking, only one working space, 44 ft. square, in which practically all of the rockhouse work is done. The different operations are carried on side by side and the labor required to deliver the different products from one process to another is reduced to a minimum. The tendency toward making the shafthouses permanent, fireproof and convenient is thus illustrated.

It will be understood that this comparison may be made without casting any reflection on the construction of the original shaft-rockhouse. That was a thoroughly modern building when erected and was a great improvement over earlier designs. The comparison serves to indicate what present managers may expect to have said of their present shaft-rockhouses 20 years from now.

Three Stages of Development

The shaft-rockhouse may be said to have passed through three successive stages as regards the materials of construction. The original ones were of course entirely of wood, and as late as 1895 large structures were being built of this material. Such buildings required heavy framing, for the vibration due to crushing, handling of mass copper, and especially to hoisting operations, was excessive, particularly since these operations are carried on at a considerable height from the ground. As has been noted in the case of Quincy No. 2 shaft-rockhouse, the draft from the upcasts soon plays havoc with the building, and this is also true of steel framed structures unless the exposed steel is repeatedly painted with a protective coating.

In the second stage a steel frame was used to support a wooden superstructure and floors. This has been common practice until recently. In the older buildings of this type the sidings were of boards and clapboards, but later galvanized iron attached either directly to the steel frame or over boards was always used.

In these first two stages the rock bins were of rectangular pattern, with sloping built-up bottoms, which were expensive to maintain. It is universally the custom at present to make the bottoms of all bins flat. The sloping bottom is obtained by filling around the edges of the bin with large boulders of poor rock and then dumping in finer waste rock until it assumes its natural angle of repose with respect to the bin openings. This forms a resistant bottom which will absorb a great deal of shock without transmitting it to the walls of the bin proper. This illustrates a principle of broad application. For instance, the main storage bins in the Red Jacket shaft-rockhouse have steel I-beams running diagonally through them, which were protected when first installed by an inverted V-shaped sheet-iron guard. This protection was found to be insufficient and the scheme was finally hit upon of riveting a piece of sheet iron, about 3 ft. wide, along the top of the I-beams on which rock accumulated and formed a good protection.

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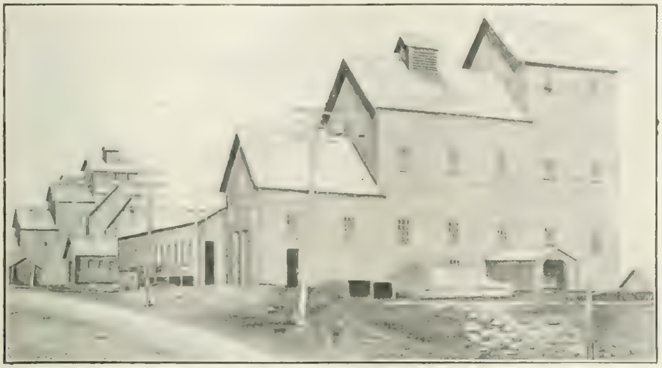
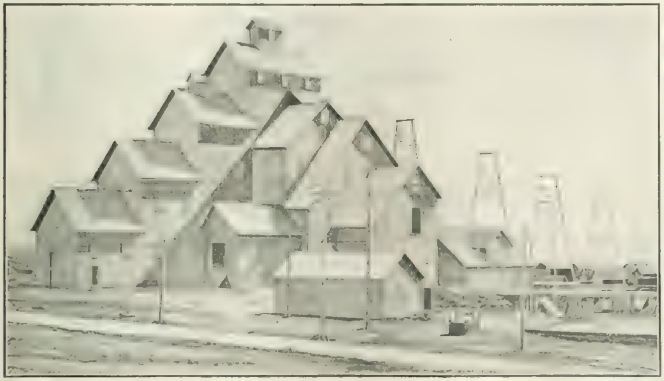
[1] Averaged arithmetically by mines, considering Copper Range Consolidated as one mine and Osceola Consolidated as one mine.

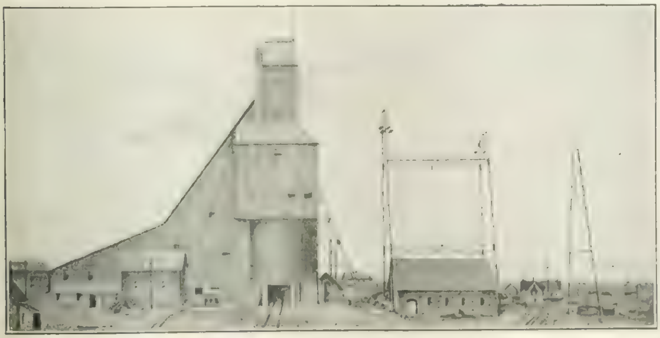
The third and latest stage in the evolution of construction methods uses a steel frame with reinforced-concrete construction throughout. Wood is used sparingly, if at all, and the fire risk is absent. Because of the heavy material handled in the building the reinforcing at many points must be exceedingly heavy, and in places this amounts to embedding heavy iron to form the exposed surfaces, especially corners. Skepticism was at first expressed as to the adaptability of reinforced concrete to this field, but results have shown it to be satisfactory where properly designed.



A—THE LAST SHAFTHOUSE OVER NO. 4 QUINCY SHAFT



B—THE FIRST SHAFT-ROCKHOUSE OVER NO. 2 QUINCY SHAFT



C—MODERN STRUCTURE OVER QUINCY NO. 2 SHAFT

FIG. 2. PROGRESSION IN COPPER COUNTRY SHAFT-ROCKHOUSE DESIGN

UNIFORMITY IN NEW CONSTRUCTION

Along with these improvements has come a tendency to standardize the building, that is, to adopt a uniform type of shaft-rockhouse throughout the district, so that practically all of the recently built examples are alike in the governing features of their design, although practice varies widely in the minor details of construction.

This design, numerous examples of which dot the Copper Country along more than 26 miles of the strike of the Keweenaw series, may be briefly described as follows: A cylindrical steel storage bin of large capacity rests on massive concrete foundations at a sufficient height above the ground to allow the passage of main-line railroad cars below it. This bin forms the foundation for a building housing the crushing floor, which is actually the rockhouse. The head sheaves are set over the crushing floor at the top of the building, and in the larger shaft-rockhouses these are in the neighborhood of 125 to 150 ft. vertically above the collar of the shaft; from this height towers, supporting idler pulleys for the skip ropes, drop off on the foot side of the shaft to the engine house, while on the hanging side the building tapers down over the incline tracks of the skip road.

The headframe proper consists of girders bearing the head sheaves and the braces supporting those girders, the girders being designed for the breaking strength of the hoisting rope. The main brace acts along the path of the resultant pull of the two parts of the hoisting rope—that is, it bisects the angle made by the rope from the engine and that from the load; the back brace consists of the truss supporting the inclined skip tracks. The heavy machinery of the crushing floor is carried on I-beams supported partly by the walls of the storage bin, but mainly by columns extending through the bin to the concrete bin foundations. The roof and sides of the building are covered with galvanized corrugated steel, attached either directly to the purlins and girts or directly to the sheathing.

Mechanical Improvements

Although the improved design of the rockhouse has been an important factor in gaining efficiency, it has been of relatively small moment when compared with the introduction of labor-saving mechanical improvements. The installation of larger crushing units has been perhaps the greatest single advance. As an example, there may be noted a rockhouse built in 1892, which at that time required the services of 12 men per shift and is now operated at much greater capacity by only three men per shift. If I were able to present exact figures as to the tonnages handled in this case, the comparison would be still more striking. This enormous increase in efficiency was largely made possible by the substitution, in two successive steps, of two 24x36-in. crushers for five crushers of smaller sizes.

All of the rockhouse crushers are of the jaw type, and all have the maximum movement of the jaw acting on the smaller sizes of the rock, which, of course, means a large crushing capacity and an irregular size of product: by them the rock is reduced to about 4-in. size, but uniformity in this regard is not important or desirable, as the purpose of the preliminary crushing is simply to reduce the rock pieces to a size which may be readily fed to the steam stamps at the mill, and in that feed a few pieces ranging up to say 4x6 in. in cross-section and 12 in. long will do no particular harm. In stating the size of crushers hereafter, the smaller dimension of the maximum jaw opening—that is, the distance between the jaws at their top—will be given first and then the larger dimension, the distance between the cheek plates. Thus the ordinary breaker of the Farrell make will be specified as 24x36 in., although the Farrell people reverse the figures and call it 36x24 in.

The original designs of the Blake crusher were not strong enough to handle a rapid feed of large sizes and reduce it to the required 4-in. size in one operation, or at least they would not stand up under this treatment. It was then necessary to crush the largest sizes of rock under the drop hammer and crush the remaining rock in two or three stages. In the rockhouse noted above as built in 1892 the five crushers used were of the following sizes: One 18x24 in., two 13x20 in., and two 9x12 in. The type of Blake crusher introduced by the Farrell Foundry & Machine Co. permitted feeding coarse sizes rapidly and running the crusher at much higher speed. This was accomplished by using a solid, one-piece cast-iron frame and by replacing cast iron at strategic points, such as the pitman, toggles, etc., by the toughest openhearth cast steel; by paying further attention to such points the duty and the life of the crusher were enormously increased. The usual type of crusher used throughout the district is, therefore, this Farrell machine of the Blake type, 24x36 in. in size. The Calumet & Hecla, however, has perfected another design, which it makes in its own shops. This is 24x48 in. and is used exclusively in its new installations.

The use of air lifts and overhead trolleys, of drop and steam hammers, has had an even more marked effect on the methods of handling mass copper. It was only a few years ago that mass was handled entirely by strong-arm methods, aided only by bars, wedges, etc. It was subsequently cleaned by the fire method—that is, by building a fire under a huge pile of the mass and thus rendering the adhering rock friable.

Shaft-Rockhouses Over Vertical Shafts

It has already been stated that the incline shaft is the more common. The famous Red Jacket vertical shaft of the Calumet & Hecla was originally planned to serve a distinct mine not connected with any other workings, so that in case of a fire in any of the incline shafts the company would have large reserves, served by the Red Jacket, from which it could keep up production; with this exception, vertical shafts are used only at the Tamarack, the Tamarack Junior, and the Hancock Consolidated, where the valuable lode underlies the property at great depth. There is another type of shaft, however, which merits attention. Profiting by the experience of the Tamarack, which in this as well as other departments bears witness to the statement "the only thing that mining at the Tamarack has shown is how not to mine at great depths," the Allouez and Ahmeek mines, which were confronted with a similar problem, reached the lode by sinking steeply incline shafts, the inclination of which changes to correspond to that of the lode when the proper depth is reached. The shafts leave the surface at an angle of about 80°, which is changed to that of the lode by simple or compound arcs of circles. By means of guides in the steep part of the shaft, the usual form of self-dumping skip is used, and the design and operation of the shaft-rockhouses do not differ essentially from those over incline shafts.

The Tamarack headworks, being of older design and serving a decadent mine, are not operated in an uptodate manner; rock is still hoisted in the tram cars on cages, and rockhouse methods are correspondingly inefficient. The Red Jacket rockhouse, while not of the most modern design, is operated in a thoroughly efficient manner, and because of the large tonnage handled it shows a low cost per ton. There are no special points in regard to it, however, which need elaboration, as its methods will be covered later in the consideration of those of the Calumet & Hecla.

The Hancock vertical shaft-rockhouse is in a different position, as it is one of the most modern in use. Its design and methods will be taken up later.

Detached Rockhouses

At the Ahmeek mine there is found a reversion to the old practice of having the shafthouse and the rockhouse in two distinct and separate buildings. The rockhouse served by its Nos. 1 and 2 shafthouses, Fig. 1, is, it is believed, the only example in the district of what used to be universal practice. In this case the arrangement was adopted in accordance with a plan of concentrating all of the mechanical equipment for these two shafts, which are 1115 ft. apart, at a point midway between them. Thus the hoists, rockhouse, boilers, and shops are centrally located. Its only advantage, aside from the concentration of mechanical equipment, is the saving in construction expenditures; the central rockhouse, being built just above the ground, is comparatively inexpensive and the two shaft-

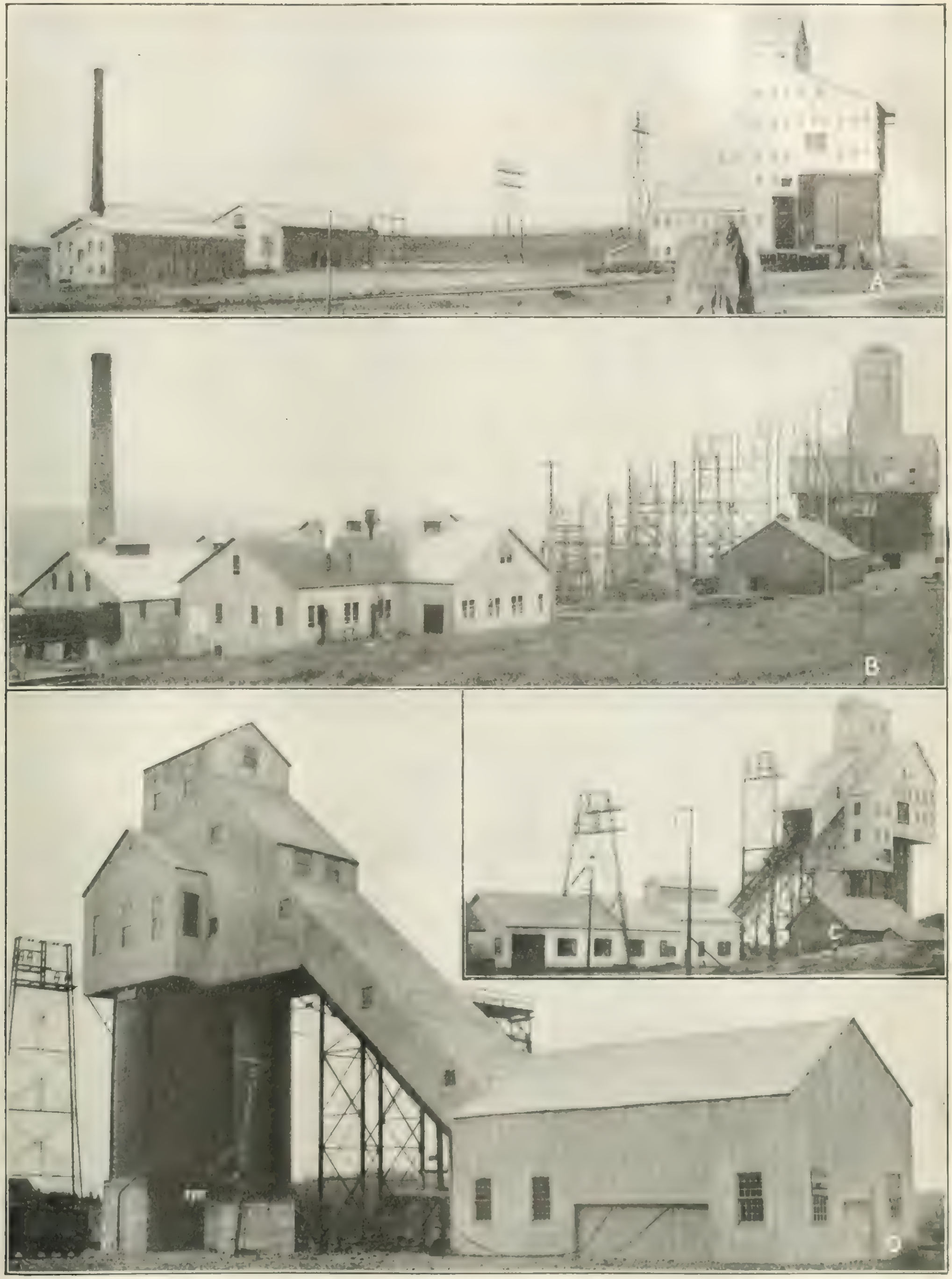


FIG. 3. RECENT EXAMPLES OF ADVANCED PRACTICE IN SHAFT ROCKHOUSE CONSTRUCTION
A—Ahmeek Nos. 3 and 4. B—Hancock No. 2. C—North Kearsarge No. 1. D—Mohawk No. 6.

houses are correspondingly so; the construction and maintenance of a long high trestle partly offset this advantage. The principal disadvantage would appear to be that if anything goes wrong with the machinery which serves both crushers two shafts rather than one are temporarily obliged to stop hoisting rock.

The system works as follows: The rockhouse is connected with either shafthouse by two double-track trestles 37 ft. high, upon either of which two 7-ton cars, each serving its respective skip, reciprocate on a tailrope haulage system between the skip dump in the shafthouse and the hopper bin in the rockhouse. From the hopper bin the rock passes to a traveling link-belt conveyor which feeds two 24x36-in. crushers. Under the crushers a hopper delivers to a shaker operated by a 7½-hp. motor, which automatically feeds the crushed rock to a link-belt bucket elevator operated by a 35-hp. motor, elevating the rock 48 ft. to the stamp rock-bin.

The South Kearsarge of the Osceola Consolidated accomplishes a similar result in a different way. Here the two shafts, 1100 ft. apart, feed one shaft-rockhouse, which is placed over one of the shafts in the normal way. All mechanical equipment is concentrated near the shaft-rockhouse, and this building is connected with the shafthouse by a double-track trestle.

RECENT CONSTRUCTION

At the present time four shaft-rockhouses of the most approved designs are just entering upon their working careers. They are serving the following shafts: No. 6 of the Mohawk, No. 2 of Hancock Consolidated, Nos. 3 and 4 of the Ahmeek (one shaft-rockhouse over two shafts) and No. 1 of the North Kearsarge mine of the Osceola Consolidated. That practice varies widely in the design of these buildings is due partly to differences of opinion, but more especially because each mine has its own individual problems of operation. Natural conditions, such as varying dip of the veins, presence or absence of heavy mass copper, etc., and external conditions, such as size of output and shipping facilities, are among those factors which impose different designs. Photographs of these buildings are shown in Fig. 3; but further discussion of them will be left until later, when the different rockhouse methods will be discussed.

(To be continued)

U. S. Mining Statutes Annotated

One of the most important publications yet to be issued by the Bureau of Mines is to come out shortly, says the *Mining Congress Journal*. Two volumes of 1000 pages each will be devoted to a compilation embracing every statute or act ever passed by Congress having to do with metal, iron, gas or coal. It will be known as "United States Mining Statutes Annotated."

The annotations consist of abstracts of decisions of all courts of the United States, Federal and state, as well as decisions of the Land Office and of the Attorney General.

These volumes are the result of long and painstaking work on the part of Judge J. W. Thompson, chief of the legal section of the Bureau of Mines. In the opinion of competent authorities, this work will be worth many thousands of dollars annually to owners and operators of mines.

The last of the proof has been corrected on each of the volumes and the finished work is expected to come from the press of the Government Printing Office soon. Owing to the heavy cost of printing, this work will not be distributed gratis. It is a sale publication, to be sold at cost, which will be $1 or $1.50 for the two volumes.

Steel Production in Great Britain in 1914

The British Iron Trade Association reports the total production of steel in Great Britain in the year 1914 at 7,835,113 long tons. This is 171,237 tons more than in 1913, and is the largest make of steel ever reported. The war has stimulated rather than checked production. The increase last year was in the face of a smaller make of pig iron, the proportion of steel to pig having increased from 73.1% in 1913 to 87.0% last year.

The total production of ingots and direct castings for the year was, in long tons, as follows:

	Acid		Basic		Total
	Tons	%	Tons	%	Tons
Bessemer	797,072	10.2	482,444	6.1	1,279,516
Openhearth	3,680,848	47.0	2,874,749	36.7	6,555,597
Total	4,477,920	57.2	3,357,193	42.8	7,835,113
Total, 1913.........	4,860,154	63.4	2,803,722	36.6	7,663,876

The increase over 1913 was 171,237 tons, or 2.2%, being wholly in basic steel. In 1913 the total production of openhearth steel was 6,063,175 tons, or 79.1% of the total; of bessemer or converter steel 1,600,701 tons, or 20.9%. The proportions in 1914, as shown above, were 83.7% openhearth and 16.3% converter steel. There was a loss in converter of 321,185 tons, but a gain in openhearth of 492,422 tons.

The production of steel in Great Britain for 10 years past has been, in long tons, as follows:

1905	5,889,460	1910	6,374,481
1906	6,462,274	1911	6,461,612
1907	6,522,748	1912	6,795,144
1908	5,295,642	1913	7,663,876
1909	5,881,628	1914	7,835,113

The make of steel in 1914 was the largest reported in the 10 years. The gain does not so much indicate an increase in finished products as a gradual decrease in the production of wrought, or puddled, iron. In the 10 years the proportion of openhearth steel to the total has increased from 65.9% to 83.7%; while there was a decrease from 34.1% to 16.3% in the proportion of converter steel.

Map of Bering River Coal Field, Alaska

A new map of the Bering River coal field in Alaska has just been issued by the U. S. Geological Survey which is in some features a departure from previous publications. This map shows the areas underlain by the various grades of coal and the formations underlying and overlying the coal measures, and gives also structure sections. The results of the proximate or exact analyses of coal from different parts of the field are printed on the face of the map. All this information is given on a base map which shows the topography of the coal field and of adjacent areas. A small insert map indicates the geographic position of the coal field in Alaska.

The new publication can be purchased from the Director of the U. S. Geological Survey for 15 cents.

Prospecting for Minerals in Ontario

By J. A. Macdonald*

SYNOPSIS—The Ontario law governing prospecting is so worded as to be difficult for the uninitiated to understand, so an explanation is herewith given. Permits are necessary for all prospectors, and certain regulations are prescribed. Working permits may be obtained when sufficient value for claim staking is not immediately available.

There are a number of important legal requirements to be complied with by the prospector or mine owner in the Province of Ontario, which are difficult for some to understand through reading the Ontario Mining Act. It certainly takes a lawyer or a mining expert to interpret this correctly, and the average prospector has considerable difficulty in knowing what to do, though the sections of the act may be before him.

Particulars as to what lands are open can be obtained at the office of the recorder, where maps are kept showing the claims taken up and the lands still open, at the following places: Haileybury, Elk Lake, Matheson, Porcupine, Gowganda, Sudbury. Claims in unsurveyed territory must be as nearly as possible squares of 40 acres with boundaries running north and south and east and west. No more than three claims can be staked out or recorded in the name of any one person or licensee in the same mining division during a single license year. The boundaries of all claims must extend vertically on all sides. Each claim includes all minerals contained within it.

In case valuable mineral is not at once discovered, provision is made for obtaining what are called "working permits." When a prospector finds a vein or indications of mineral which is not good enough to stake, but which he desires to investigate, he may protect himself by erecting "prospecting pickets."

Until a discovery post is planted, or erected, all licensees have equal rights upon lands open to prospecting, except where a licensee has found what he believes to be a vein or deposit of mineral, or an indication of such. In this event he may erect at not more than 150 ft. apart two pickets at least 4 ft. high, to be known as prospecting pickets, marking each with the letters "P. P." and his name and license number. He may then dig a trench 6 in. deep and extending at least 6 ft. from each picket along the line running toward the other picket, as in Fig. 2. When this is impracticable, he may erect a monument of earth or rock, not less than 3 ft. wide at the base and at least 2 ft. high, likewise extending 6 ft. from each picket toward the other picket. He must also blaze the standing trees, if any, along the line between the pickets (Fig. 1). Thereafter, so long as he is diligently and continuously prospecting or following up indications on the block of land extending for 25 ft. on each side of a straight line between the pickets, he is entitled to the exclusive right to prospect and to make a discovery thereon.

There is nothing, however, to prevent any licensee from prospecting anywhere outside the limits of such block of land, and the first licensee to discover valuable mineral in place and stake out a mining claim thereon is entitled to the claim, the rights of the picketing licensee ceasing thereby. A licensee, moreover, cannot have more than one block of land "picketed" at one time; if he has more than one, all his picketings are voided.

STAKING PROMPTLY AFTER DISCOVERY

After a discovery of valuable mineral in place, the proprietor (licensee), if he desire to stake out a claim, must erect his "discovery post" and as quickly as possible proceed to complete the staking out of the claim, and if he be in fact the first licensee to make a discovery of valuable mineral in place and plant a discovery post thereon, no other licensee shall be entitled to encroach on or interfere with the property while he is so completing the staking out. If, however, he be tardy in his operations and fail to complete the staking out "with diligence and speed," he shall be liable to loss of his rights in case another licensee make a similar discovery upon the property and complete the staking out before him.

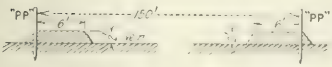


FIG. 1. PROSPECTING PICKETS WITH MOUNDS

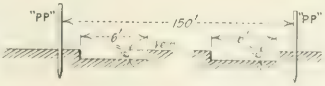


FIG. 2. PROSPECTING PICKETS WITH TRENCHES

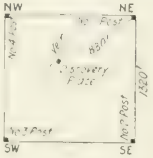


FIG. 3. DISTANCE AND CORNER POSTS

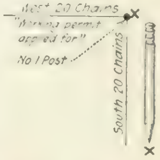


FIG. 4. PART PLAN OF WORKING PERMIT

A licensee who has staked a mining claim, or upon whose behalf a mining claim has been staked out, must within 15 days furnish to the recorder an outline sketch or plan (Fig. 3) of the claim, showing the discovery post and corner posts and their distances from each other in feet, together with an application (Form 4) setting forth the name of the licensee by whom the valuable mineral was discovered and of the licensee on whose behalf (if working for a syndicate, company, etc., the application is made. He must also give the letters and numbers of licenses; the name, if any, of the claim, and its locality, etc.; the length of the outlines; the situation of the discovery post as indicated by the distance and direction from No. 1 post; the day and hour when the discovery of valuable mineral in place was made; the time the claim was staked out, and the date of the application. The prescribed fee for registering is $10.

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*Ottawa, Canada.

A licensee who is the first discoverer of valuable mineral at a point not less than five miles from a known mine, vein, lode or deposit of the same kind of mineral, and who has staked a mining claim thereon, as in Fig. 3, accompanied by an affidavit, shall be entitled, on Crown Lands, to a patent without payment of a fixed price.

The applicant for a "free grant" must state in the affidavit accompanying the sketch and plan, Fig. 3, "that on......day of............, 191.., at the hour of..... o'clock......m., I discovered valuable mineral, etc., on the mining claim described and shown in sketch and plan hereunto attached," etc.

The following form must be used for recording a mining claim:

THE MINING ACT OF ONTARIO

Form 4. Department of Lands, Forests and Mines. Application to Record the Staking Out of a Mining Claim.

To the Mining Recorder of .... Mining Division:

Application is hereby made under the provisions of The Mining Act of Ontario to record the staking out of a mining claim containing ...... acres or thereabouts, composed of the area shown on the sketch or plan hereto attached and more particularly described as follows:

The lengths of the outlines of the claim are ....

The name of the claim is ....

The discovery post is situate ...... feet from No. 1 post.

The discovery of valuable mineral in place, upon which this claim is based, was made on the ...... day of ...., 191.., at ...... o'clock ...m., by ...., holder of miner's license No. ....

The claim was staked out and the lines cut and blazed thereon on the ...... day of ...., 191...

The claim was staked out and is to be recorded in the name of ...., who resides at ...., whose post office address is .... and who is holder of miner's license No. ......, dated the ...... day of ...., 191.., issued by the Mining Recorder of .... Mining Division

Dated at..........., this ...... day of ...., 191...

Name of applicant, License number.

Note.—If the applicant is not a resident of Ontario the name, residence and post office address of some person resident in Ontario, upon whom service may be made, must be given as follows:

Service may be made upon ...., who resides at ...., in Ontario, and whose post office address is ....

Working Permits

A licensee may obtain a working permit, which gives him, for the purpose of prospecting for minerals, the exclusive possession of an area of land open to prospecting and staking out, such area being of the form and acreage prescribed for a mining claim. This is provided for as follows:

1. Stake out the corners and mark the boundaries of such area and place numbers and particulars upon the posts in the same manner as is provided for regular mining claims, omitting only what is provided in respect to the discovery post. (The words "working permit applied for" must be written or placed on No. 1 post, and each post must be notched with three rings of notches not less than 1/4 in. deep and not less than 2 in. apart, beginning about 2 in. from the top, as indicated in Fig. 1.)

2. Supply to the recorder within 15 days after the staking out an application in duplicate indicating as definitely as possible the location of the area by reference to some ascertained boundary or locality, together with an affidavit giving the name of the licensee and other information considered necessary by the recorder to enable him to lay down the area on his office map.

3. Procure from the recorder a certificate of the application and securely affix the said certificate to post No. 1 within three days after the granting of the certificate.

4. Pay and secure to the owner of the surface rights, in the case of lands the surface rights of which have been heretofore granted, sold, leased or located, compensation for the injury or damage arising from the prospecting of such lands.

Upon compliance with these requirements and the payment of the prescribed fee, the applicant may, after 60 days from the staking out of the area, procure from the recorder a working permit which will be good for a period of six months from the date of its issue. A licensee is entitled to hold as many as three working permits in any one mining division. Until a working permit has been granted and a notice thereof (in legal form) has been affixed to No. 1 post, the area included in the application is subject to prospecting and staking out as a mining claim by any licensed prospector, but thereafter, during the continuance of the working permit or the renewal thereof, the holder shall have the exclusive right to prospect and stake out on this area.

If the holder of a working permit makes a discovery of valuable mineral in place upon the area of land included therein, he may stake out and record a mining claim there, and the necessary variations may be made in the application for the recording of the claim and in the affidavit to be filed.

The holder of a working permit must, within two weeks after its granting, start work on the claim, searching for minerals by sinking shafts or pits, digging trenches, making crosscuts, boring by diamond or other drills, or by other operations, to the extent of five days of eight hours in each week, provided such work may be accomplished in a lesser period than six months. No work, however, is required to be done between Nov. 16 and Apr. 15.

A working permit may be transferred, and the transfer must be duly recorded. The recorder can also grant to the holder of a working permit who has complied with the requirements one renewal for another six months.

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Production of Sulphuric Acid in 1914

The production of sulphuric acid in the United States in 1914, according to preliminary figures reported to the U. S. Geological Survey, was equivalent to 3,762,417 short tons of 50° acid, valued at $24,163,331; this is exclusive of 21,993 tons of fuming acid, valued at $316,596, but includes the "byproduct acid" made by zinc and copper smelters. This byproduct acid was equivalent to 950,798 tons of 50° acid valued at $5,190,293; nearly three-fifths of the byproduct acid is credited to the zinc smelting works.

PRODUCTION OF SULPHURIC ACID IN THE UNITED STATES IN 1914

Grade	Tons (2000 Lb.)	Value per Ton
50° Baumé	1,628,402	$5.96
60° Baumé	551,955	6.12
66° Baumé	916,192	11.47
Other grades	65,890	13.39
Total	3,162,439	$7.74
Total reduced to 50° Baumé acid*	3,762,417	$6.42

*Exclusive of 21,993 short tons of fuming acid valued at $316,596.

PRODUCTION OF SULPHURIC ACID BY COPPER AND ZINC SMELTERS
(Reduced to 60° Baumé acid)

	1913		1914	
Source	Tons (2000 Lb.)	Value per Ton	Tons (2000 Lb.)	Value per Ton
Copper smelters	336,019	$6.56	348,727	$6.35
Zinc smelters	296,218	7.23	411,911	7.22
Total	632,237	$6.87	760,638	$6.82
Total acid reduced to 50° Baume	790,296	.....	950,798	.....

Montana Workmen's Compensation Law

Special Correspondence

The new Montana workmen's compensation law is now in effect. Acceptance of its provisions is optional, and unless employers and employees both elect to accept its various provisions, the old law will apply. The law applies to all "hazardous employment," and about the only employments that are not included in the provisions are farm and other laborers engaged in agricultural and stock-raising pursuits, also household and domestic servants, and possibly clerks, bookkeepers and employees in stores, business houses and mercantile establishments, and practically all occupations where no power machinery of any kind is used. Interstate railroads do not come under the provisions of the act.

Both employer and employee, except as to public corporations, can exercise their pleasure as to which of three plans of compensation they wish to be bound by, or none, if they so desire. When the employer elects not to come under any of the plans, but to stay out, his affirmative defenses in an action for damages, consisting of negligence of the employee, unless willful, negligence of a fellow-employee and assumed risk, are excluded or denied him. When the employer elects to come in and the employee elects to stay out, the present law governs. When both elect to come in, the provisions of the act are exclusive. The employee is bound by the plan selected by the employer, unless he elects to stay out altogether.

It is the intention of the act that any employer engaged in hazardous occupations, before being bound by any of the compensation plans, elects to be so bound thereby and that the employee shall be presumed to have elected to be subject to and bound by the provisions of the particular plan which may have been adopted by his employer, unless the employee shall affirmatively elect not to be bound by the act. Neither can come in without the consent and coöperation of the other. The compensation for permanent disability is 50 per cent. of the employee's wages at the time of the accident, not exceeding $10 per week for a period of 400 weeks, and then $5 per week; for temporary total disability, 50 per cent. for a period of 300 weeks, not exceeding $10 per week; partial disability, half the difference between the wages received at the time of the injury and the wages he can afterward earn, not exceeding, however, the difference between such wages and the maximum amount allowed for total disability. The law is of especial interest to the mining companies, and it is generally understood that it was drawn to meet their objections and wishes. The advantage of the act to both employer and employee is generally conceded.

Plan No. 1 under the compensation law provides that any employer who can furnish satisfactory proof of ability to pay any and all of the benefits authorized by the act and also to discharge all liabilities likely to be incurred during the fiscal year may pay the compensation direct to the employees. Under plan No. 2 any employer may purchase an insurance policy, in any amount named by the board, or a larger amount if desired, in any insurance company licensed to transact business of this kind in Montana, but the insurance company is required to make deposits with the compensation board for protection of any payments of compensation the board may require. Plan No. 3 provides that any employer may come into a state insurance fund, which is divided into classes and employers are segregated under classifications, each class being assessed to pay whatever losses occur in the class, which makes these employers virtually a mutual insurance company with assessments up to a point where the class is self-sustaining. The assessments which can be levied are not limited. If an employer defaults on any assessment levied he may be sued in the name of the state.

It is believed that the new act will forever settle the controversy over the question of workmen's compensation in the state of Montana and remove one of the harassing subjects of agitation against the mining companies.

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Drilling Campaign of the Consolidated Coppermines Co.

Few people have appreciated the increase in the assets of the Consolidated Coppermines Co. at Kimberly, Nev., resulting from the drilling campaign inaugurated by the new management late in 1913. Summarized, the reserves reported to the officers of the company by Manager E. F. Gray are as follows:

	Tons	% Cu
Developed by churn drilling—sulphides ...	14,954,368	1.129
Developed by churn drilling—carbonates ..	998,529	1.720
Developed by underground work—sulphides	1,000,000	1.670
Total developed	16,952,897	1.19
Partly developed—sulphides..............	8,448,412	1.006
Total developed and partly developed ore*..	25,401,309	1.131

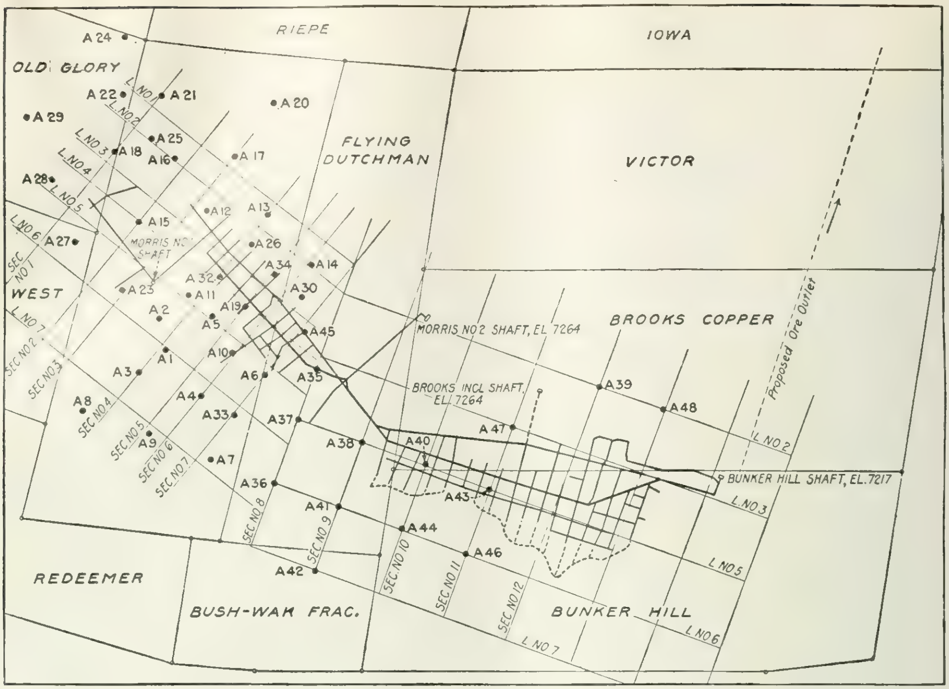
*No allowance is made for ore known to exist in the territory served by the Old Glory, Taylor, Giroux and Alpha shafts, which are inaccessible except on the 770- and 1000-ft. levels of the Giroux shaft.

It will be recalled that the Consolidated Coppermines Co. now controls the old Giroux Consolidated Mines Co., the Butte & Ely Copper Co., the New Ely Central Copper Co., the old Coppermines Co., the Chainman Consolidated Copper Co., as well as miscellaneous small groups of claims designed to give approaches to steam-shovel pits, water rights and otherwise round out the property.

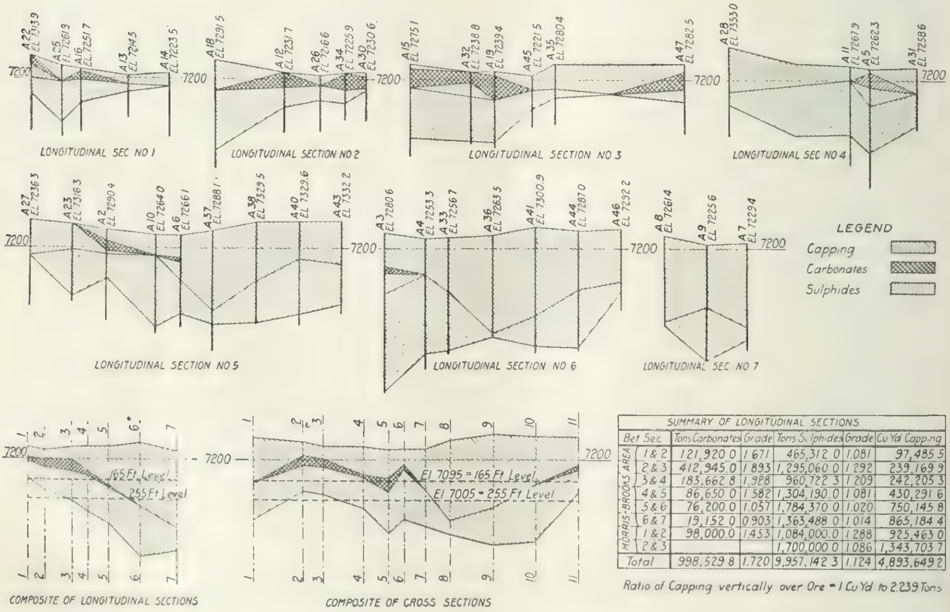
The drilling campaign began in earnest in November, 1913, and continued until Aug. 7, 1914, when drilling was discontinued owing to conditions following the outbreak of the European war. During this campaign 28,075 ft. of churn drilling was done at an average cost of $2.917 per ft., this cost including the keeping of elaborate records and samples, all of which have been carefully preserved for checking purposes.

It is planned that the ore reserves mentioned in the foregoing will be mined by steam shovel; but as the drilling so far done has not delimited the various orebodies, only the amount of vertical capping has been reported. Slopes and approaches cannot be estimated until further drilling has been done. The capping lying vertically over several of the larger orebodies is given below. It is interesting to note on the adjoining page the method the company has adopted for summarizing the results of drilling on one of the principal ore-bearing areas, known as the Morris & Brooks deposit.

Churn drilling has developed in the Morris & Brooks area 9,257,142 tons of sulphide ore assaying 1.19% Cu and 998,599 tons of carbonate ore assaying 1.72% Cu. The capping over this orebody amounts to 4,580,649 cu.yd., or 1 cu.yd. of capping to 2.239 tons of ore. The underground development from the Brooks shaft, in territory contiguous to the churn-drilled area, has proved



Plan of Churn-Drill Holes on Morris & Brooks Area of Consolidated Coppermines Co.



SUMMARY OF LONGITUDINAL SECTIONS

	Bet Sec	Tons Carbonates	Grade	Tons Sulphides	Grade	Cu Yd Capping
MORRIS-BROOKS AREA	1 & 2	121,920 0	1 671	465,312 0	1.081	97,485 5
	2 & 3	412,945.0	1 893	1,295,060 0	1 292	239,169 9
	3 & 4	183,662 8	1.928	960,722 3	1 209	242,205 3
	4 & 5	86,650 0	1 582	1,304,190.0	1 081	430,291 6
	5 & 6	76,200.0	1.057	1,784,370 0	1.020	750,145 8
	6 & 7	19,152 0	0 903	1,363,488 0	1 014	865,184 4
	1 & 2	98,000.0	1.453	1,084,000.0	1 288	925,463 0
	2 & 3			1,700,000 0	1 086	1,343,703 7
Total		998,529 8	1.720	9,957,142 3	1.124	4,893,649 2

Ratio of Capping vertically over Ore = 1 Cu Yd to 2.239 Tons

Longitudinal Sections of Orebodies Disclosed by Churn Drilling in the Morris & Brooks Area of Consolidated Coppermines Co., Kimberly, Nev.

1,000,000 tons of sulphide ore assaying 1.670% Cu.

The Emma-Nevada deposit, west of the Liberty pit of Nevada Consolidated, is estimated to contain 3,108,360 tons of sulphide ore assaying 1.006% Cu and 1,516,568 tons of partly developed sulphide ore assaying 1.008% Cu. The capping over the developed area is 661,111 cu.yd., equivalent to 1 cu.yd. for 4.283 tons of ore.

The Ora deposit, which is at the entrance of Nevada Consolidated's Liberty pit, is estimated at 1,888,865 tons of 1.344% ore and 844,000 tons of partly proved ore averaging 1%. Practically all of the capping has been stripped from this deposit. The Nevada Consolidated company mines and treats the ore as removal is required for proper grades to the Liberty pit.

These three areas account for approximately 15,000,000 tons of the company's reserves and are estimated to average 1.129% Cu. Higher grade ore has been "partly developed" by underground work at other places on the company's property, notably at the Minnesota claim, which is near the Ruth orebody of the Nevada Consolidated. As remarked in the footnote of the table, no account is taken of such ore as may have been developed in the old Giroux workings from the Alpha, Giroux, Taylor and Old Glory shafts, these workings being at present inaccessible for measuring the tonnage that may exist in this portion of the company's property.

The annual meeting of the company was held on June 8 at Wilmington, Del., 405,858 shares being represented. No opposition developed from the fiery attack made on the management recently in a circular by Col. Enos A. Wall; in fact, the management was completely sustained at the meeting, with the reëlection of Charles H. Boynton as president and most of the old officers. Four directors were scheduled to be elected; two old directors, E. F. Gray and Joseph B. Cotton, were reëlected, and the two new directors are John T. Morrow and Edwin F. Kellogg, of New York. At a subsequent meeting of the directors, Franklin E. Searle, of New York, was elected to the board to fill a vacancy.

In the annual report President Boynton directed attention to the gradual elimination of the difficulties that had confronted the executive and legal management in the merging of previously distinct and, in some cases, discordint interests. He announced that it would be the policy f the company to issue statements from time to time giving stockholders full information regarding conditions t the properties and asked that the management be suported in its development program and not afflicted with ld grievances against the original companies with which he present organization is not concerned. Perhaps the nost important announcement is the proposed plan to aise a fund of about $1,000,000 by the sale of bonds or ther means, this sum to be devoted to the payment of ndebtedness and the further development of the orebodies. The erection of a treatment plant was considered unwise t this time, both on account of the metallurgical changes ow under consideration at porphyry mines and on acount of the further development planned for the unexplored areas between some of the isolated orebodies already pened on the property of the Coppermines company. It s probable, however, that a small experimental plant will e established in the old Giroux concentrator to determine he most suitable process or processes for the treatment of he carbonate and sulphide orebodies.

Duty on Zinc in Ores

The Board of General Appraisers, on June 9, rejected the appeal of the United States Metals Refining Co. from a decision of the collector at New York, levying duty on the zinc contained in ore, the principal value of which was in copper. The ore in controversy contained zinc in percentages varying from 3.60% to [illegible]. Duty was levied on the zinc content at the rate of 10% ad valorem, upon an appraised valuation of 4c. per lb. Thomas M. Lane, counsel for the importing concern, argued that the ore is properly free of duty on the ground that the quantity of zinc contained in the ore is negligible and not capable of being recovered or used.

In overruling the contentions of the importers, Judge Fischer said: "In enacting paragraph 162 of the present act, it is clearly manifest that Congress intended not only to adopt as correct the judicial interpretation of the language of paragraph 193 of the act of 1909, but to further narrow its applicability and scope. Hence, we find omitted from the present paragraph this provision, 'containing less than 10% of zinc,' found in its predecessor in the act of 1909. There can therefore be no question whatever concerning the congressional intention to impose a duty of 10% ad valorem upon zinc-bearing ores of all kinds, including calamine, regardless of the quantity of zinc which may or may not be shown to be commercially recoverable."

An appeal will be taken from the board's decision to the Customs Court, and arguments will be made at the fall session.

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Sulphur-Sand Cement

By E. J. Hall

Sulphur-sand cement is composed of 1 part sulphur and 1.4 parts quartz sand ground to pass at least a 60-mesh screen. The mixture is heated to about 150° C. when it flows nicely and is sufficiently above the melting point of sulphur, 111° C., to prevent sudden chilling. The fact that sulphur begins to thicken above 156° C. and becomes so viscid that it will not flow at 180° C. must be borne in mind or there will be difficulty in working the cement. This is possibly the most satisfactory general cement available for low temperature work. It is readily handled and remarkably strong, has a tenacious bond, is free from cracking and inert to most solutions. It will be found valuable for large-scale work, as well as in the laboratory. I believe it was developed by Charles S. Bradley for use in his copper-leaching process; at any rate, it was learned of through him.

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French Prohibition of Lead-Ore Exports

A French ministerial decree, dated Apr. 28, abrogates the provisions of the decree of Feb. 12, in virtue of which lead ore was allowed to be exported from France without special authorization, when consigned to the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia and the United States of America. Applications for special permission to export consignments of lead ore to the United Kingdom will be favorably considered.

Some Steel Statistics for 1914

The Statistical Bureau of the American Iron & Steel Association has issued *Bulletin No. 3,* giving the production of various finished forms of iron and steel in 1914 and preceding years.

STRUCTURAL SHAPES

The production and approximate consumption of structural shapes for three years past have been as follows, in long tons:

	1912	1913	1914
Heavy shapes	2,470,415	2,553,806	1,787,281
Light shapes	376,072	451,166	243,843
Total production	2,846,487	3,004,972	2,031,124
Imports	3,120	11,659	10,145
Exports	288,164	403,264	182,395
Consumption	2,561,443	2,613,367	1,858,174

All the heavy shapes were rolled from steel. Of the light shapes, 5517 tons in 1912, 3841 tons in 1913 and 1981 tons in 1914 were rolled from iron. In 1914 there were 41 works in 10 states which rolled structural shapes.

The figures given for heavy structural shapes include all beams, tees, zee bars, angles, channels, etc., having one leg or web of 3 in. and over which were rolled for structural or fabricating purposes, while the figures given for light structural shapes include only such light shapes and small angles, etc., as were rolled for use in the manufacture of bedsteads, agricultural implements, fences, safes, vaults, or for other fabricating purposes having a section smaller than is provided for in the heavy structural classification. The production of iron and steel plates, girders made from plates, merchant bars, bars for reinforced concrete, sheet piling, etc., is not included in any of the figures given for structural shapes.

WIRE RODS

The production and consumption of wire rods for three years past have been as follows:

	1912	1913	1914
Iron	1,289	832	731
Steel	2,652,264	2,463,975	2,430,983
Total production	2,653,553	2,464,807	2,431,714
Imports	15,069	16,098	6,954
Exports	64,978	61,637	61,856
Approximate consumption	2,603,644	2,419,268	2,376,812

Small quantities of copper-clad steel wire rods are included in the totals for recent years. Iron or steel wire rods were rolled in 1914 by 37 works in 12 states.

NAILS

The production of nails of all kinds for three years past has beeen as follows, in kegs of 100 lb. each:

	1912	1913	1914
Wire nails	14,659,700	13,559,727	13,132,814
Cut nails	978,415	842,038	769,665
Total	15,638,115	14,401,765	13,902,479

In 1914 all the wire nails were made of steel; of the cut rails 99,682 kegs were of iron and 669,983 kegs of steel. Horseshoe nails, cut tacks and forged spikes are not included. In 1914 cut nails were made by 14 works in eight states; wire nails by 50 works in 15 states.

In 1914 there were no imports of nails reported. Exports were 885,843 kegs, leaving 13,016,636 kegs as the approximate consumption.

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Plants to Manufacture Barium Compounds have been established at Charleston, W. Va., and Melrose, Calif., according to the U. S. Geological Survey.

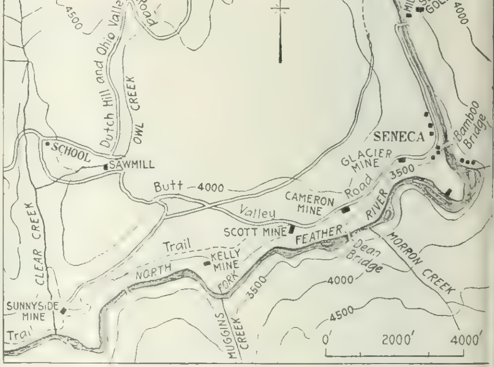
Seneca Mining District, California

By W. H. Wright*

The Seneca mining district, California, is interesting both as to mining and geological conditions. This district lies along the north fork of Feather River in the northwestern part of Plumas County, extending from Mosquito Creek to Ohio Creek, and is directly west of the Taylorsville, Greenville and Crescent Mills districts. It embraces a portion of the southeastern part of the Lassen Peak lava fields. Mining has been carried on at elevations ranging from 3000 to 5000 ft. above sea level. The bed of the north fork of Feather River has been mined from the days of the gold rush to the present time, although the work is now sporadic and done mostly at low stages of the river.

GEOLOGY OF THE SENECA MINING DISTRICT

The auriferous slates, all more or less metamorphosed, form the country rock. These range in age from the Silurian to the Jurassic inclusive. Predominating in this field are the Calaveras of the Carboniferous era and the Cedar of the Juratrias. These are the most productive. The earth movement which formed the Sierr Nevada folded these slates so strongly that the strata ar steeply tilted and in places stand almost vertical; als they have been broken and displaced along a series o thrust faults. Intrusions of eruptive rocks—diabase, po phyrite, peridotite and diorite—are numerous. Muc quartz, more or less auriferous, is found lying parallel t the rock layers, but the richest ore deposits are found i veins in or near the contact of the slates and eruptives.



SKETCH MAP OF SENECA MINING DISTRICT

Volcanic activity of the Lassen Peak field, which bega at the close of the Ione epoch (Miocene) and has continue intermittently ever since, produced great lava flows whic filled the ancient and more recent river channels and places formed dams across cañons, producing lakes whic subsequently became meadows. The buried gravel cha nels furnish the present lava-cap drift mines.

Some of the basalts are old, but on the whole they a judged to be the youngest lavas of the district. The B

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*Mining engineer, 5494 College Ave., Oakland, Calif.

Flat channel at Seneca was filled after the river had cut a cañon through the slates and older lavas. Since then the river has cut its cañon several hundred feet deeper, leaving the gravel exposed in places under the lava along the sides of the cañon. Dutch Hill, near Seneca, is an example of Neocene gravels. These are lava-capped, and since their deposition the drainage of the country has been greatly changed. The stream which deposited them flowed northwest, while the Big Flat channel and the present river flow southwest. Dutch Hill is 1000 ft. above the present river bed and 4600 ft. above sea level. It has been estimated that this region has been elevated 4000 ft. since the deposition of the gravels. The auriferous gravels of the present river bed received their enrichment from the erosion and decomposition of the auriferous slates and from the ancient gravels.

In the vicinity of Mosquito Creek and Caribou, placer mining is being done on a small scale. On the Big Flat channel, which extends from the mouth of Butt Creek to a point a mile above Seneca where the river cuts through it, are situated several gravel mines.

Drift Mining in the Scott Claim

The Scott mine is perhaps the most interesting of the drift mines on the Big Flat channel. The methods employed in the present development by Charles H. Grill and Frank Stokes under lease have an important bearing upon channel mining in this and similar districts. In the '90s Fred Scott, from whom the mine took its name, advanced an abandoned 160-ft. tunnel a distance of 20 ft., broke into rich gravel and extracted $80,000, when a fault cut off the gravel. The later operators drove a new 700 ft. tunnel and raised 12 ft., entering barren light wash of shaly débris. A 350-ft. drift from the raise again disclosed the fault where the gravel was very rich. The drift was continued into the bedrock for a distance of 60 ft., and a raise broke into fine pay gravel. The drift was advanced and other raises were driven at distances of 40 ft. and 60 ft.; these raises also found pay. Crosscuts are now being run from the last two raises to determine the width of the channel and to block out the ground. The fault, which is nearly at right angles to the channel, has caused a vertical displacement of 20 ft., and the line of faulting is occupied by a quartz vein of small gold content. The bedrock varies, slate, shale and limestone predominating.

Some "breasting" has been done from time to time to meet expenses. All the bedrock gravel contains gold, but the amount is variable and ranges from $2.50 to $10 per car (approximately 1 cu.yd.). The gravel is firm enough to require blasting, but breaks up so thoroughly as to offer no difficulties in washing. The ground stands well in the drifts and gangways. All of the breasts visited were from 5 to 8 ft. ahead of the timbers, and the [illegible] showed no signs of working. The posts and caps are of split white cedar, which abounds in this vicinity, and have a cross-section of not over 60 sq.in., generally much less. Split slabs of yellow pine are used for lagging. While the timbering is light, there is no sign of squeezing or breaking even in the oldest sets. The greater part of the bedrock tunnel requires no timbering.

Briefly the system of mining is as follows: A main adit is driven in the bedrock lengthwise of the channel and under it. Raises, each of sufficient size to contain a chute and manway, are run into the gravel at short distances. From the tops of these raises gangways are driven across the channel. In these gangways about 3 ft. of bedrock is taken out with 3 to 4 ft. of gravel. The breasting is done from the gangways. Only enough gravel to allow working room is taken, as the gold lies close to and on the bedrock. As the ground is breasted the room is packed with large rock. This serves the double purpose of holding the ground and eliminating the tramming of valueless material. Ground breasted several years ago is still standing.

Seneca Consolidated Mill on Feather River

A Breast in the Scott Drift Mine

The gravel from the raises is trammed to the bin at the mouth of the tunnel. A grizzly over the bin separates the cobbles from the fine gravel so that they pass down a chute to the waste dump. A large tank near the bin stores the mine water for washing the gravel. Hungarian riffles are used for the first 60 ft. and then for a like distance are riffles of 2x4-in. lumber, placed lengthwise and separated by cleats of the same material. The sluice boxes are 16 in. wide and have a grade of 1 ft. in 12. The gold is coarse and no quicksilver is used. The operators have been able to meet all expenses of development with the gold recovered in this work and the little breasting they have done.

Other Big Flat Mines

Other gravel mines situated on Big Flat channel are the Sunnyside, Western, Kelly, Cameron and [illegible]. The Sunnyside mine is famous for production in the past. It is being reopened by Robert Costar. The Western, farther up the river, is yet only a prospect, but has disclosed some good gravel. The Kelly mine, situated near the

Western, was worked under bond last summer by W. W. Robbins and associates. The results have not been made public. The Cameron mine, a mile below Seneca, is being developed by a tunnel driven under the channel and a raise put up to tap the gravel. Gilmer brothers are the owners. The Glacier mine, a short distance below Seneca, is being worked under bond and lease by R. J. Stone. In the middle of August the tunnel had been advanced to the 1575-ft. point. Since then a raise has been driven with the expectation of finding the channel.

The Dutch Hill mine is situated about 2½ miles west of Seneca. This mine was first worked as a lava-cap drift mine and produced a large amount of gold. When the underground gravel was exhausted, attention was turned to the surface deposits of lower-grade gravel. Several hundred thousand dollars was spent in building a pipe line and ditch and installing machinery for hydraulicking. Anti-débris legislation forced a suspension of operations, with great loss to the company. Modern methods economically applied should result in reopening the property.

LODE MINES RECEIVING MORE ATTENTION

In the Seneca district more attention has been paid to the gravel deposits than to the quartz veins, although there is one active lode mine and several promising prospects. The Dean mine, a short distance below Seneca, has recently been bonded and a contract let for development work. The property of the Seneca Consolidated Gold Mines Co., on the north fork of Feather River a mile above Seneca, consists of a group of claims and a milling plant.

The White Lily and Del Monte lode mines are being worked jointly, the surface rights of one being indispensable to both. Until last summer the property had been tied up by apex litigation, which resulted in the apex and all extralateral rights being awarded to the Del Monte. Then the mill was remodeled. It now contains 16 stamps, arranged in three batteries of two stamps and two batteries of five stamps, and three concentrating tables. Power is developed by water taken from the river. Twenty men have been employed steadily since last spring. The mine is on a quartz vein having a northwest strike. A diorite dike seems to have been instrumental in the vein formation. Records produced in the apex suit showed a production of $268,000 under the ownership and management of R. J. Dunn. The mine is peculiar owing to the fact that no blasting is required to break the ore. The vein matter is greatly crushed and partially decomposed. The principal gangue is quartz, containing a small amount of pyrites and a little galena. The square-set system of timbering is used. J. J. Riley, who is heavily interested in the property, is manager.

The climate in the Seneca district is decidedly healthful. While there is a large annual precipitation, it practically all occurs in the winter months in the form of snow. Of course, there are occasional showers during the open season, but these are not heavy and some seasons there is almost no rain. Light snows come early in the fall, but the heavy snows hardly ever start before December and generally after Christmas. The roads then are impassable for heavy hauling, and all supplies must be taken in before the snows begin. There is only one road open all winter, and that is to the Western Pacific at Keddie by Cañon Dam, Greenville and Crescent Mills. The roads are generally open for heavy hauling in May.

The country is covered with a fine growth of timber suitable for all purposes, and there is a sawmill on the Butt Valley road, 3 miles from Seneca. The Great Western Power Co. has a hydro-electric plant at the mouth of Butt Creek that was used in the construction of Cañon Dam, which converted Big Meadows into Lake Almanor. This plant is not running at present, but will undoubtedly be put in operation when the demand for power warrants.

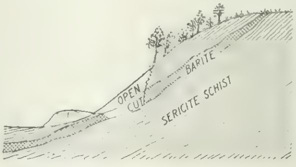
Barytes at Kings Creek, S. C.

By Joel H. Watkins*

Since the outbreak of the European war the demand for domestic barytes has been greatly increased. As a consequence, many abandoned mines and undeveloped deposits have been examined and exploited. A few of these are now being actively operated.

THE CHEROKEE CHEMICAL CO.'S PROGRESS

One of the most interesting of these new developments is that of the Cherokee Chemical Co., at Kings Creek, Cherokee County, S. C. A barytes mill was erected at this point several years ago by the Cherokee company and since then small quantities of crude and floated barytes have been produced from time to time. In the past few months, however, a controlling interest in the company has been acquired by outside capital and under the new management better progress is being made. The ore occurs as lenticular veins in quartz-sericite schist. The vein matter is chiefly massive granular barytes, varying in color from pure white to a deep, rose pink. The only impurities which have thus far been observed are occasional veinlets of white quartz, small inclusions of the wall rock, and small amounts of galena, which is mostly segregated along definite lines. The vein matter usually forms a clean, sharp contact with the wall rock, though in places there is a slight gradation into the schist. The veins vary in thickness from a few inches up to 8 ft. or more and conform roughly to the strike and dip of the inclosing schist. Small veinlets forming offshoots from the larger veins are not infrequent, and often cut the structure of the wall rock. In one opencut three parallel veins, from 1 to 3 ft. in thickness, are being worked. The schists in this area form a series of folds so that the veins show considerable variation in dips. In general the strike is about N 25° E, and the dip varies from 10° to 45° where exposures were observed.



SECTION SHOWING POSITION OF BARYTES VEIN AND POSITION OF INCLOSING ROCKS

Nature has played an important part in uncovering the barytes veins in this area, so that a considerable tonnage of ore can be won from opencuts with little stripping. The veins which are exposed for several hundred yards both north and south of the Southern Ry., a short distance east of Kings Creek, dip to the southeast and are roughly parallel to the slope of a hill. Near the base and at the top of the hill they are exposed by erosion, but on the slope the hanging wall, which consists of weathered schist, is from a few inches to 10 ft. in thickness. The ore is at present being mined simply by stripping the veins in open cuts and shooting the massive barytes from the solid.

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*Geologist, Southern Ry. Co., 1320 Pennsylvania Ave., N. W., Washington, D. C.

The former owners of this property report that they were unable to make a clean separation of the quartz, which occurs as a gangue mineral with the barytes. The quartz which could not be readily separated was therefore ground with the rest of the ore. This high percentage of silica was not desirable, so that it was difficult to market the output of the mill. W. H. Kemler, engineer in charge of the property, has installed two jigs, which, it is claimed, successfully eliminate the quartz when the ore is finally crushed. The small portion of the vein which shows galena is easily selected by hand and is being sold as second-grade crude ore.

The ore is at present being mined from two large opencuts, one north and the other south of the railroad, and within a short distance of the mill. At the time of my last visit to the mine a large area had been stripped and the vein was showing a thickness of about 6 ft. It is not uncommon to see masses of white barytes weighing several tons being thrown down by a single shot. The mill has been thoroughly renovated and some new machinery has been installed. The company is negotiating for contracts for both crude and floated ore.

Mining Barytes in Opencut, Kings Creek, N. C.

Breaking from 6-Ft. Vein After Stripping

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Decreased Fluorspar Production in United States

The quantity of domestic fluorspar reported to the U. S. Geological Survey as marketed in 1914 was 95,116 tons, compared with 115,580 short tons marketed in 1913.

The market for the bulk of the fluorspar sold in the United States depends on the steel industry, and when that industry becomes depressed, the demand for fluorspar quickly diminishes. Gravel spar is consumed as a flux in basic openhearth steel furnaces and to a smaller extent in other metallurgic operations. In 1914 the marketed production of gravel spar constituted about 83.3% of the total marketed output of domestic fluorspar.

The market for lump fluorspar for the manufacture of hydrofluoric acid is reported to be improving. This report appears to be confirmed by the increase of nearly 55.8% in quantity.

In Illinois the output in 1914 came from three mines, all in Hardin County. Spar was shipped from 10 mines in Kentucky (nine in Crittenden County and one in Livingston County), one mine in New Hampshire, and five mines in Colorado. The mines in Arizona and New Mexico that were active in 1913 reported that there was not sufficient demand for their product to warrant any shipments during 1914.

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Library Service Bureau

The Library Service Bureau of the United Engineering Society, 29 West 39th St., New York, has been studying the problem of making the splendid reference library of the society more valuable to the members. The library receives currently 800 engineering or scientific periodicals and has over 60,000 volumes on technical subjects. It is obviously impossible for any one man to read all these papers, and the bureau proposes to furnish accurate abstracts on specified subjects and translations of articles appearing in any language, bibliographies on any engineering subject, copies of articles or photostatic prints or diagrams, maps or of printed pages, if desired. In a circular sent out recently by E. Gybbon Spilsbury, chairman of the library-service committee, a schedule of prices for this work is announced. It is proposed to issue subscription cards for the convenience of members upon receipt of $10, so that bookkeeping and the expense attending the collection of small amounts will be eliminated. Some of the charges are as follows: Reference cards, 10c. each; copying, per 1000 words, $1; translating, per 1000 words, $2.50 to $3.50; bibliographing, $1 per hour; abstracting (English), $1.50 per hour; searches for patent purposes, $3 per hour; statistical searches and reports, $2.50 per hour. This has been arranged with a view to rendering service for practically what it costs the bureau. All work of the bureau is strictly confidential. This service should be of much value to engineers who are too far away to visit the library personally, and also to those who live in the vicinity but desire to economize their time.

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The Broken Hill Proprietary Co. of New South Wales started its first iron blast furnace at Newcastle on Mar. 15. The steel works are about ready, but it is proposed to accumulate a considerable stock of pig iron before starting on steel, so as to prevent all danger of having to stop in case of any mishap to the furnace.

Details of Practical Mining

The Blacksmith's Use of Borax and Cyanide*

No one knows the name of the first blacksmith who found that a bit of borax on his iron made it weld with more certainty, but we do know the importance which fluxes have in work that requires a union of metals under heat.

The action of borax as a flux appears to be one of melting in its own water of crystallization. When heated above a red heat, it fuses and makes a sort of glass which will adhere to metals even up to the welding heat and higher. It is this property of coating the surface to which it is applied at a temperature below that at which active oxidization takes place, and staying there until the welding or brazing heat is reached, that gives it its value to the blacksmith.

Various mixtures of borax with other elements are used. How much more valuable they are than borax alone is difficult to determine, because the process of welding is so dependent on the personal element that a man's judgment may be influenced by things which have nothing to do with the results obtained. One of the substances mixed with borax is sal-ammoniac. This is supposed to make a compound which will restore "burnt" steel, or steel which is sufficiently overheated to make the grain coarse and crystalline. Sal-ammoniac is NH_4Cl. Borax is $Na_2B_4O_7$ (10 H_2O) and contains no carbon, so it is hard to see just how the two together can be a restorative. It is true, however, that "burnt" steel can be improved in quality by heating nearly to a welding heat and hammering. If the directions with the compound call for much hammering and if they are followed, the material will undoubtedly be improved, though not brought back to its original composition.

Other mixtures contain iron filings as well as borax and sal-ammoniac. The value of the iron filings seems doubtful; used alone, they almost surely prevent welding. It seems likely that they must burn before the welding takes place.

The heat treatment of steel, short of the welding point, brings into play another series of chemicals, of which cyanide of potassium is the best known. Its poisonous properties should always be kept in view, as its effect is extremely virulent whether taken internally or admitted to the blood through a cut in the skin. It is even dangerous in the cooling tank of a blacksmith's forge, though it only gets there in the small amounts carried over with hot steel. Cyanogen, $(CN)_2$, is the base of a number of compounds useful in the arts.

The action of cyanide in heat treatment is that the cyanogen is decomposed and gives up its carbon to the hot steel or iron, thus making a thin case-hardening. It also reduces oxides at red heat. For case-hardening purposes it should be kept boiling and the pieces left in it for about five minutes. It spatters badly, and the fumes are especially bad. If about 2% soda-ash is added, the fumes will be reduced.

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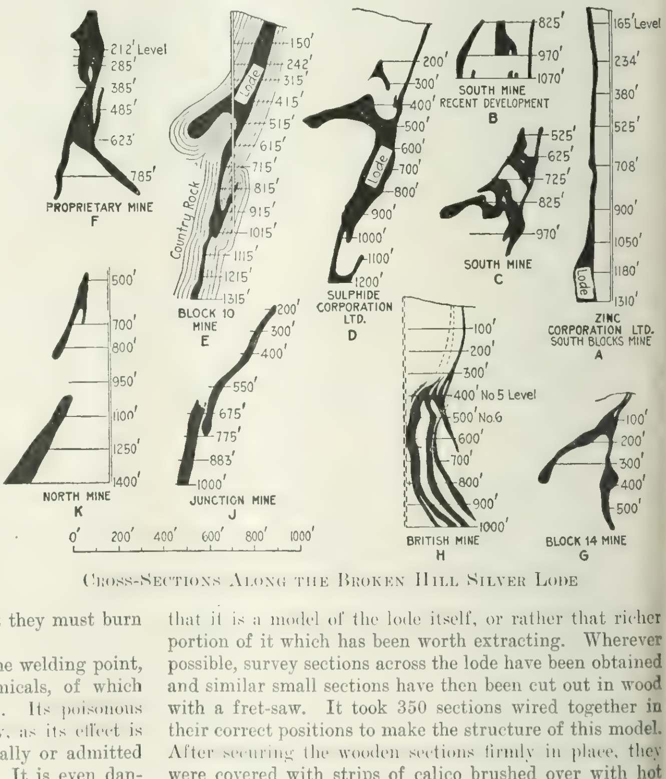
Mine Model of the Broken Hill Lode

A mine model 15 ft. long, representing a length of three miles of the Broken Hill lode, New South Wales, has recently been completed for the Panama-Pacific Exposition. This model differs from the ordinary mine model in that it is a model of the lode itself, or rather that richer portion of it which has been worth extracting. Wherever possible, survey sections across the lode have been obtained and similar small sections have then been cut out in wood with a fret-saw. It took 350 sections wired together in their correct positions to make the structure of this model. After securing the wooden sections firmly in place, they were covered with strips of calico brushed over with hot glue; the whole was then painted. The purpose of the ordinary mine model is to show the workings of the mine. The object of this one apparently has been to show the



Cross-Sections Along the Broken Hill Silver Lode

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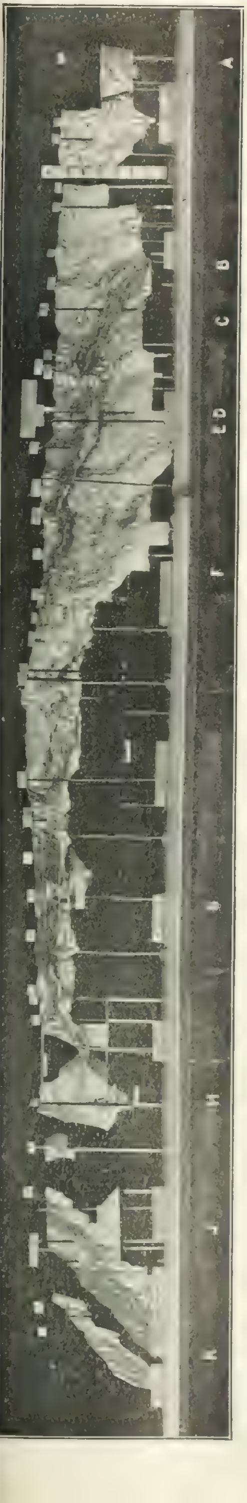
*Abstract from "Chemicals Used in Shop Processes Requiring Heat," "American Machinist," June 10, 1915.



Mine Model of Broken Hill Lode

lode as it was before being mined, as has been proved by the workings during the time in which it has been mined.

The accompanying illustrations show various cross-sections along the Broken Hill lode, taken from plans supplied by the various mine managers and communicated to the Journal by E. F. Pittman, Government Geologist and Under Secretary of Mines, Sydney, New South Wales. These sections are indicated by letter on the illustration showing the mine model as exhibited. *A* shows a section of the main lode, the thick portion at the bottom being a ridge of ore on the western side pitching from north to south. The isolated saddle seen in *D* is connected with the main lode on the east, both north and south of this section. The portions left white between the dark lines on *H* consist of rhodonite and quartzite; they are really portions of the lode proper, but not worth working. At *E* is shown the main lode or fracture following the course of the limb connecting an anticlinal and synclinal fold. This may be considered as a fairly typical section, illustrating the true nature of the lode.

The importance of Broken Hill as a mineral producer is evidenced by the 1913 output of silver-lead-zinc, which amounted to nearly $30,000,000, a result largely to be attributed to the flotation process.

A Compressed-Air Meter

The need for a device for measuring the air consumption of air drills has long been felt. The usual methods used for measuring this air consumption have been either expensive or cumbersome, with the result that very few mines are ever able to test the air consumption of their various machines, much as they would like to do so.

A new device for accomplishing this purpose has just been put on the market.* This device, shown in Fig. 1, is not only simple and inexpensive, but takes advantage of a well-known law in such a way that there is no complication of moving parts to wear and get the instrument out of adjustment.

The French scientist Poncelet deduced the law, which briefly stated is: The volume of a definite compressed fluid or gas flowing under small constant head through multiple orifices of the same shape and size is directly proportional to the number of orifices exposed to the flow.

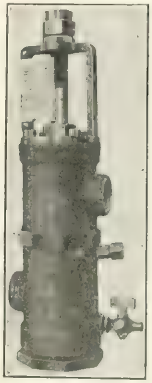


Fig. 1. Compressed-Air Meter

Reference to Fig. 2, which shows a section of this device, will make the operation of this meter clear. The device consists of two parts, a housing with inlet and outlet flow for the compressed air to be measured and a moving element inside, which consists of a weighted piston *P* loaded with the weight *W* in the upper or metering cylinder; a small piston in the oil dashpot below; and a rod joining these two pistons and extending upward, where it moves freely without contact, inside the sight-glass at the top of the meter. This rod rises and falls with the pistons, so that its height in the sight-glass corresponds exactly to the relative position of the piston in the metering cylinder, which corresponds to the volume of air flowing. A scale plate mounted against the outside of the sight-glass permits reading the exact height of the top end of the rod.

Air enters at the lower left-hand opening *A* into the chamber surrounding the dashpot cylinder and passes through ported openings into the interior of the metering cylinder *C*. The wall of this metering cylinder is drilled with a large number of small holes accurately reamed and uniformly spaced; only the holes in the plane of section are shown in the cut. To pass to the outlet chamber *D* the air lifts the piston and exposes some of the holes to the flow. The throttling effect on the air in passing through these small orifices reduces the pressure in the chamber *D* slightly below the pressure in chamber *C*. This small difference in pressure is counterbalanced by the weight of the loaded moving element described, when it has risen high enough to give proper port opening to the required flow of air. It is the floating of the moving element, due to the varying amount of air flowing through the port, which indicates on the graduated scale the cubic feet of air flowing through the instrument.

If the meter is connected to an air line and the valves are opened suddenly to the full pressure, the moving element will rise from its lowest position to the top, but it will not go to the extreme limit of its travel unless the volume of air flowing is in excess of the rated capacity of the meter. In the latter event, no harm would be done to the meter, but of course a reading could not be taken, because the indicator would be off the scale.

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*By the New Jersey Meter Co., Plainfield, N. J.

This is not a velocity meter which will give readings proportional to the square of the volume flowing, but is a direct-volume gage with a uniform scale on which one cubic foot is represented by the same distance whether working at high or low capacity. The loss of pressure due to the throttling in passing through the metering device is so slight that it cannot be detected by a gage, and the meter cannot be injured by a flow in excess of its metering capacity. There are no leather pockets, rubber or leather disks, bearings, gears, valves or other parts which can develop defects to change the accuracy. The use of bronze parts prevents corrosion or rusting.

The size of the instrument is very handy, it being only 12 to 18 in. high and 2 to 3 in. in diameter, and costs less than $100. It is manufactured in two sizes, the 1-in. meter being called the Tool-om-eter, with a capacity of from 10 to 100 cu.ft. per min., and is recommended for small tools, including chipping and riveting hammers, plug, hammer, and stoping drills, wood-boring and metal-drilling machinery, rated by manufacturers at not over 60 cu.ft. per minute when new. The 2-in. size is called the Drill-om-eter, with a capacity of from 50 to 300 cu.ft. of air per min., and is especially adapted to rock drills, coal punches, diamond drills, hoists, pumps, etc., where the actual consumption is not over 300 cu.ft. per minute. Larger sizes of meters are manufactured to meet exact requirements.

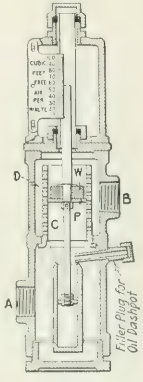

FIG. 2. SECTION THROUGH AIR METER

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Relocation of Washington Mining Claims

By A. L. H. STREET*

Under the mining laws of Washington, a notice of relocation of a quartz or lode claim must show on its face whether the claim is located as forfeited or abandoned property, according to the decision of the Supreme Court of Washington lately announced in the case of Florence-Rae Copper Co. vs. Kimbel, 147 *Pacific Reporter,* 881. It is insufficient, the court holds, to give that information in the statutory certificate recorded with the county auditor.

Another point decided in the same case is that, in order to sustain a relocation, one seeking to avail himself of a preceding locator's failure to do required assessment work must establish the failure and the relocation by clear proof, since courts are disinclined to decree forfeitures of property rights.

The Supreme Court further holds that making of large expenditures by a mining company, which had made an original location, in preparing trails and cable lines leading to its claims, constituted such resumption of work as precluded a subsequent valid relocation.

Incidentally, it is declared in the opinion in this case that since the matter of disposing of mining ground is within the control of the Federal Government, state regulations providing for giving of location notices, etc., must be regarded as mere peace regulations, rather than as affecting titles to mining property.

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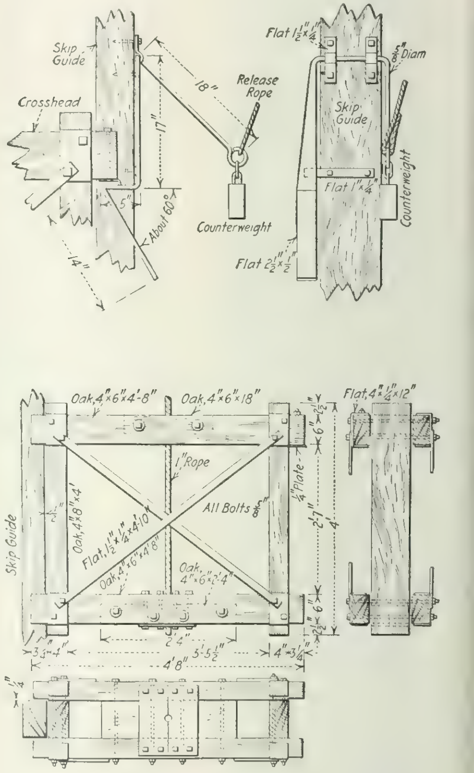
Crossheads for Bucket Hoisting

In many states the law requires the use of a crosshead when hoisting a bucket in a shaft, and also some device to prevent accident owing to the crosshead hanging up on the guides and subsequently dropping on the men riding in the bucket. The accompanying illustration* shows a satisfactory crosshead which was used during the sinking of a shaft on the Mesabi Range. Short pieces of rope should hang from this crosshead so that the men can hold to them when riding in the bucket. This would prevent any slight cause from hanging up the crosshead, and if it did hang up, would warn the men in time for them to take proper precautions.



UPPER CROSSHEAD STOP AND HOISTING CROSSHEAD

The illustration also shows the upper crosshead stop, which is used on the headframe to hold the crosshead out of the way while the top lander is dumping the bucket. This stop has to be released by pulling on the rope shown and lifting the counterweight.

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*Attorney, St. Paul, Minn.

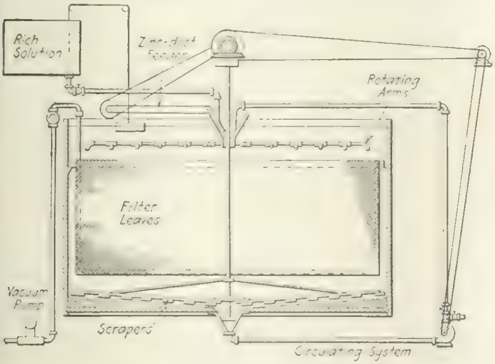
*From "The Wisconsin Engineer," April, 1915.

Details of Milling and Smelting

Precipitating Apparatus for Use in Cyaniding

A system of precipitation (U. S. pat. 1,123,778) has been devised by Louis D. Mills, now of Johannesburg, but formerly of San Francisco. The patent is assigned to the Merrill Metallurgical Co., of San Francisco. The distinctive feature of the process is the maintenance of a homogeneous mixture of the pregnant solution and mobile precipitant at the surface of the filtering medium, so that as the solution is passed through the medium the precipitant and precipitates are deposited on the filter as a homogeneous and uniformly permeable cake. Such homogeneity of the mixture is maintained by continuously circulating it.

The accompanying illustration shows a typical installation for carrying out the process. There is a tank containing a number of filter leaves disposed vertically to facilitate circulation. These leaves are connected with a vacuum pump, such as is usual in vacuum filtration. A circulating pump is also provided, drawing from the bottom of the tank and delivering into a hopper at the top. The hopper connects with a set of rotating arms, which are above the line of the filter leaves, but below the surface of the solution in the tank. The bottom of the tank is made slightly sloping and is provided with arms and scrapers to prevent the settling of precipitant or precipitate upon the tank bottom. A source of pregnant solution supplies the hopper over the tank through a pipe, and the precipitant is fed in with it. The pregnant-solution pipe and the circulating-solution pipe enter the hopper below the level of the solution in order to prevent oxidation.



ZINC-DUST PRECIPITATING SYSTEM

The operation of the process is evident. The precipitant and pregnant solution are added at the hopper, agitated in the tank and passed down through it. The precipitant and precipitate are partly removed in the form of a cake on the filtering surfaces, while the circulating pump keeps the solution and remaining solids in movement constantly, thus promoting precipitation. When a cleanup is desired, the entry of solution and precipitant is cut off and the tank emptied as far as possible by pumping the solution through the filters. Then the cake on the leaves is flushed off into the bottom of the tank and pumped to the drying press.

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Testing Oils for Flotation*

It has long been recognized that a well-equipped experimental testing laboratory is necessary for the successful working of a flotation concentrating plant. Of the many various tests which are required from time to time, the most frequent and perhaps the most important is the testing of oil, or active floating medium. The following remarks refer chiefly to eucalyptus and resinous oils:

The first material necessary is a standard ore sample. For the purpose of oil testing, a thoroughly representative sample of the material to be treated is dried, crushed to pass 60 mesh and bagged. For convenience, a supply ready for use may be weighed off in 1-lb. lots and put up in small tins.

A sulphuric acid solution, containing 405 gm. of H_2SO_4 per liter, is generally used, 1 c.c. of such a solution containing 2 lb. of pure acid per ton, when working on 1 lb. of ore sample.

A standard oil sample is that oil which has been found to fully meet the requirements of the proposition, upon which all future calculations are based and comparisons made. It may be stored ready for use in bottles.

PRELIMINARY EXAMINATION

For specific gravity tests hydrometers reading to 0.001 are required. In all cases it is necessary to ascertain the specific gravity of the oil, with the view, at least, to future calculations. This may be carried out at any suitable temperature which has been fixed upon as standard. It has been found advisable to check the specific gravity of the standard oil simultaneously because of the gradual increase in specific gravity which takes place owing to the loss of lighter oils by volatilization. A correction for temperature is made by allowing 0.00015 for each degree Fahrenheit.

A small burette is used for counting the number of drops in 1 c.c. of the oil, also for admitting the oil to the machine during testing operations. The greater the number of drops delivered by the burette, the greater is the accuracy of the test. To obtain a suitable dropper, cut a burette about 8 in. above the cock, almost close the discharge orifice by dumping up the glass with a blowpipe flame, then grind the outside back to a point so that a minimum surface is presented to the oil drop. The burette should at normal temperatures give between

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*Excerpts from an article by J. [illegible], in "Aust. Min. Stand.," Apr. 8, 1915.

80 and 90 drops per cubic centimeter, when run at the rate of 1 drop per second. The temperature of the oil during the dropping test should correspond with the temperature during the flotation test.

Having obtained the number of drops per cubic centimeter and the specific gravity, it is easy to calculate the number of pounds of oil per ton of ore, when working on 1 lb. of sample. Thus $\frac{2240 \times sp.gr.}{453.6 \times drops\ per\ c.c.} = lb.\ of\ oil\ per\ ton.$

It is sometimes desired in practice to use a mixture of oils. When the oil under examination is to be used in conjunction with other oils, these should be wholly miscible in the proportions in which they are to be used.

The following classification and explanations will serve to give a general idea of the methods employed when carrying out various tests: (1) Flotation of lead, zinc and other sulphides, as a mixed concentrate; (2) differential separation, or selective flotation of one sulphide in the presence of other sulphides (the term "differential separation" is usually applied to the selective flotation of lead sulphide from zinc and other sulphides); (3) flotation of copper and iron sulphides.

Outline of Test Process

The testing of oils in the laboratory is carried out by comparing measured quantities (from 3 to 6 drops) of a standard oil, with a similar quantity of the oil under examination, the values being arrived at by comparing the results obtained from each series of tests. Tests are usually made on 1 lb. of standard ore sample in 4 lb. of water at a standard temperature, acidulated with a definite quantity of sulphuric acid. The oil then being admitted, the mixture is agitated in a specially constructed agitating machine, the principle of which is dependent on the object of the test. The float produced is skimmed off, dried, weighed and assayed.

Test 1. The Flotation of Mixed Sulphides.—Almost any eucalyptol oil which produces a persistent froth and leaves a gummy residue on evaporation is suitable for this class of work. An agitating machine may be constructed by cutting a packing bottle about 10 in. above the neck (a bell jar of suitable dimensions can be obtained). Fit four copper baffles, 4x1½ in. wide, to a copper band of the same width and push this arrangement hard down into the bottle (the band being first bent to fit the inside circumference of the bottle). The lower ends of the baffles will jam hard at a point where the concave glass begins. The band is then expanded hard against the glass and held in position by soldering the separated ends. The mouth, or discharge end, is closed with a rubber stopper, through which is passed a glass or metal tube fitted with a short rubber tube and clip. The bottle with the baffles in position is inverted and clamped centrally under two pairs of suitable bearings, which carry a ½ in. impeller shaft. At the upper end of the shaft is fitted a driving wheel, and at the lower end a four-bladed impeller which just has clearance between the lower points of the baffles and the glass. The blades of the impeller have a lateral angle of about 45° and should be driven at about 1200 r.p.m. in a lifting direction.

Test 2. Differential Separation.—For differential separation, an oil high in phlanderene which leaves a gummy residue on evaporation is used. Phlanderene may be tested for by a polariscope. Differential separation is worked in acid and neutral and in hot and cold liquors, and being still in its infancy, allows of many types of machines and schemes. Each different ore requires some modifications, but the principal in main is the addition of medium and aëration from below, which is effected by air jets or suction created by the impeller.

Test 3. Flotation of Copper and Iron Sulphides.—An oil which gives a deflection by the polariscope of 60 or over is considered sufficiently high in phlanderene for use in copper flotation. Tests are usually made with the apparatus described in Test 1, using cold circuit liquors made slightly acid. In practice the mine water usually contains sufficient acid for the purpose.

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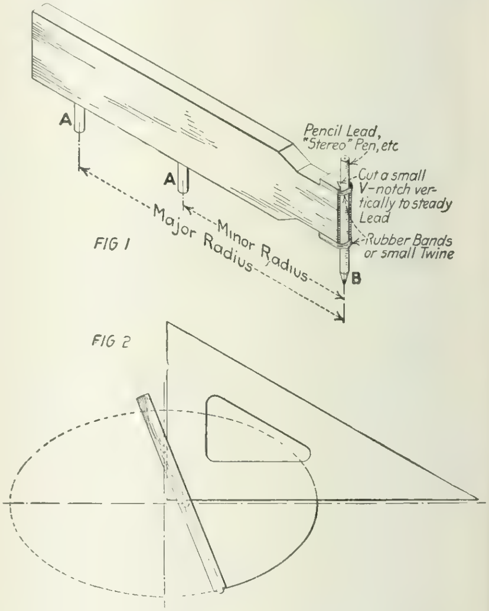
Simple Method of Drawing Ellipses

To many draftsmen the drawing of ellipses seems to be a troublesome job, says *American Machinist*. In Fig. 1 is shown a simple ellipse trammel for this purpose.


A
A
Pencil Lead, "Stereo" Pen, etc
Cut a small V-notch vertically to steady Lead
Rubber Bands or small Twine
B
Major Radius
Minor Radius
FIG 1
FIG 2

Simple Method of Drawing Ellipses

This is made from soft wood about $\frac{3}{16}$x¾x12 in., which size will be found to cover almost all work where it is required.

A little care should be taken to get the two points *A*, which the made from phonograph needles, and the tracing point *B* in practically a straight line. In shop work, a scriber, or metal point, may be substituted for the lead point shown.

The manner in which the trammel is used is illustrated in Fig. 2.

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The Ash in Coal Will Fuse below 2550° F., according to John H. K. Burgwin ("Journ. Ind. Eng. Chem.," August, 1914), if the coal contains over 3% of iron plus sulphur.

Company Reports

Butte & Superior in 1914

The report of the Butte & Superior Copper Co., Butte, Mont., for 1914, shows a net increase in assets of $365,478 after all expenditures, including dividends amounting to $611,908. The company is to be complimented on the completeness of its financial statements given in the report. This elucidation is accomplished by the addition of a plain statement or analysis of the net increase in quick assets or "working capital" such as the JOURNAL has been making from time to time for the benefit of those who do not readily understand the meaning of the conventional financial statements given out by some of these large companies. Looking at this statement one may see at a glance the differences between the reported net income from operations and the earnings actually available for dividend payments. A summary of the statement given is reproduced herewith:

DETAILS OF NET INCREASE IN WORKING CAPITAL DURING THE YEAR

Increases:		
Net income from operations (see income account)		$1,417,128
Capital stock issued less bonds converted		3,982
Premium from sales of capital stock		10,023
		$1,431,133
Applied as follows:		
Properties	$211,262	
Investments	49,751	
Deferred charges	177,959	
	$438,972	
Dividends paid	611,908	
Taxes for 1913	14,775	
		1,065,655
Net increase		$365,478
Working Capital		
Ore on hand		$2,359
Shipments in transit, estimated		197,035
Material and supplies		180,813
Accounts receivable		12,278
Prepaid insurance		1,471
Cash		874,677
		$1,269,633
Current liabilities		111,385
Working capital		$1,158,248

Income Account, 1914

	Amount	Per Ton Treated
Income:		
Sales of zinc and lead concentrates and residues	$4,037,647	$11.876
Less freight	799,233	2.862
	$3,238,414	$9.014
Operating costs:		
Mining 326,686 tons	$1,062,345	[illegible]
Milling 327,210 tons	709,834	[illegible]
Other charges	73,323	[illegible]
Total operating costs	$1,845,502	[illegible]
Net profit	$1,392,912	[illegible]
Other income	24,215	
Net income	$1,417,127	

The company now owns 27 claims with an area of 164.7 acres and undivided fractional interests in nine claims having a total area of 58.3 acres. Surface rights to 12 acres were purchased to provide for impounding tailings. During the year 16,796 ft. of development work was performed, consisting of 7432 ft. of drifts, 7842 ft. of crosscuts and 1522 ft. of raises and stations. Total development to date, exclusive of old, inaccessible workings, was 55,651 ft. Stoping operations have now probably exhausted ore to a point 120 ft. above the 700-ft. level. A considerable amount of development work was done eastward from the shaft on the 1500-ft. level, and it is stated that a part of this proved fully up to expectations.

It is stated that only sufficient development work was undertaken to maintain substantially the existing tonnage of ore reserves, and an estimate of ore actually blocked out at the end of the year shows about 1,030,000 tons averaging 20% zinc and 7 oz. of silver. This is a decrease of about 20,000 tons during the year.

There were 326,686 tons of ore mined during the year at an average cost of $3.20 per ton, including all expenses for development work directly connected with mining and blocking out ore reserves, but exclusive of exploration work on outlying claims. The mill treated 327,210 tons of ore compared with 269,940 in 1913. The actual operating time during the year was 10 months, due to a shutdown; otherwise the mill would have treated about 100,000 tons. The following table gives the average assay value and details of metal contents in ore and concentrates:

	Gold, Oz.	Silver, Oz.	Copper, Lb.	Lead, Lb.	Zinc, Lb.
327,210 tons crude ore:					
Average assay.	0.0196	9.5315	0.2015%	1.340%	18.5730%
Total contents.	6,401.01	3,118,810	1,318,336	8,770,222	121,545,158
101,411 tons zinc concentrates.					
Average assay.	0.0504	25.4288	0.4774%	2.436%	53.1642%
Total contents.	5,110.49	2,578,758	968,185	4,941,850	107,828,679
2972 tons lead concentrates.					
Average assay	0.0716	40.512	0.298%	46.432%	13.721%
Total contents.	212.64	120,385	17,708	2,759,521	815,441

The mill recovery for the year averaged 88.71% compared with 86.43% in 1914. The average milling cost was $2.12 per ton compared with $2.69 in 1913. Operating costs for 1915 are expected to be about the same as during 1914, although there are some prospects of improvements in milling costs.

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Old Dominion

The Old Dominion Copper Mining & Smelting Co., Globe, Ariz., reports a production of 30,210,361 lb. of copper, 148,159 oz. of silver and 3308 oz. of gold from ores smelted in 1914. Of this production, 17,816,284 lb. of copper, 33,311 oz. of silver and 602 oz. of gold came from Old Dominion ores and the remainder from custom ores. The total amount received for the metals from company ore was $2,473,582; the profits from the treatment of custom ores, $200,623, and the total receipts, $2,674,205. Expenses at Globe were $1,431,654, and refining, commissions, transportation, taxes and other expenses were $264,042, making the total expenses $1,695,696. The net earnings for the year were $978,509. Depreciation on plant amounting to $570,750 is not included in the figures just given. Dividend payments were $445,500, making total dividends to date $3,807,000. The mines produced [illegible] tons of ore, averaging [illegible] copper, and the mining cost was $5.20, compared with a cost of [illegible] in 1913. Development work totaled [illegible] ft. The average flow of water in the mine was [illegible] gal. per 24 hr. Power costs for 1914 were [illegible] per hp.-year, compared with $71.02 per hp.-year in 1913. The concen trating plant treated 151,893 dry tons of ore averaging 4.67% copper at a cost of 93.2c., compared with a cost of 87.8c. in 1913. Deducting oil-flotation experimental expense in 1914, however, the cost of concentration was about the same as during the previous year.

A 16-box 300-ton Minerals Separation oil-flotation machine has been installed on the lower table floor of the mill. The operations to date have increased the saving of copper, and still better results are looked for. The concentrates made on these machines are difficult to settle by ordinary methods, and an Oliver filter will be installed to filter the material. The smeltery treated 207,595 tons of charge at an average cost of $2.669 per ton of new charge. The cost of converting per ton of fine copper produced was $5.65. A 12-ft. converter shell, that was put into service in July, 1913, has produced 23,350 tons of copper, which is an extraordinary performance. The cost of producing fine copper was 8.22c. per lb., after deducting silver and gold values and profits from treatment of custom ores. These costs include taxes and Boston office expense.

Milling at the Tonopah Belmont Plant

The Tonopah, Nev., plant of Tonopah Belmont Development Co. has been in continuous operation in 1914, during which period 181,424 tons of ore was milled. The average content of this ore was 22.3 oz. silver and 0.2336 oz. gold, a total of $16.721, counting the silver which was sold at 50c. per oz. The stamps reached 93.83% of their possible duty. The average tonnage per stamp-day was 8.88 tons, and the average daily tonnage, 499.8 tons.

OPERATING COSTS AT THE BELMONT MILL
Mar. 1, 1914, to Feb. 28, 1915

			Amount	Per Ton
Crushing and conveying			$12,322.83	$0.068
Stamping			55,836.04	.307
Classifying			3,995.54	.022
Tube milling			66,051.37	.364
Thickening			9,976.43	.055
Concentrating			14,138.23	.078
Agitating slimes			149,045.52	.821
Filtering and discharging slimes			31,006.94	.171
Precipitating			24,342.65	.134
Assaying			2,561.40	.014
Refining			7,702.38	.043
Lighting			1,862.46	.010
Shift bosses			6,460.54	.036
Watchmen			2,097.50	.012
Surface and plant			3,784.74	.021
Total direct cost			$391,184.57	$2.156
	Amount	Per Ton		
Administration	$10,200.00	$0.056		
Office and storehouse	2,740.47	.015		
Taxes and insurance	9,438.44	.052		
Depreciation	50,000.00	.276		
General expense	1,622.05	.009		
Total indirect cost			74,000.96	.408
Total milling cost			$465,185.53	$2.564
Dry tons milled			181,424	
Labor, per dry ton				$0.419
Miscellaneous and superintendence, per dry ton				1.726
Power, per dry ton				.419
Total				$2.564
Average number of stamps dropped daily			56.3	
Tons per stamp			8.88	

The direct milling cost was $2.156 per ton, and the indirect cost, $0.408 per ton. The cost of production per ounce of doré was $0.123. Better mill efficiencies than were obtained last year are indicated by this comparison, since the gross metal content of the ores was about 15% lower. The average extraction on tonnage milled was 95.78% of the gold and 91.81% of the silver, or a combined extraction of 92.99%. The average extraction is somewhat less than last year, several reasons accounting for the fact. Among them was the more refractory nature of the ore, which contained much more sulphides of the base metals.

The old plant at Millers has been operated continuously throughout the year, with the exception of six days in November, when operations were stopped while changing to a new process. During the year 44,692 dry tons of ore was treated, with a resulting profit of $24,344. The production was 1,031,745 oz. of silver and 12,468,927 oz. of gold. Because of unsatisfactory results in extraction and operating costs, the mill was reconstructed during the year and the process changed from filtration to the continuous counter-current decantation process. The cost of reconstruction was $24,930. A contract was entered into with the Jim Butler Tonopah Mining Co., whereby that company, in consideration of a reduced treatment charge, refunded the capital expenditure for alterations as above at the rate of 50c. per ton milled. Under this contract, the Jim Butler Tonopah Mining Co. receives for the ore treated at Millers the actual recovery of metals made at the actual prices at which the products are sold, and pays treatment charges equal to the actual direct and indirect milling costs plus 5%. During the last three months of the year, the period of operation of the contract, 10,503 tons of ore have been treated under it at a profit of $3807.

During the first nine months of the year, while the filtration process was in operation, the mill treated 34,189 tons of ore. On this tonnage an average extraction of 87.45% was made at a total operating cost, direct and indirect, of $4.034 per ton. In January, 1915, with the new process in operation, but as yet not properly tuned up, the extraction became 90.05% and the total costs were $3.766 per ton. The economy of the new processes is thus indicated at about 2.6% in extraction—47c. per ton on $18 ore—and about 27c. in operating costs. It is probable that with the new process tuned up, a saving of 80c. per ton will be attained. The accompanying table shows in detail the costs incurred in ore treatment at the Belmont mill in Tonopah.

Centennial Copper Co.

The Centennial Copper Co., Calumet, Mich., reports a loss of $3213 for 1914 on a production of 2,287,130 lb. of copper, sold at 12.111c. per lb., and miscellaneous earnings of $5025. There was a balance of $24,634 in assets after the close of the year's business. The mine was put on a three-quarter basis following the outbreak of the European war, but on Dec. 1 full time was resumed at lower wages. On Feb. 1, 1915, the wages were raised to the rates in force prior to the cut of Dec. 1.

The following table gives the operating record of the Centennial for the last four years:

	1911	1912	1913	1914
Tons of rock treated	86,543	106,517	85,443	138,136
Yield, pounds of refined copper	17.26	16.36	18.87	16.56
Cost per pound of refined copper (in cents):				
Mining, milling and transportation	10.38	11.74	11.55	11.10
Construction	....	....	....	....
Smelting, freight, commissions, etc.	1.43	1.32	1.37	1.11
Interest	.43	.40	.46	.35
Total cost per pound	12.69	13.46	13.38	12.56
Development work included in above costs:				
Shafts	....	203	135	....
Openings, etc.	2639	2404	1326	2278
Percentage of hoisted rock discarded	0.214	1.041	5.986	0.671

Correspondence and Discussion

The Five-Hole Cut

Noting the discussion by H. A. Morrison of "The Five-Hole Cut," we have thoroughly tried the well-known approved methods and have found them lacking. Contrary to our expectations from experience gained in widely diverse mining camps, we have concluded that the "five-hole burn cut" is most practical for the rock and ore at Franklin, N. J. The rock is a highly crystalline white limestone which seems very resilient and tough, and resistant to the shocks of drilling and blasting. It does not lend itself to "bulldozing" or even mammoth blasting with churn-drill holes in quarrying operations, and the ore possesses similar mining properties. Although many types of V-cuts, cone cuts, draw cuts and side-round cuts have been tried, their success has been indifferent unless they have been placed with an accuracy not reached in practical mining. The V-cuts will shoot only several of the collars of the holes or else burn their bottoms if the spread of the holes at their collars is much less than the depth of the round which is expected. If a raise is made 6½ ft. wide, it will be possible to get a spread of holes of only about 2.9 ft. if the cut holes meet 5 ft. in advance of the face, and about 3.2 ft., if they meet 6 ft. in advance, providing a standard air-feed stoping drill (of about 56 in. minimum length) is used with a 2-ft. starting drill; the ratio of cut spread to round depth is thus about 58% and 53%, respectively, which is too slight to permit breaking the Franklin ground.

The general theories and practices of concentrating the explosive at the bottoms of the drill holes do not produce as satisfactory results in the ore and rock at Franklin as the uniform distribution of explosive. The uniform distribution is obtained by drilling the holes of as small a diameter as is practicable in order to get the requisite strength of drill steel and the necessary changes in gages, thus distributing the explosive throughout a considerable length of the drill hole. Often, less room is left for tamping (or "stemming") than the space occupied by the explosive, which is contrary to the usual recommendations of explosives engineers; but other factors, recognized by a few explosives experts, should be taken into consideration. A gelatin dynamite is used, as this shows the highest rate of detonation of the various dynamites. So, when No. 6 or No. 8 detonators are placed in the sticks nearest the collars of the holes, their effect produces a compressive force upon the remaining explosive in the hole, while, because of the high rate of detonation, a lesser amount of tamping will produce the same explosive efficiency gained with more tamping from a dynamite of lower detonating velocity. Also, the crystalline particles of ore at Franklin, with their high specific gravity, form an unusually effective tamping medium, since their inertia is great and the interlocking of grains offers great resistance to sudden displacement. After extensive working tests of various ammonia, nitroglycerin and gelatin dynamites from 40% to 93% nitroglycerin and 7% guncotton (or approximately 110% straight-dynamite equivalent strength), the 50% low-freezing gelatin dynamite was adopted. This proved as effective as the 60% and much better than the 40% or mixed 40% and 60%.

It seems quite possible that the rate of detonation of an explosive used in blasting drifts and raises plays a more important part than is usually realized. Although two different explosives may have the same total power liberated by detonation as shown by tests with ballistic pendulums or Trauzl lead blocks, the initially applied forces may not be equal; and if one exerts sufficient initial force to strain the rock to its elastic limit for a considerable distance and the other does not, the shattering effect will be widely different. The expulsion and propulsion of rock masses is in general not a very useful type of work in mining solid rock; therefore, the shattering effect of an explosive should be chiefly sought. It also seems probable that for any given rock there is an economic limit to the useful work accomplished by a stronger explosive of the same rate of detonation, as well as by one with an increased velocity of detonation, providing the rock is well shattered by an explosive of less strength or a slower rate of detonation. In fact, there appears to be an open field for much research in regard to the adaptation of explosives to blasting rock, bearing in mind always that the useful work accomplished is not necessarily measured by the laboratory methods in vogue.

In regard to Mr. Morrison's criticism of raising rounds at Franklin, we can express no surprise over his holding such views, for general experience elsewhere would tend to support them. His error is merely in failing to realize that "there are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

B. F. T.

Franklin Furnace, N. J., May 13, 1915.

Science vs. Dreamland

Following up the shaping of the ingot of argumentative monologue (which was first cast by a gentleman who asserted that science has never made a fortune, but that business has), permit me to hammer, as I chant the "Anvil Chorus."

One underlying cause of popular misconceptions regarding scientists is the fact that many people who get the credit for being scientists are merely rank imitations. They are simply "business men" in the sense that *business* means the act of being busy trying to convince other people of what one wants said people to believe.

If the victims believe and are contented, successful business results. If money passes, the proceeding may be characterized as "successful practical business."

Some of the phony scientists are cruising to Dreamland and back again. Those who fail to get back with regularity are given machinery nicknames, such as "eccentric," "nut," etc. Some of the most successful pose as squirrel-food simply for pure joy or for the corn which eventually comes their way.

The point is this: There have been, and there still live, many scientists and fractional-scientists who have set out to investigate the things which were discovered in Dreamland. The idea has been to learn the truth about them. When the truth is found and classified so that the ordinary business men can understand it, science becomes of practical advantage to humanity.

But if a scientist is engrossed with the idea of chiseling his own name on the tablets of fame, he often forgets to tell the world enough of the truth to make his experiments serve any real practical purpose.

Suppose a scientist takes a microscopic quantity of metal and conducts an elaborate series of tests which yield nine solid pages of complex mathematical formulæ which fail to interest even the fellows of his Royal Society. The quantity of material involved in the experiment is so tiny that a chemical analysis is out of the question. Other scientists, who are too lazy to analyze the equations and too polite and too ethical to question the accuracy of the final values for the pollywog and pothook symbols, put on their tortoise-shell lorgnettes and look wise as they nod approval.

The result is that the libraries are glutted with a nauseating mass of conglomerated facts and misunderstood misinformation. Thousands of dollars are wasted annually by individuals and corporations who employ more or less conscientious students and readers to rake over the muck-piles and pan out a few facts of real practical value.

Profane language is out of place in respectable technical magazines; but, to speak bluntly, it is high time for some of the damned nonsense in the archives of technical literature to be classified and labeled in such a way that it will die and *stay dead*. Dreamland is a beautiful place for a vacation, but beans and bacon are more nourishing than warm zephyrs.

WILLIAM B. MCKINLAY.

New York, June 12, 1915.

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Recent Progress in Flotation

In the JOURNAL of May 29, 1915, recent progress of flotation was discussed by O. C. Ralston and F. Cameron. After an interesting review of various subjects pertaining to flotation methods, the flotation of nonsulphide minerals was discussed. The writer has obtained a basic patent on the sulphidizing of nonsulphide mineral for purposes of flotation in 1905, and has since then done extensive work in this line, some of which is of recent date and has not been published. Messrs. Ralston and Cameron make a number of statements in their article which might unintentionally create the impression that only low-grade concentrates can be obtained by this process. Copper concentrates assaying 23.40%, 24.60% and 13.40% in copper, which I have made, can hardly be called low grade. Nor should lead concentrates assaying from 53% to 71.50%, obtained from lead-carbonate ores, be classed as low grade. In the latter case extractions of 76% can be made commercially without difficulty. Zinc concentrates obtained from carbonate and oxide ores, some of them carrying some sulphide, assaying 52% to 57%, can also be classed as good smelting products, and commercial extractions of 80% and better are obtainable when the proper methods are employed. It might be well in publishing definite conclusions to state under what conditions such tests were made. The flotation of nonsulphides is a field even more difficult than the flotation of sulphides, and surely those who have not made exhaustive tests on the subject might obtain poor results, while when the proper conditions are provided excellent results may be obtained both in the way of getting high-grade concentrates and good extraction. It is here pointed out in the previously mentioned article that a great deal of gangue, especially iron, is carried up. This also is quite contrary to my experience. The H_2S process lends itself particularly well to selective flotation—more so than any other method I have known, and I have separated complex ores with great success. The application of the H_2S process is particularly important for the flotation of those sulphide ores which either carry a percentage of carbonates and oxides or else do not lend themselves well to flotation. This is invariably due to the fact that the sulphides are slightly coated with nonsulphides. Metallic copper and native silver are susceptible to this treatment, and the writer begs to differ with Messrs. Ralston and Cameron in their estimation that the present outlook limits the application of the H_2S process to copper ores. It rather seems that the injection of H_2S gas, which is inexpensive and can be made from waste products which are usually on hand, and the fact that this process can be used in connection with any suitable method of flotation, should secure for it almost universal application.

A. SCHWARZ.

Joplin, Mo., June 2, 1915.

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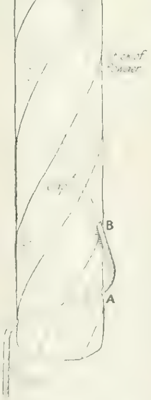
Making Primers

To keep the fuse from pulling out of the powder when making primers, I find a good practice to be as follows: Punch a hole through the powder at *A* and another almost through at *B*. Then push the fuse and cap through *A* into *B* and pull the fuse tight. The cap will not come out then unless the powder comes with it.



METHOD OF PRIMER MAKING

JOS. P. RUTH, JR.

Idaho Springs, Colo., May 25, 1915.

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Working During High- and Low-Price Conditions

Just as one of the suggestions the outsider can always give: Why do not mining companies of ample resources work their highest-grade deposits when prices are high and the low-grade when prices are low? This would enable them to make the maximum output of metal when prices were up, and a maximum tonnage over which to distribute overhead costs and other luxuries, with a minimum of metal to disturb the market, when prices are down. During the low-price period development work would be carried on to leave big bunches of high-grade where it would be easy to get at. The above is not supposed to apply to gold ores.

A. A. NASON.

June 7, 1914.

NEW PUBLICATIONS

THE BASINS OF NELSON AND CHURCHILL RIVERS. By William McInnes. Pp. 149, illus. Memoir No. 30, Canadian Geological Survey, Ottawa, Canada.

JOPLIN NEWS HERALD'S 1915 ZINC AND LEAD HANDBOOK. By L. L. Wittich. 3¾x8½, pp. 59, illus., paper; 25c. Joplin News Herald, Joplin, Mo.

LEAD POISONING IN THE MANUFACTURE OF STORAGE BATTERIES. By Alice Hamilton. Pp. 38, illus. U. S. Bureau of Labor Statistics, Washington, D. C.

GEOLOGY OF FRANKLIN MINING CAMP, BRITISH COLUMBIA. By Charles W. Drysdale. Pp. 252, illus. Memoir No. 56, Canadian Geological Survey, Ottawa, Canada.

ORGANIZATION OF WORKSHOPS AND FACTORIES. By Robert Grimshaw. 3½x5¼, pp. 104, paper; 50c. Published by the author, 1330 St. Nicholas Ave., New York, N. Y.

ANNUAL REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE YEAR 1913. By John McLeish. Pp. 363, illus. Canadian Department of Mines, Ottawa, Canada.

A PRIMER ON EXPLOSIVES FOR METAL MINERS AND QUARRYMEN. By Charles E. Munroe and Clarence Hall. Pp. 125, illus. Bull. 80, U. S. Bureau of Mines, Washington, D. C.

THE CONDENSATION OF GASOLINE FROM NATURAL GAS. By George A. Burrell, Frank M. Seibert and G. G. Oberfell. Pp. 106, illus. Bull. 88, U. S. Bureau of Mines, Washington, D. C.

SOME MINING DISTRICTS IN NORTHEASTERN CALIFORNIA AND NORTHWESTERN NEVADA. By James M. Hill. Pp. 200, illus. Bull. 594, U. S. Geological Survey, Washington, D. C.

MAPS OF THE MINING DISTRICTS OF MINNESOTA, 1915. Compiled by E. H. Comstock. 12x17¼, 13 sheets; $1. Minnesota School of Mines, Experiment Station, Minneapolis, Minn.

SUMMARY REPORT OF THE MINES BRANCH OF THE DEPARTMENT OF MINES FOR THE YEAR ENDING DEC. 31, 1913. Pp. 214, illus.; 15c. Canadian Department of Mines, Ottawa, Canada.

ANNUAL STATISTICAL REPORT OF THE AMERICAN IRON AND STEEL INSTITUTE FOR 1913. 6x9; pp. 152; paper. Bureau of Statistics, American Iron and Steel Institute, Philadelphia, Penn.

NOTIZIE SULL'INDUSTRIA MINERARIA NELLA VENEZIA SOTTO IL DOMINIO DELLA REPUBLICA. E. Oreglia. Appendice alla "Rivista del servizio minerario nel 1913." 7¼x10¼, pp. 82, illus., paper. Ministero di Agricoltura Industria e Commercio, Rome, Italy.

ANNUAIRE POUR L'AN 1915, PUBLIE PAR LE BUREAU DES LONGITUDES. 4x6, pp. 1075, illus., paper; 1.50 fr. Gauthier-Villars et Cie, Paris, France.

In addition to the customary astronomical tables this contains a number of mathematical tables, and conversion tables of weights and measures.

STAMP MILLING AND CYANIDING. By Francis Andrew Thomson. 6x9, pp. 285, illus.; $3. McGraw-Hill Book Co., Inc., New York, N. Y.

In spite of the number of books already offered in the field of milling and cyaniding, both as textbooks for students and reference books for operating engineers, this one is not superfluous. Usually stamp milling and cyaniding are treated in separate volumes, but Prof. Thomson prefers to take them together. This is perfectly natural, since all ore that is cyanided must first be milled in some way. The author does not confine his section on stamp milling to the actual operation of stamps, but includes ore crushing by other methods, such as chilean mills, rolls and similar machinery. The book is particularly applicable to the uses of students, for which purpose its value is enhanced by a complete bibliography attached to each chapter. Professional men should also find this of interest and value, since it may lead to the discovery of unknown data. Of course, articles on pertinent subjects are continually appearing in the technical press, and no book can presume to be up to the minute with references to them, but Prof. Thomson has certainly succeeded in selecting the most important of those articles and books which have appeared in recent times.

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The Gold Hill Consolidated

One year ago this week (June 15) the New York *Sun* treated the public to the edifying reproduction of a letter on Senate stationery, signed by a pseudo-mining-geologist, giving his opinion that a valuation of $60,000,000 for the Gold Hill property was a conservative figure.

The Journal dealt with this at length in its issue of June 20, 1914, and editorially suggested a method whereby any uncertainty as to the value of the Gold Hill property could very quickly be relieved.

A news dispatch from North Carolina now announces the appointment by the court of receivers for the Gold Hill property, which has been shut down and idle for several months, and adds that Walter George Newman, of New York, the president of the company, who defended his use of United States Senate letter paper in a publicity campaign booming the property, is not at the mine and there is no one in his absence to tell of the company's assets and liabilities.

It did not require a periscope of perspicacity to foresee this dénouement.

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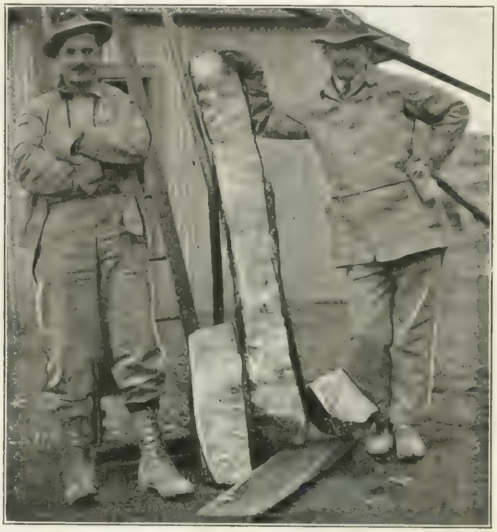
Rich Ore at the Temiskaming Mine

In the accompanying photograph is shown a rich slab of ore from the 530-ft. level of the Temiskaming mine, at Cobalt, Ont. This slab is almost wholly metallic. It is 7 in. wide—the width of the vein—5 ft. 7 in. high and weighs about 600 lb. Its approximate assay is 10,000 oz. silver per ton. Its value as a specimen is increased through its large content of ruby silver. The specimen has nearly the shape of a bass viol, and is not far from the average size of such instruments.



Rich Ore at the Temiskaming Mine

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Spanish Prohibition of Metal Exports

The exportation from Spain of the following articles has been officially prohibited, according to the *Iron and Coal Trades Review*: Aluminum and alloys thereof; antimony and alloys thereof; bauxite or aluminum ore; tin and alloys thereof; zinc and alloys thereof in cakes; nickel and alloys thereof; rubber and mixtures thereof; anhydrous or hydrated alumina; chrome; molybdenum; manganese (metal); vanadium; ferrochrome; ferromolybdenum; ferronickel; ferrotungsten; ferrovanadium; partly or wholly manufactured articles of copper or brass; tinplates.

Photographs from the Field

Delarof Development Co.'s Cyanide Plant, Unga Island, Alaska

Treating tailings from 500,000 tons of ore crushed during the 25 years of operation of the Apollo mill. The cyanide plant is a 200-ton leaching installation

Uptodate Construction Methods at the Anaconda Plant, Montana

Setting up the leaching-plant dewatering tanks with a locomotive crane. This set of tanks is 101 ft. long

Rochester, Nev.
A view of the new camp that is making a good reputation and living up to expectations

Eureka Mountain, Johnsville, Plumas County, Calif.
This hill is one of California's best producers. $10,000,000 is claimed to have been taken from it

Mr. Ryan on Copper

John D. Ryan, president of the Anaconda Copper Mining Co., who has for several years been arguing vigorously for legislation permitting American manufacturers and sellers of commodities to combine in their selling organizations abroad for the purpose of mutual protection, recently gave the new Federal Trade Commission some very important information on the conduct of the copper export business and created a very favorable impression, it is said. As reported by the *Boston News Bureau*, Mr. Ryan made the following statements and arguments:

> "If, during the 10 years ended with 1913, the American copper producers had been permitted to sell their export metal through one organization and thereby meet the combined forces of European buyers, we would have received $60,000,000 more for our copper which went abroad in that period. This would have been an average of $6,000,000 a year."
>
> Figures were presented by Mr. Ryan showing that three producers of this country, controlling 50% of the output, had in the 10 years' period in question sold 5,560,000,000 lb. of copper for which $821,000,000 was realized. Of the total 2,580,000,000 lb. was sold to home users at an average price of 15.21c. per lb. delivered at New York or Connecticut points, whereas the 2,980,000,000 lb. sold abroad brought an average price of but 14.38c. per lb. delivered at European ports. In these cases the producers paid the freight abroad.
>
> He then went on to tell of the manipulation conducted by foreigners through the medium of the London Metal Exchange when they desired to buy our copper cheap. After hammering down the quotations on the London Exchange, he said, the market here was affected and the European buyers were able to get their copper at low figures. This was done, he added, through a combination of buyers. Not until after the cheap copper had gone to the foreigners did the American consumers have a chance to get into the market and they were as a result forced to pay higher prices.
>
> "If the producers were permitted to combine in selling to foreign purchasers there would be no more cut-throat competition among the Americans to secure export business. All of us would get a share of the business at better prices and the American manufacturer would be able to get his copper at a price surely as low as that commanded abroad," continued Mr. Ryan in elaborating on his theory.
>
> "In the 10 years' period which I have mentioned the domestic consumers were forced to pay about ⅞c. per lb. more for their copper than the Europeans, and this condition should not prevail," he added. "If necessary legislation were put through Congress and this commission given power of control it would be the best thing that could happen for all of us interested in exportation of products."
>
> Mr. Ryan laid great stress on the fact that natural products of this country were being practically given away because the American manufacturers and producers were forced to compete against each other in striving for foreign business.

Recovering Potassium from Flue Dust

A process for the recovery of potassium from flue dust is proposed by Samuel Peacock (U. S. pat. 1,124,798).

The flue dust resulting from portland-cement manufacture, as well as from other sources, includes valuable potassium salts, since in the ordinary processes of roasting and drying as much as 50 to 75% of the potassium contained in the charge is volatilized and passes out with the flue dust. It is generally known that the total potassium in this dust, from 40 to 60%, is usually combined as a basic silicate, and is insoluble in water. According to the Peacock process, the flue dust is first treated with water to extract any water-soluble potassium oxide, and in order to recover the potassium from its silicate combination a solution of ordinary acid sulphate in water which contains phosphoric acid, chiefly in the form known as monocalcium phosphate, is used. When the basic potash salts or silicates are finely ground and digested with a hot solution of the monocalcium phosphate, a reaction occurs which yields potassium phosphate and calcium silicate. When the calcium silicate which contains the potassium salt is finely ground and digested with acids, such as sulphuric acid, the potassium is recovered in the form of a soluble salt of the acid used. Accordingly, the flue dust may be treated with a suitable acid and the potassium held in the calcium silicate may be recovered.

The New Camp of Willard, Nev.

Special Correspondence

The camp of Willard, Nev., christened for the champion over Jack Johnson, seems to be making good. The first free gold was found by knocking off a piece of slate from a ledge which stands 20 ft. high in a gulch. The discoverer, J. H. Downey, a mining man from Idaho, then came to Lovelock and took an option on the claim on which he had found the gold for $2000, and secured the help of Mr. Ward, a placer miner from Alaska, and Mr. Benedetti, a moving picture man. Five hundred dollars was then paid on the claim. They started to work; the news spread and a substantial camp has resulted.

The New Camp of Willard, Nev.

Willard has now several hundred people in its vicinity. It is nine miles northeast of Lovelock, but only four miles from Kodak, a siding on the Southern Pacific R.R., where the ore is now shipped. The Humboldt River runs close to the railroad, and there is also a spring about half a mile from the main camp.

A telephone line is in operation. The Nevada Valleys Power Co. has made surveys and is arranging to establish a transformer station on its line which passes within two miles of the camp on its way to Rochester, Nev.

High-grade rock has been found on six different claims, while pannings can be secured on as many more. The district is about two miles east and west by a half mile north and south, but the veins strike northwest-southeast and dip west. The hill where the first strike was made is slate with the values in the silicified bedding planes; but there are volcanic intrusives on the claims to the east, where some of the high-grade has been found.

It is too early to give any definite idea of the geological structure. Suffice it to say that there are andesites, porphyries, schists, rhyolites and basalt, as well as slates. Galena, sphalerite, copper stains and garnets are found in the quartz.

There are 18 sets of leasers now at work, six of whom are sacking ore. The Oddie lease, on the claim of the original strike, has let a contract for a shaft which is going down with two shifts daily. Anything over $20 per ton can be shipped at a profit, as the wagon haul to the railroad is only $2, and smelting and freight, $6.50, sliding upward according to value.

The past 30 days has seen the usual disputes and adjustment of differences on claim boundaries and ownership interests.

Several deals are pending and companies are beginning to be formed. A mill is already being figured on, as several good-sized bodies of low-grade, free-milling ore have been cut by short tunnels on leaser's ground. A townsite was formed, but has had little success, as of course it cannot give satisfactory title; besides, people are not spending their money for lots.

WILLARD—A VIEW FROM THE WEST

SACKING AND LOADING THE FIRST SHIPMENT

With the amount of work now going on, the next 60 days should determine the extent and nature of the orebodies, and give those who "come right in and turn around and go right out again" a better chance to pass judgment, as all new camps must go through the hot fires of the critics' analyses until they get on a permanent producing basis.

Celebration of the Fiftieth Anniversary of the Worcester Polytechnic Institute

The founding of the Worcester Polytechnic Institute in 1865, the first technical school to have a regularly equipped manufacturing establishment to supplement the course in mechanical engineering, was appropriately celebrated June 8, 9 and 10 at Worcester, Mass. Delegates from nearly 90 colleges, universities and technical schools were present, as were also delegates from eight engineering societies. The American Society of Mechanical Engineers was represented by its president, John A. Brashear, and its secretary, Calvin W. Rice.

It had been expected that Maj.-Gen. G. W. Goethals, U. S. A., would be one of the principal speakers, but owing to his being summoned to testify in the United States Court at Indianapolis, his presence was impossible. Much of the disappointment of the audience, however, was allayed by the splendid address of Mr. Brashear, who spoke directly to the graduating class and student body of his many years of experience, interspersing many amusing anecdotes and giving a personal and intimate touch to his remarks, because of his long friendship and association with Dr. T. C. Mendenhall, former president of the Institute, and Dr. Ira N. Hollis, its present head.

Mineral Production of South Australia

The official report for 1914 gives the production of metals and minerals in South Australia for the year as follows, the figures in parentheses giving the corresponding production for 1913: Gold, 6258 oz. (6556 oz. in 1913); silver, 3006 oz. (2650 oz.); silver-lead ore, 18 tons (153 tons); copper, 6881 tons (7161 tons); iron-ore flux, 42,622 tons (60,658 tons); limestone flux, 54,054 tons (44,300 tons); phosphate rock, 6083 tons (5950 tons); crude salt, 65,000 tons (65,000 tons).

In addition to the outputs given above there was a production of miscellaneous minerals valued at $179,425. The chief items of this production were gypsum, kaolin and radium producing minerals. This brought the total value up to $2,881,704 for the year.

The number of mining claims and leases held at the close of the year was 1039, covering 57,089 acres; of search or prospecting licenses, 286, covering 718,800 acres. The number of men employed at the end of the year was 5755, of whom 3000 were working in the copper mines and 1650 in connection with the smelting works at Port Pirie. The total number of accidents reported in mines and quarries was six, in which four persons were killed and two injured.

Editorials

Developments in the Spelter Situation

About two weeks ago spelter touched its high point. Since then the market has been recessional. Although all conditions are abnormal, developments are occurring in a perfectly normal way. The upward pushes in the market were given by the ammunition manufacturers. When they ceased buying there was nothing to hold it up, peaceful manufacturers having been put out of business. In the meanwhile production is increasing, and is likely to increase further, for smelters are doing the obvious thing in the direction of increasing capacity.

It has of course been recognized that the present situation in spelter is ephemeral, that it is not to be expected to continue after the termination of the war. The uncertainty about the latter is what prevents the erection of new smelteries. A new plant in the Kansas-Oklahoma gas fields might be built in about eight months. A plant for the Eastern coal fields would require 12 to 18 months. It is unnecessary for us to elaborate upon the dubious conditions that would attend the inauguration of new smelting enterprises. In this juncture the obvious thing, of course, was for existing smelters to add more furnaces to their plants, which could be done in relatively short time and at moderate cost. We understand that this is being done already in several cases.

In the meanwhile domestic consumption is being contracted in an unmistakable way. It is idle to say that a little difference in the cost of the raw material does not trouble the ultimate consumer. Some one needs a new sheet of zinc to put under his kitchen stove. A square 5x5 ft. of No. 21 gage—0.08 in. thick—weighs 75 lb. In ordinary times this would cost him about $6. Now it costs him about $30. Nobody would pay such a sum for such a purpose. He would either make the old sheet do a while longer or would put down a piece of sheet iron. This illustration is not imaginative. It summarizes an occurrence. So it is that the ordinary consumption of zinc in the form of sheet for galvanizing and for brass-making is being annihilated. We are in receipt of numerous inquiries for ways out of the predicament. One galvanizer asks us about erecting a smelting plant on his own account. Another inquires for an expert who can teach him how to make terne plate as a substitute for galvanized. A plumber figuring on a household job advises the use of sheet iron instead of sheet zinc. Galvanizers are drawing their pots and offering spelter for resale. This exemplifies the state of the natural market that has been disrupted for the sake of ammunition manufacturing.

What are the prospects for the next six months? The two great factors are the state of the sales books of the producers and the state of the order books of the ammunition manufacturers. Of considerable importance also is the position of speculators who intervened to scalp a profit on the rise. Of course none of these factors can be gaged any more than approximately. It has been the common assumption that the ammunition buying was endless. Nothing could be more erroneous. The brass-making capacity of America, if nothing else, imposes a limit. Assuming the brass-making capacity to be 450,000 tons at the outside, the spelter requirement would be 150,000 tons at the maximum. It is doubtful if in any year previous to 1915 any more than 75,000 tons of spelter was ever used for brass-making. It is probable that the ammunition-makers to a large extent contracted at one time for all the spelter they were going to need. Certain of them did so, having thus informed us. When buying was conducted in that way it was but natural that the price for the metal should be elevated to an extravagant figure.

As for the smelters, they have probably contracted to deliver about 50% of their expected production in the second half of 1915, which will probably be about 250,000 tons. They have therefore a large surplus still to sell, which will be increased by the production of new furnaces, while the supply also will be swelled by the unloading of speculative accounts and by consumers' resales.

The nervousness that has been exhibited since the cessation of the crazy buying for ammunition has been indicative. The ammunition demand has probably not yet exhausted itself, but it is likely to be executed more judiciously than heretofore. Previous to the war the world's annual production of spelter and copper was about 1,000,000 metric tons of each, and the consumption was approximately the same. It is incredible that the Allies are going to buy in six months 250,000 tons of spelter for military use, and 500,000 tons of copper to go with it. But if they are not going to buy it the price must manifestly come down to a point where galvanizers may resume the use of the metal.

Sooner or later this is what is going to happen to spelter. The decline that has already begun may or may not be the beginning of the big decline. A decline in our market below the London parity may renew an exportation from here and check temporarily a further decline. But whatever the market fluctuations may be, recessions or rallies, it is self-evident that unless the military are going to consume all, or nearly all, of the world's production of spelter the price must fall to a point permitting resumption of its use in the ordinary channels of trade.

The Rise in Lead

The further rise in the price for lead, which proceeded with a violence that exceeded that of the rise in spelter in its early stage, is better explained by madness on the part of the buyers than by anything else. In this metal there was never any such stress in the statistical position as in the case of spelter. Even before the war the overproduction by the mines was creating a desperate situation, and in spite of the curtailment enforced during the fall, in order to avert disaster, the mines of the United States reported a staggering production for the year. It is incredible that normal consumption in the United States in the first half of 1915 has increased so as materially to alter the conditions of natural absorption. In the meanwhile Great Britain has been regaining its normal supplies from Spain and Australia, while as for the Mexican supply, that is just about what is was last year, i.e., insignificant. In short, we do not see how there can be any dearth of lead supply, either present or prospective.

Rather does it seem to us that the sudden and extravagant rise in the price for lead is ascribable to the same kind of ill-advised buying that was responsible for the spectacular rise in spelter. Perhaps it was due in part to the effect of the latter upon the imagination of buyers. The burned child dreads the fire, and having been burned in the spelter market everybody thought to escape a similar happening in lead, and the same idea occurring to everybody at the same time the precise condition was brought about that it was aimed to avoid. A lot of buyers cannot contract within two or three weeks for all the lead they are going to require in six months without creating a crazy market. It is something like that which we have lately witnessed, and among the strange things incident thereto we have seen the American Smelting & Refining Co. supplying its regular customers at less than their competitors, and certain of the independents holding aloof to catch the crest of the wave before selling.

We cannot conceive how there can be any shortage of lead in the United States, for not only is there plenty of lead ore, but also there is a great surplus of lead smelting capacity over what was used in making the phenomenal production of the first half of 1914. While the high price lasts, however, it will be a boon to the mining industry that will be more generally distributed among the small mines of the Rocky Mountains than the high prices for copper and zinc, and without doubt their operators will make hay while the sun shines.

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Human Nature Does Not Change

When the economic history of the metal markets in 1915 is written—say 10 years hence—with the perspective of a distant review many events that are now accepted as matters of course will stand out as things grotesque. No one of these will appear more fantastic than the events in the zinc industry unless they be surpassed by the wild movement now going on in lead. In zinc we have witnessed a rise in value of upward of 500% within a half-year. We have seen zinc mining and smelting companies that one year ago were hopeless derelicts, with neither money nor credit, surpassing the stories of Aladdin and Monte Cristo and talking now about earning this year a sum equal to their entire capital stock. We have beheld a crazy speculation in their shares and doings extraordinary in the spelter market. Yet most of these favorites of fortune are unhappy. Aladdin and Monte Cristo were satisfied. The possessors of zinc interests are not. Right down the line, from the capitalists who have reaped the greatest profits to the workmen who have gained the least, there is dissatisfaction, discontent, and a demand for more. With spelter at 25c. it was regarded as a matter of right that it ought to be 30c. A tendency of the market to recede was considered as something akin to criminal. The cupidity of human nature had one of its most startling exhibitions. For the benefit of the future historian let us state—in a fragmentary way—some of the things that have happened and are happening.

The rise in zinc in its early stages so stimulated the production of zinc ore that the smelters did not have capacity enough for all that was offered. Where they had sliding-scale contracts they were obliged to live up to them, but if there were any provision for a minimum to be taken they exercised it. Producers who had no contracts found themselves unable to sell ore at all. Result, unhappy miners.

The Joplin producers have a theory that the price for ore in their district ought to be eight times the value of 100 lb. of spelter, but when spelter was around 10 to 12c. the price for ore was only about \$55@60 and not until spelter went above 20c. did ore go to \$100. This led to a demand upon the Department of Justice to see if the smelters had not combined to skin the producers, who were very unhappy. At the same time the consumers of spelter, unhappy over the high price for spelter, requested the Department of Justice to investigate if they also were not being skinned.

When ore rose to \$100 in the Joplin district there was a better feeling there, the occasion being celebrated with the aid of a brass band; but it turned out that there was a fly in the ointment. The miners naturally wanted more pay. When an increase was given them they did not want to work more than five days in a week, stating that they could earn enough money in that time—which was perhaps good philosophy, but was adverse to the maintenance of production.

The smelters have been making a lot of money, but they too have complaints. In the early part of the year they complained that they had to take in ore under contracts and could not sell spelter ahead against it as freely as they ought to. Later when that condition changed the burden of their complaint was that they were having to take in ore on the basis of 25c. spelter while they were delivering spelter on their old contracts at 8@10c. per lb.; that while they would realize on their high sales in the third and fourth quarters, that was a long time to wait; and what if some buyers should fail to make good on their contracts? Hence some unhappiness on the part of the smelters.

Among the buyers of spelter the purchasing agents for the ammunition manufacturers finally became alarmed, their prospective profits being seriously threatened. As for the galvanizers and manufacturers of brass for peaceful purposes, they had to watch their business becoming paralyzed. The calamity fell upon the ultimate consumer and from him was reflected upon the manufacturer, from whom it will be reflected upon the smelter.

The unhappiness of the manufacturers and consumers is of a different sort than that of the producers. The consumers find themselves unable to enjoy conveniences that formerly they used to. The manufacturers see their business being ruined. The producers are unhappy for not making money enough!

Human nature remains unchanged. Riches have always bred discontent and always will. When spelter was at 5c. per lb. and everybody was working hard in order to make both ends meet everybody was happy. We [illegible] the lead producers will be the next to become unhappy. The copper producers appear so far to be the only contented ones, but copper is not yet 50% above normal, while spelter has been to 500%, and lead to nearly 200%.

The Tonopah Belmont Report

We had occasion not long ago to call attention to the extraordinary completeness of the report of the Goldfield Consolidated Co. That report was valuable to those who study mill operation from the financial standpoint, as well as to the practical technologist. It is a pleasure to call attention at this time to another report that is quite as complete and satisfactory from both points of view. This is the statement of the Tonopah Belmont Co. for 1914. The company always has been prolific in the distribution of its data, but this report contains several items which are particularly interesting to the profession. Not the least among them is the account of the change, at the Millers plant, to treatment by the continuous counter-current decantation system, in which the costs of both processes are set forth. This is the kind of information that really counts, and the kind we hope to meet with increasing frequency. Such reports are creditable to the company that makes them and a tribute to the intelligence of those interested in mining, whether as an investment or as a profession.

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We understand that metallurgical operations at Chuquicamata have been begun with far less hitch than was expected by the designers of the plant, who naturally had in view the probability of infantile disorders. A 10,000-ton charge has been leached in one of the mammoth tanks without development of any of the irregularities which skeptics predicted. In fact the extraction is reported to have been higher than 90% of the copper in the ore. Copper is now being precipitated in the electrolytic department, but none of the cathodes has yet been melted. Congratulations are extended to the Chuquicamata staff for their success so far, with a renewal of the assurance that everyone hopes that their originality and boldness will result in one of the great metallurgical triumphs of the age.

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The premier among the war stocks is easily Federal Mining & Smelting, which last week rose from $18 to $60 per share. Early in the year it sold for $8. More than half of the common stock of this company is in the treasury of the American Smelting & Refining Co., which bought it years ago when it used to sell above par. Since then it was written down on the books of the smelting company as an investment greatly shrunken in value. The high price for lead will be a boon to this company, but the behavior of the stock, along with United States Reduction & Refining Co., Quicksilver, Comstock Tunnel and others of that ilk, savors of a reckless speculation that takes no account of value.

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The curb market which for a long time has had but a short list of good mining stocks has lately gained a considerable number of respectable issues. Among these are: Alaska Juneau; American Zinc, Lead & Smelting; Chile Copper Co.; Howe Sound (Britannia); Kennecott Mines, and St. Joseph Lead Co. All of these are big companies, most of them producers which heretofore have been closely held. The street is an exercising ground where they are exhibited to the public. If they are received favorably and a distribution of their shares is effected such stocks in the course of time are usually transferred to the Exchange.

The zinc stocks had a spectacular rise. During the last fortnight the lead stocks soared in a similar way, but even more rapidly. Some of the copper stocks have scored good advances since the beginning of the year, but none of them has discounted the rise in the metal. The porphyries are selling at about where they ought to if copper were at 14½c. Amalgamated and Anaconda are actually lower than they were in the early part of 1914.

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We judge from the press dispatches that the idea is obtaining recognition in Mexico that recent events in Washington have extinguished the policy of "watchful waiting"; wherefore it will be wise to consider means to end the lawlessness that has for several years prevailed south of the Rio Grande.

BY THE WAY

At Wallace, Idaho, they are training the young lads to be miners. As an added attraction for their Fourth of July celebration they have arranged for a team of 11-year-old drillers. A team entered from Sumpter, Ore., has a record of 21¼ inches drilled in hard granite in 15 minutes.

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An engineer at Salt Lake City writes that one of the smelters in the Salt Lake Valley came near getting "stung" lately by a shipment of "duplex cable" which was billed by the junkman as copper wire. On transmission lines in the West a considerable amount of duplex cable-wire having an iron or steel center and copper surface is used on long spans where great strength is desired. Some of this cable eventually finds its way, via the junkman, to the smelters. However, in the instance cited, the real character of the cable was discovered before payment was made. It may be added that several copper works in the East have at times paid for copper when they received a large proportion of steel. One of the difficulties in detecting the duplex cable is that in shearing small wire there is a tendency for the soft copper to be drawn over the steel center, thus obscuring the real character of the wire.

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The following picturesque and beneficent result of the rising price of zinc is from the New York *Times*:

> A wealthy mine operator of Joplin and Indianapolis owes his life to the high price of zinc. Held prisoner in an abandoned zinc mine, he had been left to perish, and doubtless would have done so had not two prospectors gone into the old diggings and discovered him after he had been in the drift five days. He was unconscious, but was soon revived. The high price of ore caused the prospectors to enter the drift in the hope of finding zinc overlooked by former operators.
>
> The operator says he was accosted at a Joplin hotel by strangers who said they were desirous of looking at mining land. He does not remember the names of the men, but says they drove with him to the abandoned mine. In a remote drift, he says, he was bound, gagged, and tied to a piece of mine timber. The kidnapers attached a long fuse to a box containing dynamite. The fuse was lighted, and one man said:
>
> "This will reach the dynamite in 12 hr., and if the rats don't get you first, this will finish the job."
>
> The rescuers discovered that the men in walking about had accidentally cut the fuse.

[If the proposition wasn't any better than some we have been dragged out to look at, we can appreciate the frame of mind of the alleged "kidnaper."—EDITOR.]

PERSONALS

Arthur J. Hoskin, Denver, is at Tin Cup, Colo., examining placer property.

R. M. Henderson, manager of the Wellington Mines Co., Breckenridge, Colo., has been in Denver.

Geo. Watkin Evans, of Seattle, Wash., recently visited New York City on professional business.

Philip Argall, returning from London, spent a few days in New York and then proceeded to Denver.

Willard S. Morse is in charge of the new tin-smelting plants of the American Smelting & Refining Co.

William Braden left for Chile last Saturday. He is engaged in exploring a promising new copper deposit there.

Pope Yeatman is expected home from Chile in July. E. A. Cappelen Smith will probably remain at Chuquicamata until the fall.

Frederick P. Burrall has gone to the Klondike district on professional work. He will return to New York about the middle of October.

D. B. Dowling of the Canadian Geological Survey is in charge of investigations into the coal and oil resources of Alberta and Saskatchewan.

Geo. H. Garrey, who has been on examination work in British Columbia, Nevada and California for the last eight months, has returned to New York.

Karl Eilers is about to leave on a long tour of inspection of the western plants of the American Smelting & Refining Co., returning to New York in October.

W. E. Hartman, Chicago, has been retained by the Youngstown Sheet & Tube Co. as consulting engineer on the construction of 204 coke ovens at Youngstown.

Stewart M. Marshall has resigned as chief engineer of the Cambria Steel Co., Johnstown, Penn., to accept a position with the Southwark Foundry & Machine Co., Philadelphia.

Frederick G. Clapp, of Pittsburgh, has recently returned from a year and a half spent in geological explorations in China. His address is as before, 331 Fourth Ave., Pittsburgh.

John W. Finch, one of the best known mining engineers of the West, was operated upon some days ago at St. Joseph's Hospital in Denver for appendicitis. At last reports he was well on the road to recovery.

E. R. Faribault, who has made a special study of the gold-bearing series of Nova Scotia, will continue the geological mapping of this series in Queens and Shelburne counties for the Geological Survey of Canada.

J. W. Mercer is on a summer journey through the West, expecting to visit the gold mining states of the Rocky Mountains and the Pacific Coast, whence he does not intend to return to New York until late in the summer.

Durward Copeland, metallurgist for the Cia. Estañifera de Llallagua, has been in New York and vicinity for several weeks, and will leave soon for a trip to the principal tin-producing centers. He will return to Bolivia in about five months.

M. R. Hull, who, for the past six years has been connected with the engineering department of the Anaconda Copper Mining Co. at Great Falls and Anaconda, Mont., has recently been appointed superintendent of construction at the Washoe Smelter at Anaconda.

C. H. Morse, Sr., now more than 80 years old, has resigned as president of Fairbanks, Morse & Co., after serving in that capacity for 25 years. He is succeeded by his son, C. H. Morse, Jr., but will retain his interest in the company and will act as a director.

J. A. Dresser is this season conducting for the Canadian Geological Survey an investigation of the mineral and other natural resources of the Lake St. John region in Quebec. This will include the Palaeozoic basin surrounding the lake and the deposits of iron ore in the region to the east.

John Nichols, who has had charge of the El Paso mine, Cripple Creek, Colo., and has been operating mines throughout the West for many years, has retired. His place has been filled by the appointment of Joseph J. Darnell, also a practical superintendent of many years' experience not only in the district but throughout the state. It is understood that the company's new directors have inaugurated radical changes in operation and development.

C. L. Miller, vice-president and general superintendent of the American Steel & Iron Co., Pittsburgh, announces the following appointments, effective June 1. B. D. [illegible], superintendent of Donora furnaces, has been made superintendent of the Central furnaces at Cleveland, Ohio, succeeding Chester A. Orr, who resigned to become manager of the Cleveland Metal Products Co.; Charles J. Brown, formerly superintendent of Shoenberger furnaces in Pittsburgh, has been transferred to Donora, and John C. Hopkins, superintendent of Emma furnace at Cleveland, has been made superintendent of the Shoenberger furnaces.

OBITUARY

Michael J. Toomey, a well known Porcupine prospector, was drowned in the rapids near Keys, Ont., on the Porcupine River, June 9, by the upsetting of a canoe. He took a cramp and sank instantly. He leaves a widow.

Thomas Roach died at Pueblo, Colo., June 5, aged 63 years. He had lived in Pueblo for 33 years and had been connected with the mills of the Colorado Fuel & Iron Co. Under his charge the first rails made in Colorado were rolled.

Frank A. Milne died at Butte, Mont., June 4, aged 50 years. He was born in Lockport, Ill. He went West first a number of years ago, but returned to his eastern home. A few years ago he went to Montana again and settled in Anaconda. In 1913 he went to Butte and became associated with the Davis-Daly Mining Co. as auditor.

SOCIETIES

American Society of Mechanical Engineers—The spring meeting will be held at Buffalo, N. Y., June 22-25. Headquarters will be at the Hotel Statler and the sessions will be held there and at Niagara Falls.

Colorado Scientific Society, at its regular June meeting, was addressed by Prof. Herman Fleck, of the chemistry department at the Colorado School of Mines, on the subject, "The Commercialization of the Chemical Reaction."

McGill University, Montreal—The applied science department has turned over its mechanical equipment for the manufacture of shell tools and every student of this department will devote his time exclusively to this class of work.

American Mining Congress—Official notice has been issued of the 18th annual meeting, which is to be held in the Exposition Memorial Auditorium at San Francisco, Sept. 20-22. The program is a long one, including many important topics for discussion.

Machinery Club of New York—Charles A. Schieren, Charles A. Schieren Co., New York, was elected president at a meeting of the board of governors held June 1. John A. Hill, Hill Publishing Co., was elected vice-president; E. H. Benners, Crown Castings Co., treasurer, and Frederic Stadelman, Wellman-Seaver-Morgan Co., secretary.

International Engineering Congress—A very convenient booklet has been issued by the Committee of Management, International Engineering Congress, 1915, which contains valuable information for members in the Congress and for visitors who intend going to the Pacific Coast at the time of the sessions of this Congress. The booklets can be obtained by mailing a postal to W. A. Cattell, secretary, International Engineering Congress, 417 Foxcroft Bldg., San Francisco, Calif

INDUSTRIAL NEWS

The Sullivan Machinery Co., announces that its office in Boston is now Room 1010, Unity Bldg.

The California Slimes Extraction Co., of Sutter Creek, Calif., has recently purchased a 5x10-ft. adjustable quick-discharge tube mill from Chalmers & Williams, Chicago.

The United Lead Co., 111 Broadway, New York, has succeeded in producing a lead alloy high in copper for use as bearing metal, etc., from which the copper will not segregate on cooling no matter how many times remelted. It solidifies at 900° F.

Editorial Correspondence

SAN FRANCISCO—June 9

The Late Snowfall in northwestern mining counties, coming in May, will insure an abundance of water for hydraulic and dredging and other placer mining in Trinity, Siskiyou, and Humboldt Counties. The storms prevented the completion of bridges and necessary repair of roads until early in June. Bridges crossing Mad River and Trinity River have been completed and for the first time in the present year, traffic was opened June 2, between Red Bluff, Redding and Eureka. During the winter months the state road was closed to travel. Hydraulic mining in Humboldt and Trinity was in general uninterrupted except in the higher elevations where the storms were extremely heavy. The late snowfall in the Sierra between Placerville and Lake Tahoe has not been altogether encouraging. The greatest depth recorded was 44 in. in a drift just below Pierce Camp. At Echo Lake mail box the record was only 33 in. The extreme summit is entirely barren of snow. Between the summit and the 49-mile stone, the depth is from 24 to 42 in. The warm weather which prevailed practically all over the state with the beginning of June is likely to cause a greater rapidity of melting of the snow than is desirable by the mines dependent upon the snow in the Sierra. However, the indications are that the season will be by no means a dry one.

Lone Pine District, 14 miles northeast of Mohave, near what is known as Jawbone district, named after Jawbone Creek, is attracting a large number of prospectors. These districts are new to the mining industry and are not included in the Geological Survey records. There has been a good deal of prospecting from a point south of Jawbone Creek northeasterly to the Cinco, Garlock, and Goler districts. The Garlock and Goler districts are situated north and northwest of Randsburg. The State Mining Bureau mineral maps show a scattering of gold northeast of Mohave, along the line of and west of the Southern Pacific R.R. A good deal of this country is pockety, and there are dry placers that have been tried out by various methods, but not with commercial success. Recently San Francisco men have taken options on what are known as dry-placer lands in the Randsburg district. The purpose is not to introduce dry-placer methods, but to bring water to the ground. Water may be developed in most of this region northeast of the Mohave, although in some instances it will be necessary to carry it a distance of 10 to 20 miles. The Yellow Aster mine at Randsburg has for many years been using water developed at Goler and Old Wells. There is no reason why other water may not be developed, not only in the Randsburg district, but in the region southeast of there. The great drawback to a large portion of this region is the intense heat during most of the year and the absence of water immediately available. Another thing that retards the progress of prospecting and development on the part of mining men of experience is that the local newspapers are inclined to exaggerate in recording the value of the ore disclosed. For instance, a recent item gives the value of $1000 per ton of ore in Lone Pine district. Another item credits Crede district in Lone Pine Cañon with ore from the Gold Peak mine at $33,000 per ton. These figures are ridiculous when meant to convey the idea that the districts produce ores in commercial quantity of such extraordinary value. But these stories need not deter sensible prospectors and careful investors from investigating the region.

BUTTE—June 11

When the Miners Decided to Get Along Without a Union and found that they were better off in dealing individually with the mining companies and thereby saved many dollars that they had been compelled to contribute monthly toward the maintenance of expensive officers of the Western Federation, there remained active in agitation and trouble only some of the trades unions in Butte, and to foster a little more independence among business men and business houses there was organized an Employers' Association to which practically all the business houses and merchants subscribed. It looked like a long-needed protective organization, and one that would bind employers with a tie of mutual interest, but on the very first issue with labor unions the new association divided and its purpose bumped on the rocks of fear. June 13 was Miners Union day, but the miners didn't care to observe it or celebrate it by claiming a holiday. They had had enough holidays and preferred to work at $4 per day. However, the Clerks Union, one of the most active of labor organizations in Butte, decided to observe Miners Union day whether the miners wanted to or not, and declared that on June 14 (Monday) all stores in Butte should remain closed and a resolution was adopted that every member of the union who worked on that day would be fined $5. The Employers' Association gave notice that all stores would be open on that day, but some members of the association, led by the new Claflin management of the Hennessy department store, decided to give in to the clerks' demands and declared a holiday. Others followed the action of the big store, and the Employers' Association was compelled to revoke its first order and agree to a general holiday. All the mines worked as usual. It was the first anniversary of the big labor riot in Butte which resulted in the dynamiting of the Miners Union hall, the disruption of the Miners' Union, the reign of I. W. W. terrorism, and the later reign of peace under martial law, and restoration of order.

DENVER—June 10

In Refutation of Newspaper Exaggerations George E. Collins, manager of the Mary Murphy mine, published in a Denver daily: There is not more than 100,000 tons of milling ore of a $15 value, blocked out in the mine above the 14th level; during no five-months' period in recent years have shipments averaged more than 1000 tons per month; reserves are insufficient to keep mill busy four years; operation of the mine for ten years is not assured; present mill capacity is 175 tons, not 100 tons, per day.

Investigation of Freight Rates is sought by Judge E. A. Colburn, of Denver, owner and operator of the Ajax mine and mill at Victor, who has filed complaint with the state commission on public utilities requesting an investigation of the rates charged by the Florence & Cripple Creek R.R. Co. holding a monopoly of the traffic in the Cripple Creek district. His accusation is that the schedule of rates is so unfair that ore cannot be transferred between points within the mining district as cheaply as it can be hauled to outside points, the effect being that his custom mill, at Victor, is unable to compete with the Golden Cycle mill at Colorado City.

SALT LAKE CITY—June 11

A Flotation Plant will be installed by the Silver King Coalition of Park City. Experiments and tests have been carried on for some time. The new plant, which will occupy one section of the present mill, has been designed to treat the sulphide milling ores, now being obtained in increasing quantity below the Alliance tunnel level, and in the new workings below the 1300 level in the southwestern part of the mine. The new plant will consist of Callow flotation cells similar to those being used at Mullan, Idaho, and installation is to be started at once. The initial capacity will be 60 tons. The present Silver King mill is treating in the neighborhood of 250 tons of ore daily, largely mixed carbonate and sulphide ore. It is unofficially announced that the regular quarterly dividend of 15c. a share amounting to $187,500, will be paid July 1. Earnings have been largely increased by the advance in the price of lead.

The Ohio Copper Property at Bingham and Lark has been leased to the General Exploration Co., which filed articles of incorporation June 9. The lease covers all property of the company, and work is to be resumed at mine and mill at once. The new company will finish installing the crushing equipment that was being put in the mill, when the property closed down. In September, 1914, the Ohio Copper Co. filed a voluntary petition in bankruptcy. The assets, consisting of mining property, were valued at a million dollars, and copper in possession of the American Smelting & Refining Co. was valued at $316,000. The liabilities were placed at $1,668,000. The United States district court of New York appointed Duncan MacVichie, Ernest Bamberger and H. L. Lamprecht as appraisers to place a valuation on the tangible assets of the company. A. Frank and M. H. Sowles were named by the trustees as local representatives of the company, when the petition in bankruptcy was filed. At this time copper was about 12 or 13c a pound, and on account of the advance in the price of this metal, the company is reported to be in much better financial condition at present. The directors of the

General Exploration Co. are: Alfred Frank, formerly general manager and in charge of the Bingham Central R. R., Clarence Bamberger, and E. L. Newhouse, Jr., of Salt Lake City, John MacGinnis, of Butte, Mont., and C. W. Saacke, of New York.

SEATTLE—June 8

Tolovana Gold has an assay value higher than the gold from most of the creeks in the Fairbanks district. The clean dust is worth $18.75 an ounce.

Alaska Copper Belt is active on account of the stimulated market. The mines at Latouche, Kennecott and Ellamar are running to their capacity and the production will be greater this year than ever before in their history. Effective at once, the Copper River & Northwestern Ry. will run three trains a week each way between Chitina and Kennecott, instead of maintaining the usual summer schedule of one train a week. This has become necessary on account of the increased shipments of copper ore from the Bonanza and Jumbo mines which the branch line is unable to handle. Two trains a week will be operated between Cordova and Chitina. With the continued rise in the price of copper the output of these mines is to be still further increased to 120 cars, or 6000 tons a month. At the present price of copper this month's ore shipment will have a value of over $1,500,000.

Opening of Navigation in interior Alaska has brought no slackening of interest in the Tolovana district, notwithstanding the report of Mine Inspector Maloney, generally regarded as pessimistic. Mr. Maloney's opinion is that a small camp, such as Hot Springs, Circle and Koyukuk will eventually be developed, but that there is little chance for a camp comparable with Nome, Fairbanks, and Iditarod. The steamer "White Seal" will make regular trips on the Tolovana River to the head of navigation; she has recently been equipped with tackle for removing the large amount of drift and the log jams that at present obstruct the river. Lake City is being abandoned in favor of Discovery townsite, situated at the head of navigation. Lynch, Stone & Verdi, on Olive Creek, have placed their machinery and erected the gin-pole, and are ready to hoist pay. Just below them Gus Peterson is working with a crew of 20 men. There is great activity on Livengood. Patterson is sinking on his lay on the Cascaden-McCord ground; Wagner has reached depth of 80 ft. on 2 Above Discovery, second tier; Berg & Sullivan are sinking on 3 Above. An unverified report is current that pay has been found on Alabam Creek.

HOUGHTON—June 10

Copper Production in the Lake Superior District—While the copper mines of this district are at present breaking some of their best records in monthly rock tonnages and in refined outputs of copper there seems to be a too general inclination to overestimate not only the copper outputs but the earning capacities of all of the mines. In figuring the records for the year 1915 it is unfair to take a May or June record either for production or for price received. The first three months of the year did not show so well as the second three-month period likely will. If the third and fourth quarter of the year show up in comparison with the second, some remarkably good figures can be made, but that is presuming on unusually high price and top-notch production records. Friends of the Calumet & Hecla company, for instance, are publishing figures showing that the output of the old mine alone will be over 100,000,000 lb. this year and some estimate the output of the Calumet & Hecla and subsidiaries as high as 180,000,000 lb. These figures are undoubtedly secured by estimating each property at the top notch figures of its most enthusiastic shareholders. As a matter of fact the total production of copper from the Calumet & Hecla and subsidiaries, for the year 1915, with good fortune and no unforeseen difficulties, will probably reach 144,000,000 lb. This is a fairly reasonable production based on present performances and considering the fact that the first quarter of the year did not show present outputs. Figured at the rate for the first four months it would amount to 121,000,000 lb. Figuring the other eight months at the May rate the total would be nearer 140,000,000 lb. Of this total it is fair to figure Calumet & Hecla alone at not more than 72,000,000 lb. This figure is generally overestimated. Ahmeek can fairly be estimated at 22,000,000 lb. Allouez has now reached the maximum of expectations for the year and is making a fine showing and can be counted on for 10,000,000 lb. for the year. Isle Royale will produce 8,000,000 lb. with good luck. The rock is running close to 14 lb. to the ton at the present time. There will be no difficulty in Osceola producing 18,000,000 lb. It would be unfair to expect Centennial to run over 3,000,000 lb. Centennial is a small mine, of limited acreage and limited workable territory. It is now producing the highest grade of rock in its history with the exception of one month. In October, 1906, Centennial sent to the mill 14,500 tons of rock. In May this year it sent down 15,150 tons of rock carrying better than 16½ lb. to the ton. Superior's production and that of Tamarack will be about 4,000,000 each, although in the case of the latter there is a possibility of even better results. White Pine is producing steadily. Three [illegible] of mineral have come down from the mine to the smelter since operations began. It is necessary to wait for [illegible] weather to get the barrels of mineral from the mill to the lake shore for scow shipment. The White Pine [illegible] 30 lb. of refined copper to the ton. The losses in the tailings in the mill are about 13 or 14 lb. to the ton, owing to the light weight flaky mineral. Ultimately these can be saved by the installation of special equipment. In the [illegible] the showing of copper is likely to be better rather than lower, for the reason that the first output came very largely from the stock piles. Now more of it is coming from the stopes in the mine. It is reasonable to figure that the White Pine will produce 3,000,000 lb. of refined copper this year. The returns from this will be applied immediately to the payment of the indebtedness to the Calumet & Hecla, the parent company holding preferred stock representing the outlay in building the plant, erecting the mill and putting the White Pine on its feet.

ISHPEMING—June 9

E. J. Longyear Co. has taken a contract to sink a shaft to a depth of 1200 ft. near Christiania, Norway. M. E. Richards and Capt. William Holman, of the Judson Mining Co. at Alpha, have drawn up the plans and made the arrangements. Capt. Holman and 60 miners from Marquette range will sail from New York during June to start work. He will be abroad until the work is well under way. The contract is to be completed in a year's time. American machinery will be used on the work. The American company was allowed to submit a bid in order that something might be learned of American methods of shaft sinking. The miners will receive good wages and will be paid from the time of leaving until they return. They will receive a bonus for all footage over 65 ft. per month. Over 300 miners applied for positions.

CUSHING, OKLA.—June 10

Producers in the Cushing, Okla., Oil Field are said to be greatly worried by the presence of large quantities of sulphur in the crude. Heretofore refineries which could work entirely on Cushing crude were considered to have an advantage over all others. Now they will probably be at a disadvantage.

KINGMAN, ARIZ.—June 9

Much Excitement in the Kingman District of Arizona was recently caused by the discovery that the ore waste from the Columbia mine was a telluride ore, running from $50 to $300 in gold and silver per ton. When the news of the chance discovery reached Kingman there was a big rush of prospectors to the Wallapai Spring section where the mine is located. All the ground for several miles around the Columbia mine was staked out in a few hours. The mine is owned by Messrs. Frost, Mehaffy and Myers. For some time they had been working a pay streak of galena ore, the remainder of the material that came out of the shaft being thrown away. Some of this waste was assayed and it was found to be exceedingly rich.

TORONTO—June 12

Toluol and Trinitrotoluol The Dominion Steel Corporation has been for some time manufacturing toluol as a byproduct for the British War Office, to be used in the manufacture of trinitrotoluol, a high explosive. Some months since the company was asked to carry the process further and produce the finished article. It is now announced that this has been done and that trinitrotoluol is now being manufactured at the Sydney plant. Toluol is being produced at the byproduct coke-oven plants at Sydney and Sault Ste. Marie, and it is understood that its manufacture will also be undertaken at Hamilton, and by the Crows Nest Pass Coal Co., at Fernie, B. C.

The War and Financial Depression have caused a great falling off in prospecting and the development of claims in the mining areas under the jurisdiction of the Federal government. Last year prospectors had little difficulty in getting grubstaked and many oil finds in the West were recorded. From May, 1914, to May, 1915, upwards of 1[illegible],000 oil claims and 900 mineral claims were filed at the Department of Mines at Ottawa, but these were all for discoveries made before the war. There is now a marked decrease in the number recorded. There are also numerous applications for an extension of time for doing the [illegible] work required during the first year. Recently important discoveries of oil have been made around Great Slave Lake, but owing to lack of available capital the claims remain unworked.

The Mining News

ALASKA

NO. 1 ABOVE DISCOVERY, ESTER CREEK (Fairbanks)—Sullivan & Ollsen, lessees on 1 Above, Ester Creek, are working 40 men and are hoisting 175 buckets of gravel per day. They are also sluicing two dumps taken out during winter.

VALDEZ (Valdez)—Work will be commenced immediately to open up vein. Contract has been let to Ted Johnson and associates to run 200 ft. of tunnel near Valdez glacier. Because of recent excellent showing on Ramsay-Rutherford group adjoining, it is expected that valuable ore will be uncovered on this property.

GRANITE GOLD (Valdez)—Big tunnel to tap lead at depth of 500 ft. now in distance of 400 ft. and double shifts are completing work which is opening up large orebodies. There is now sufficient ore ready to operate new mill for eight months. Will be started up as soon as millman arrives from outside. New 10-stamp plant will bring daily capacity of mill to between 60 and 70 tons.

KENNECOTT COPPER (Kennecott)—Bonanza mine of this corporation said to have produced copper for some years at cost of 4½c. per lb., the lowest cost in the world; has produced to date 90,000,000 lb. of copper. The Jumbo and Beatson mines have both entered producing class. Combined production of three expected to be about 5,000,000 lb. per month.

MIZPAH (Fairbanks)—Thompson, Geis & Hess, owners of Mizpah quartz claim, situated on left limit of Fairbanks Creek near mouth of Too Much Gold Creek, are installing hoist. Recent run at Heilig custom mill returned $1150 from 14 tons of ore. Operators estimate that they have 800 tons of ore of similar grade developed above 80-ft. level, and it is planned to mine this before proceeding with other development work.

7 ABOVE, CHICKEN CREEK (Chicken)—First application to be filed at Fairbanks for permission to mine coal under recent Federal regulations made by Geo. A. Eastebrook, Fortymile district. Coal vein is in ground held as placer claim 7 Above Discovery, first bench, right limit, Chicken Creek. Applicant asks permission to mine coal under five-acre tract, which has been granted.

ARIZONA

Cochise County

PHELPS, DODGE & CO. (Tombstone)—Now has working force of about 400 men employed upon its properties in this district.

CALUMET & ARIZONA (Warren)—Tucson, Cornelia & Gila Bend Railroad has been organized to construct railroad from Gila Bend on Southern Pacific to Ajo to give an outlet to mines of C. & A. Will be 42 miles long. Ownership of railroad will be equally divided between Phelps-Dodge and Calumet & Arizona.

Gila County

MIAMI (Miami)—Production for May approximately 3,600,000 lb. of copper, largest monthly production yet made by company. Is expected output will be increased to 4,000,000 lb. by August.

INSPIRATION (Miami)—On steel headframe at Main West shaft crew of iron workers busy for last two weeks making changes and additions necessitated by decision to use Otis elevator for hoisting men. Coarse-crushing plant has been "limbered up" and can be put into commission as soon as new mill is ready. For conveying compressed air into mine 14-in. pipe line will be provided in shaft. From this line 10-in. branches will be taken off on haulage levels.

Greenlee County

SHANNON (Clifton)—Produced 1,028,000 lb. of copper in May, which is about normal production, at cost said to be about 12½c. per pound. Production will be maintained at around 1,000,000 lb. per month.

ARIZONA COPPER (Clifton)—Company is proceeding with remodeling its No. 4 mill at Clifton, which will treat 500 tons of ore daily and is also making some changes in No. 6 mill at Morenci, which will increase capacity of this mill by 500 tons per day.

Mohave County

GERMAN-AMERICAN PIONEER CONSOLIDATED (Kingman)—Has sold its group of mines to Joseph Winchester, of Cripple Creek, Colo., and associates. Property is equipped with 10-stamp mill and water-supply system. Although large quantities of milling ore were developed in mines, operations were suspended several years ago on account of differences that arose among stockholders. It is planned by new owners to carry on extensive operations.

Yavapai County

HARRY PARKER (Clarkdale)—Has purchased Custer and Arkansas claims near Jerome from R. Rothemel and M. D. Ross. Consideration was $50,000

BIG PINE CONSOLIDATED (Prescott)—Considering change in crushing end of mill using 10-ft. new-style Lane mill instead of Chilean and tube

UNITED VERDE EXTENSION (Jerome)—During May 90 tons ore averaging 48% copper were shipped to United Verde smeltery. Shipments have been temporarily discontinued. Shipments to date have amounted to $150,000.

UNITED VERDE (Clarkdale)—Has arranged to operate Copper Giant mine, situated eight miles east of Hackberry, Ariz. It plans to extract and ship about 50 tons of ore daily to its new smeltery.

CALIFORNIA

Amador County

BUNKER HILL (Amador City)—The 2400 level will be retimbered and raises driven to 2200 level. Installation of Hardinge mills is contemplated, in order to increase the tonnage.

CENTRAL EUREKA (Sutter Creek)—Thirty of 40 stamps are dropping on good ore from lower levels. Repairs in shaft completed. Sinking below 3100 level will begin soon. James A. Davis, superintendent.

Calaveras County

VICTOR LAND & MINERAL (Angels Camp) — Arrangements are being made for settlement of debts and re-opening of Reiner Mine. Directors of the company are F. W. Clough, J. T. Dickie, Ralph Lemue, of Angels Camp; E. H. Ehrler and A. E. Haid, of St. Louis.

Eldorado County

GREENWOOD (Greenwood)—Test runs of old mill tailing are being made to determine whether values will warrant installation of mill. Property is operated by Turlock men.

IVANHOE (Garden Valley)—Tremain two-stamp mill and Hendy concentrator are in operation. Steam and gasoline power are used. Reported that equipment will be improved if development warrants.

SELBY (Diamond Spring)—Mine recently bonded to Eastern men. Present development consists of 240-ft. double compartment shaft. Peacock Copper mine situated parallel to, and 500-ft. east of Selby, is included in bond.

Inyo County

WILSHIRE BISHOP CREEK (Bishop Creek)—It has been necessary to install new 100-hp. motor for tube mill. New bunk house completed and cabin and tent houses are under construction. There are 53 men on the payroll.

Kern County

SHIPSEY (Randsburg)—Recent cleanup from King Solomon of 49 tons of ore totaled $3600.

MINNEHAHA (Randsburg)—Ore averaging $25 per ton recently disclosed. Mine adjourns Yellow Aster and was formerly producer. Development has been in progress about two months by Wilson Jones and Jerry O'Leary.

Modoc County

MODOC MINE (High-Grade)—Will drive cross-cut tunnel 2238 ft. to connect with shaft at 500 level. Having run into sulphide, mill project is deferred until final character of total orebody is permanently established.

Nevada County

EMPIRE (Grass Valley)—New 60-stamp mill has been formally accepted by company. Mill was built by Robert Hathaway, of Nevada City. George W. Starr is superintendent.

RAGON FLAT (Grass Valley)—After cleaning and unwatering incline shaft company has surrendered bond and machinery will be removed. Mine is owned by Robert Nye of Grass Valley.

Trinity County

GLOBE CONSOLIDATED (Dedrick)—Operating Globe-Chloride-Bailey gold mines at Dedrick. Is running milling plant only intermittently.

San Bernardino County

CALIFORNIA-TRONA—U. S. Circuit Court of Appeals in San Francisco affirmed injunction granted in Los Angeles against this company. Order restrains Thos. W. Park, Stella Schuler and Joseph K. Hutchison from interfering with 15 placer claims at Searles Lake.

COLORADO

Clear Creek County

LAKE (Idaho Springs)—Development along this vein that produced heavily during last winter has opened another shoot, 2 ft. thick, running $30 per ton.

HUDSON MILL (Idaho Springs)—S. P. Warren, E. M., has completed series of experiments in oil flotation on local ores and orders have been placed for equipment to handle custom ores by this process.

Lake County

PENROSE (Leadville)—Each of new electric centrifugal pumps working without interruption, except for occasional 30-min. stops to lengthen its column; capacity more than 2000 gal. per min. Water level in downtown mines has been lowered about 160 ft.

PONSARDINE (Leadville)—Sulphide orebody recently disclosed by caving in of old workings that have been unwatered by Downtown Pumping project has been partially explored. It is known to be at least 15 ft. thick and 70 ft. long, running 23 to 31% zinc and 19% lead. Owners are seeking market for this kind of ore.

San Miguel County

TOMBOY (Telluride)—During May mill ran 29 days and crushed 12,000 tons ore which yielded $47,500. Concentrates shipped brought $55,500. Expenses for period $60,500 leaving operating profit $42,500.

Teller County

DANTE (Victor)—Mill is treating 2000 tons of $2 ore per month at fair profit.

ALPHA-OMEGA (Cripple Creek)—Will be equipped with small hoist and 6-drill electric-driven compressor.

EL PASO (Cripple Creek)—May production was greatest for any month in several years, viz., 2080 tons having gross value of about $20 per ton. Several new leases have been granted recently.

STRATTON'S INDEPENDENCE (Cripple Creek)—According to London advices, production for April was 5489 tons of ore averaging 6 dwt. 12 grains per ton. Low-grade mine and dump ore milled, 8387 tons. Net profit to company, $8000.

IDAHO

Shoshone County

TERRIBLE EDITH (Murray)—Under lease to Charles Conn & Son, of Butte. Shipped recently several cars of concentrates assaying over 51% zinc. Silver values not as high as in many of Cœur d'Alene properties.

HERCULES (Burke)—Mine closed down because of expiration of smelting contract with A. S. & R. and inability to agree on terms of new contract. Contract just expired said to have been most advantageous smelting contract in the Cœur d'Alenes, being several dollars lower than Bunker Hill & Sullivan's. Hercules seriously considering erection of smelting plant.

NATIONAL COPPER (Mullan)—Considerable force of men working at property reopened last week after several months' idleness. Shaft sinking will be started. Operation of 500-ton mill completed just before mine closed down, will depend upon further developments underground.

INTERSTATE-CALLAHAN (Wallace)—New tramway from mill to Sunset station will be in operation early in July. Foundations for towers are completed and towers are all framed, and will be erected and in readiness for cables and other fixtures when they arrive.

MICHIGAN

Copper

LAKE (Lake Mine)—Work of unwatering shaft is progressing rapidly.

MASS CONSOLIDATED (Mass)—Now shipping 2000 tons of rock daily; largest output in history of property.

COPPER RANGE CONS. (Painesdale)—Furnishes all copper used by American Steam Gauge & Valve Mfg. Co., which has just received $1,000,000 war order.

AHMEEK (Ahmeek)—Additional head at stamp mill has been started, making five heads now operating on Ahmeek rock, and means daily tonnage of about 3300 tons. Will be three months before sixth head is ready for operation. Ahmeek is sending up highest-grade rock ever mined from this property. At North Ahmeek working force numbers 90.

CALUMET & HECLA (Calumet)—At old mine, adding to the underground forces every day. Rock tonnage larger now than ever in history of property. Shipping over 11,000 tons of rock daily. Two ton shipments of silver sent to New York this week. No. 2 regrinding mill is working successfully on the sand pumped up from big pile in lake.

MOHAWK (Mohawk)—Will this summer erect complete electric power and lighting plant to operate from No. 1 to No. 6, extreme north and south ends of property. Line, poles, wires, etc., will be owned, erected and cared for by company. This will bring about reduction in rate for power and light furnished by Houghton County company. Poles are now on the ground. Electricians now at work installing underground telephones throughout mine. Officials were figuring on electric pumps but on account of small amount of water this subject was dropped. There is large amount in No. 6 but very little in other five. Electric haulage underground is likewise possibility of the future.

Iron

FORBES (Iron River)—Orders have been received from Jones & Laughlin to ship all of ore in stock and all that is being hoisted. Monthly production is now 12,000 tons.

CRYSTAL FALLS—Shovels are working off and on at the stockpiles of Dunn, Bristol, Tobin and Great Western mines. It looks as though large amount of ore in stock would be moved this year.

NEGAUNEE (Negaunee)—Sales of ore totaling 300,000 tons have been made for this property. Over 200,000 tons will be taken by Lackawanna Steel Co.; remainder is for Michigan blast furnaces. All of ore in stock will be moved.

HEMLOCK (Crystal Falls)—All of machinery has been removed and mine sealed for all time. Ore is exhausted. Big Gates crusher has been shipped to Balkan at Alpha. Remainder of machinery will probably be used at Warner, when mining is started there.

GREAT WESTERN (Crystal Falls)—Steam shovels have finally attacked large pile of low-grade ore which has been in stock here for years. It is stated that half of pile will be moved. Mine has been idle for several years but has considerable ore underground.

MINNESOTA

Duluth

WARRIOR DEVELOPMENT CO., controlled by Congdon interests, will hold stockholders meeting in Arizona to decide upon dissolution and distribution of assets. Distribution will give each share of stock approximately $1 cash and one-tenth share of Rainbow Development Co.'s stock, which latter company controls property in Butte, Mont.

RAINBOW DEVELOPMENT CO., at annual meeting held June 1 following officers elected: E. C. Congdon, pres.; C. A. Congdon, vice-pres.; Frederic R. Kennedy, secy.-treas.; Thos. F. Cole and Joseph B. Cotton, directors. Company voted to issue general mortgage 6% convertible bonds for $100,000 and to increase shares from 80,000 to 150,000, par $10. Property in Butte, Mont.

MISSOURI

CATHERINE (Fredericktown)—Under lease to Federal Lead Co. has been unwatered and is again in operation.

MINE LA MOTTE (Fredericktown)—Belt on flywheel of mill engine broke resulting in engine running away and bursting flywheel. Mill badly da[illegible] half wheel held together and went through ro[illegible] None of workmen was killed, but two [illegible] Company has largely increased output [illegible] construction of mill to handle lead ore contained [illegible] around old surface and shallow diggings that [illegible] to be of no further value. Two Thew steam sh[illegible] sufficient to keep this mill supplied, so third shovel [illegible] purchased and another locomotive. Also planning [illegible] and much larger mill to handle mine ore. About [illegible] are now employed.

MONTANA

Broadwater County

BLACK FRIDAY (Radersburg)—Extensive development work being done, consisting of 200 ft. of drifting from 400 level and 100-ft. upraise from 400 to 300 level, contract for which has just been let. Gold ore valued at $40 per ton has been recovered from 200 level. When work of extracting ore is actively taken up concentrator will be built along lines of present testing plant which has demonstrated 90% recovery. Ore recovered in course of development being shipped to Washoe.

Lewis & Clark County

BARNES KING (Marysville)—Announced that company has concluded negotiations with owners of Shannon mine near Marysville, by which company will take over that property on favorable terms. If mine justifies expectations, cable tramway will be installed to take ore from Shannon mine to new Gloster mill, distance of about 2½ miles.

Silver Bow County

BULLWHACKER (Butte)—An extensive cave-in in workings, produced by heavy rains caused temporary closing down of operations to allow repairs to be made. Mine has been shipping about 40 cars of ore monthly to Anaconda. Is expected to increase output to 4500 tons per month.

TUOLUMNE (Butte)—Letter addressed to stockholders by president asking them to loan money to company at 8%, to furnish working capital amounting to $35,000 so that mining operations may be resumed. Stated that considerable amount of ore blocked out in mine can be taken out at profit at present prices.

BUTTE-BALLAKLAVA (Butte)—Arrangements completed to increase output by about 25% for month of June. Total tonnage for May little more than 4000 tons. Grade of ore above 3% copper and 4 oz. silver. From 1600 level winze now being sunk to 1700 level, has opened up 5 ft. of ore, assaying 5½% copper and 7 oz. silver. About 90 men are at work.

PILOT-BUTTE (Butte)—Restraining order issued short time ago in suit of Anaconda against Pilot-Butte modified by Judge Lynch so as to permit plaintiff to do necessary work in preparation for hearing of case in near future. Order allows sinking of winze from 2000 level of vein in dispute to 2400 level with some drifting on vein. Anaconda company agreed to store ore extracted or sell it at market price and account for returns.

BUTTE & BACORN (Butte)—Supreme court issued writ of supervisory control, returnable Sept. 20, in case involving this company on application of Frank F. Whitman of Butte, minority stockholder, who seeks to intervene in suit brought by Fred Bacorn against Butte & Bacorn company to quiet title to 30-year lease. Alleged that lease was obtained through collusion and fraud upon part of Bacorn. Under lease company receives royalty of 8% payable in ore delivered on dump. In lower court application of Whitman was denied and lease was sustained.

ANACONDA (Butte)—May output was 20,500,000 lb. copper. This is largest for any month this year but less than any month for corresponding period last year. May production 1914 was 23,500,000 lb. Poulin mine has been closed so far as mining operations are concerned to permit sinking shaft to deeper level. Mine employs about 200 men. Output has been about 250 tons per day. Shaft is now 1500 ft. deep. How much deeper it is to be sunk has not been announced. Original mine of Anaconda closed for several weeks, resumed operations, adding 1000 tons of ore to daily output of company. Concentrator at Great Falls which it was not expected would be used again will be immediately put into commission.

NEVADA

Elko County

BLUSTER (Jarbidge)—New 10-stamp mill completed and ready for operation.

NEVADA COPPER M. M. & P. (Contact)—Site for flotation mill decided on near Mammoth and New York properties. Diesel engine ordered for generating power.

Esmeralda County

SOUTHWESTERN MINES (Hornsilver)—Formerly Great Western planning to erect mill on property. S. H. Brady, formerly manager of Tonopah Belmont and other Tonopah mines, is vice-president and general manager.

MERGER MINES (Goldfield)—Statement made by George Wingfield that all differences between minority and majority stockholders adjusted. Papers to end litigation prepared. Dees Mines Co. will be dissolved. Directorate of Merger will be reorganized.

Humboldt County

HONEY BEE (Willard)—Block No. 2 leased to [illegible] men. Lease calls for 150 ft. of development work, [illegible] of which is to be sinking. Six-foot shoot shipping [illegible] opened in shaft on company ground. Tunnel now being [illegible] to [illegible] shoot at depth of 200 ft. Smelter returns on [illegible] shipped recently gave $940 net.

ROCHESTER MINES (Rochester)—Second bullion shipment made recently; clean-up from 16 days mill run, valued at $26,000. Two suits filed in district court, by stockholders, against company in an endeavor to prevent an increase of capitalization for purpose of purchasing Weaver group. Temporary restraining order has ben asked for preventing any increase of capital stock or purchase by company of Weaver group. Appointment of receiver is also prayed for to manage affairs of company until suit is settled.

Nye County

TONOPAH ORE PRODUCTION for week ended June 5 amounted to 10,645 tons valued at $217,570 compared with 11,001 tons valued at $223,978 week previous. Producers were: Tonopah Belmont, 3445; Tonopah Mining, 2900; Tonopah Extension, 1830; West End, 856; Jim Butler, 1150; Tonopah Merger, 401; and North Star, 63 tons.

SUNSET (Rhyolite)—Mill running steadily on $6 ore will be increased from 50 to 100 tons.

MONITOR-BELMONT (Belmont)—Rapid progress being made in construction of mill. Oil flotation will be used. First unit to have capacity of 150 tons per day. Dump ore will be treated; of this 50,000 tons will assay $10 per ton.

Lincoln County

PIOCHE ORE SHIPMENTS for the week ended June 9 totaled 80 cars estimated at 4000 tons, valued at $45,000, compared with 62 cars the week previous.

Mineral County

SCOTIA (Terrill)—Announcement made from Boston office that operations will be resumed. Milling plant may be built. Ore uniformly good-grade, assaying $15, with pockets of high-grade. Work discontinued several months ago when engine house burned.

SOUTH DAKOTA

Lawrence County

ECHO (Maitland)—Large amount of water at 100 level has caused suspension of operations. Compressor of large size will be installed to furnish air for pump.

WASP NO. 2 (Flatiron)—Fire destroyed hoist and building but did not cause decrease of tonnage. Ore which was hoisted from underground workings by this equipment is now sent through opencut workings and there hoisted by main tram. Considerable tungsten ore is being taken out in new workings and will be shipped.

Pennington County

BLACK HILLS TUNGSTEN (Hill City)—Mill under lease has been put into operation on concentrating of tin ore. Mill has been remodeled and good concentrate is now obtained.

HOMELODE (Silver City)—Second shaft is nearly 100 ft. deep and as soon as reached, connections will be made with main shaft. Plant for treatment of ore will be erected this year.

UTAH

Beaver County

PALOMA GOLD & SILVER (Milford)—Lead-silver ore 1½ ft. thick has been cut on 325-ft. level. New hoist capable of sinking to 600 recently installed. Compressor is being considered.

Juab County

TINTIC ORE SHIPMENTS for May amounted to 540 cars, estimated at 27,000 tons valued at $700,000, compared with 580 carloads in April, 356 in March, 297 in February and 430 in January. With exception of old Mammoth mine, which had made little effort to ship until May, none of largest producers equaled their outputs in recent months. Individual shippers were: Sioux mill dump, 124 cars; Centennial-Eureka, 80; Iron Blossom, 77; Mammoth, 43; Chief Con., 42; Eagle & Blue Bell, 39; Gemini, 24; Dragon Consolidated, 18; May Day, 17; Grand Central, 13; Lower Mammoth, 12; Gold Chain, 8; Eureka Hill, 7; Colorado, 6; Beck Tunnel, 5; Bullion Beck, 5; Yankee Consolidated, 4; Victoria, 3; Carisa lease, 3; Godiva, 3; Uncle Sam, 2; Opohongo, 1; Black Jack, 1; Minnie Moore lease, 1; Sioux Consolidated, 1; Copper Queen, 1; Total, 540.

CHIEF CONSOLIDATED (Eureka)—Compressor to be used in diamond-drilling on North Tintic claims, recently acquired, has been received. Assessment work calls for an expenditure of $23,000.

EAGLE & BLUE BELL (Eureka)—New electric equipment capable of sinking to 2500 level has been ordered. As soon as new equipment has been installed, shaft will be sunk 200 ft. below 1700 level.

IRON BLOSSOM (Silver City)—Winze being sunk from 600 level in north end of property, and some drifting has been done at 100-ft. point, although ground will be more thoroughly prospected at greater depth. Diamond drilling is in progress on the 1900 level.

GEMINI (Eureka)—As soon as pumps have been placed in operation work will start here and in adjoining Ridge & Valley, where shipping ore has been left in section at present under water. Drifting in Ridge & Valley will be done under contract. About 100 leasers are working at Gemini.

UTAH-APEX (Bingham)—Now producing at rate of over 30,000,000 lb. lead per annum. Expected to increase production to 40,000,000 lb. by installation of flotation process at expenditure of about $20,000.

Summit County

PARK CITY ORE PRODUCTION for week ended June 5 were 1740 tons valued at $69,000 compared with 1744 tons week previous.

SNAKE CREEK MINING & TUNNEL (Park City)—Tunnel now in 11,192 ft. During May, 330 ft. were made, and better progress is expected. Tunnel is in diorite, which breaks well and requires no timbering. Ground was drier than usual; present flow at portal is 17 sec.-ft. or 8000 gal. per min.

Washington County

THE TOWN OF GOLDSTRIKE continues to grow; lots have been sold, and buildings will be erected as fast as lumber can be brought in. A two-story hotel, a restaurant, billiard hall, drug store, and hospital are planned.

BEE BEE (Modena)—Development on this property at Goldstrike has opened ledge 5 ft. wide. Three-stamp mill has been ordered similar to one already operating in camp. Bee Bee ore carries up to $19 gold per ton.

GOLDSTRIKE CONSOLIDATED (Modena)—This company has taken over Enterprise group 4000 ft. northeast of Hamburg; and drifting is being done from bottom of 135-ft. shaft. Ore carrying silver and gold has been opened.

GOLDSTRIKE BONANZA (Modena)—This company, organized with capitalization of $100,000, has begun work on a 500-ft. tunnel to prospect what is thought to be western extension of Hamburg vein, about mile west of Hamburg claim. H. G. Snyder is president.

WISCONSIN

Grant County

LOOMIS (Platteville)—Small milling plant being erected on lease adjoining West Hill.

WEST ENTERPRISE (Platteville)—Churn drilling has proved up run of zinc ore on McGregor land in city limits, under lease to Kistler and Stephens.

Lafayette County

VINEGAR HILL (New Diggings)—Has sub-leased Murphy and Blackstone tracts, at New Diggings, and begun development work where recent discoveries were made by churn drill.

WISCONSIN ZINC (New Diggings)—Work of building new roaster of Skinner type has been started. Shaft sinking has been started on C. A. Thompson lease and an option taken on Sally Waters property, both at New Diggings.

CANADA

Alberta

SOUTHERN ALBERTA (Calgary)—This company has encountered oil in large quantities at depth of 3527 ft. in well two miles north of the Dingman well. It will sink second well in same vicinity.

British Columbia

ROCHER DE BOULE (Hazelton)—Shipments of 400 tons per week to be increased to 100 tons per day. Shipments go to Anyox smeltery.

CONSOLIDATED MINING & SMELTING (Trail)—Shippers to smeltery for week ended June 5 were 13, compared to 19 week previous, but tonnage was greater; 8027 tons being treated.

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for the month of May were from Cobalt proper: Beaver, 42 tons; Chambers Ferland, 133; Cobalt Comet—By Dom. Red Co., 63; Cobalt Laboratory, 8; Coniagas, 74; Crown Reserve—By Dom. Red. Co., 99; Kerr Lake, 30.37, by Dom. Red. Co., 57.20, 87; La Rose, 127; McKinley-Darragh, 211; Mining Corporation of Canada, Ltd.—Cobalt Lake Mine, 78.68, Townsite City Mines, 318.01—395; Nipissing, 64; Penn Canadian, 66; Peterson Lake (Seneca Superior ore), 65; Temiskaming, 40; total silver-ore shipments, 1482 tons. From South Porcupine, Dome Lake, (gold), 41 tons; From Schumacher, Vipond, 1.66 tons. From Porquis Jct., Alexo Mine (nickel), 982 tons.

CHAMBERS-FERLAND (Cobalt)—Connection has been made with Northern workings of Nipissing at 350 level, which will give better ventilation to drifts of both mines.

PORCUPINE PREMIER (Porcupine)—F. G. Wright of New York has arranged for development of this property. Shaft will be sunk 100 ft. and crosscuts run east and west to cut large sulphide body which shows good gold contents at 30 and 40 ft.

McINTYRE (Porcupine)—At 600 level of No. 4 shaft orebody measures 26 ft. wide, assays $10 per ton. On north side of property No. 5 shaft is down 400 ft. At this level vein has been opened up for 150 ft. and is 30 ft. wide in some places. Vein has been proved by diamond drilling to further depth of 100 ft.

MOND NICKEL (Sudbury)—Is building third furnace. This will make two new smelting furnaces since war started for this district for Canadian Copper has already added another one to their plant. Mt. Nickel mine, few miles north of Sudbury, is being operated under lease by Holmes & Travers. Ore is being smelted by Mond Nickel.

MEXICO

Sonora

GREENE-CANANEA (Cananea)—Reported that operations will be resumed at once. Mines and plant kept in good condition since shut-down last August. In 1913 produced 44,480,000 lb. copper at cost of slightly under 9⅜c. per lb.

SOUTH AMERICA

Chile

BETHLEHEM STEEL (Tofo)—It is expected to deliver ore from mines in Chile to its furnaces in South Bethlehem at cost of 6½c. per unit of iron.

BRADEN (Rancagua)—Production for May 2,364,000 lb. of copper, smallest for any month thus far in 1915. Total for five months 12,696,000 lb. compared with 11,789,000 lb. during corresponding period last year. Alterations in mill practically completed, making the capacity 4500 tons per day

AFRICA

Transvaal

GOLD PRODUCTION in the Transvaal in May is cabled as 763,548 oz., which is 19,468 oz. more than in April and 43,319 oz. more than in May, 1914. For the five months ended May 31 the total reported is 3,368,921 oz. in 1914, and 3,652,768 oz. in 1915; an increase of 283,847 oz. this year.

The Market Report

Metal Markets

NEW YORK—June 16

Copper was stronger during the last week. Spelter declined steadily. Tin had a sharp rise and then relapsed. Lead rose to the high point of the movement and then started to decline as rapidly as it had gone up.

Copper, Tin, Lead and Zinc

Copper—In the early part of the week a rather large business was done, the market gradually becoming established on the basis of 20@20¼c., regular terms, equivalent to about 19.80@20.05c., net cash, New York. The Wall Street and daily papers have had it higher, but that was not the fact. In the latter part of the week the market turned dull and some copper was to be had at 20c., r.t., while the principal sellers were asking 20¼.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer has withdrawn all quotations. Wire is quoted at 21@21½c. per lb. at mill.

Copper Exports week ended June 5 are reported by the Department of Commerce at 13,180,000 lb., the larger items being 6,251,000 lb. to France, 4,318,000 lb. to Italy and 2,232,000 lb. to Great Britain. Imports were 8,438,000 lb. metal and 726,000 lb. in ore and matte; total 9,164,000 lb.

The Department of Commerce reports the imports of copper into the United States during the month of April as follows: Ore, 23,409 tons, copper contents, 6,262,244 lb.; matte, 1958 tons, copper contents, 1,485,245 lb.; pigs, bars, etc., 11,378,410 lb.; old, etc., for remanufacture, 577,685 lb.; composition metal, chief value copper, 18,288 lb.; total, 19,721,872 lb. Exports are given as follows: Pigs, ingots and bars, 55,682,592 lb.; plates and sheets, 1,696,438 lb.; rods and wire, 6,805,865 lb.; all other, 3,779,114 lb.; total, 67,964,009 lb. In addition there were 1604 tons of matte exported, valued at $15,534. This makes the total imports four months ended Apr. 30 this year 34,126 long tons; exports, 111,478 tons.

Tin—In sympathy with the rise in London there was a sharp advance in the price on June 14, a moderately large business being done, but on the following days there was a reaction. This is a narrow and sensitive market, which is affected sharply by stray currents of demand and supply.

Messrs. Ricard & Freiwald, London and Amsterdam, estimate tin supplies in May as follows: Shipments from the Straits, 6551; Australia, 173; sales of Banka and Billiton, 1523; arrivals of standard, 740; total 8987 long tons. Deliveries, United Kingdom, 2292; Holland, 82; other Europe, 1341; America, 6155; total, 9870 tons.

Lead—This market is difficult to quote. We can do nothing but give the range of daily transactions whereof we had reports. The A. S. & R. Co. made prices as follows: 6¼c. on the 10th, 6½c. on the 11th and 7c. on the 12th. These respective advances did not, however, equal the prices that were being realized by independent producers on the same dates. The St. Louis market was practically on a parity with New York. A rather large business was done during the first four days, but nowhere nearly so large as in the previous week. On June 15 the market began to be much disturbed by the attempts of speculators to realize, and on June 16 all of the producers were offering lead at the price of the A. S. & R. Co., while from speculative hands it was obtainable on much lower terms. There was talk of a 500-ton lot being offered at 6c. The market closed in a very unsettled condition.

In the early part of the week galvanizers were inquiring for lead in 1000-ton lots, but transactions did not develop, although several of them were buyers of smaller quantities. There is some skepticism respecting the ability of galvanizers to switch to the manufacture of terne plate overnight, so to speak.

Spelter—The weakness that was in evidence at the close of our last week of record continued steadily, the decline occurring upon relatively light business, most of the reported transactions being 100-ton lots, with only a few in excess thereof, and the aggregate of the business being comparatively small. The purchasing agents for manufacturers were conspicuous by their absence, while on the other hand there were plenty of sellers, not only for late deliveries, but also for early and prompt. In the morning of June 16 prompt was freely offered from several quarters at 20@20½c., while in the afternoon a fairly large lot was offered at 19c. The reapproachment of the New York and London markets resulted in at least one transaction for export on June 16.

With spelter commanding £110 in London it will be curious and interesting to figure out some day why the Germans should be able to buy it in 1000-ton lots at the equivalent of £29 in their country.

On June 15 the attorney-general of Missouri filed a charge against a long list of zinc-smelting companies, including about all of the zinc smelters of the United States, alleging that they have entered into an unlawful combination for the purpose of buying ore in the Joplin district to the disadvantage of the producers of ore in that district.

Zinc Sheets are a little lower; base price $30 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged.

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
10	4.7838	49¼	19.60 @19.80	40¼	6.25 @7.00	6.00 @7.00	23.00 @24.00
11	4.7831	49⅜	19.65 @19.90	41	6.50 @7.50	6.50 @7.50	21.00 @23.00
12	4.7825	49⅜	19.75 @20.00	41	7.00 @8.00	7.00 @7.75	21.00 @23.00
14	4.7800	49½	19.90 @20.10	42½	7.00 @8.00	7.00 @7.75	20.00 @22.00
15	4.7700	49¼	19.90 @20.10	42	6.75 @7.25	6.75 @7.25	19.50 @20.50
16	4.7650	49⅛	19.80 @20.05	41	6.50 @7.00	6.50 @6.90	19.00 @20.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Electrolytic	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
10	23$\frac{5}{16}$	83⅝	18.14	84⅝	95	166	164½	27⅝	6.00	107⅝	23.36
11	23⅜	84½	18.35	85½	95	168	166	27⅞	6.06	110	23.90
12	23⅜										
14	23$\frac{7}{16}$	86¼	18.71	87¼	96½	174½	170	28⅛	6.11	110	23.90
15	23⅜	86¼	18.71	87¼	96	173½	169½	27⅞	6.06	110	23.90
16	23¼	85⅝	18.57	86½	96½	169	167	25⅛	5.45	110	23.90

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver, which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.86: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = [illegible]. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—June 16

Aluminum is strong and has some tendency to advance. There are only small stocks of imported metal. The chief domestic producer is reluctant to quote. Prices reported are 28@30c. per lb. for No. 1 ingots, New York.

Antimony—The market is experiencing a quiet spell and there is very little business doing. In the absence of sales prices are altogether nominal. For ordinary brands 36@38c. per lb. is asked; while for Cookson's 46@48c. is named, with no sales.

A U. S. Consular report from Hankow, China states that the exports from that district to the United States in 1914 were 10,071 tons crude metal, 1384 tons regulus and 13,958 tons ore, oxide and dross. The exports for three months ended Mar. 31, 1915, were 2560 tons crude metal and 1067 tons regulus.

Nickel is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.

Quicksilver is strong and prices have advanced, partly on account of the demand from cartridge makers and partly because of the embargo on exports from Italy. New York quotation for large lots is $95 per flask of 75 lb.; for smaller orders, $95@100 per flask. San Francisco price is telegraphed at $85@90, with a strong tendency. London price is £14 15s. per flask, with the same quotation from second hands.

Gold, Silver and Platinum

NEW YORK—June 16

Gold Imports at New York included some further amounts from Ottawa. The total gold brought from Ottawa since that place was made a depositary for London is nearly $71,000,000, and more is reported to be coming.

Sterling Exchange during the last week reached about the lowest point on record, 4.76¼ being quoted on one day.

Gold production in the Transvaal in May was $15,782,537; for the five months ended May 31 it was $75,502,715; showing increases over 1914 of $895,504 for May and $5,867,117 for the five months.

Silver—The market is dull. The foreign demand is limited; but this is offset by the fact that exports also have declined so that the supply and demand have marked step together, both being smaller in volume. The decline in foreign exchange has contributed in a measure to mark down the London bar silver quotation as expressed in cents per ounce in New York.

Shipments of silver from London to the East Jan. 1 to June 3, as reported by Messrs. Pixey & Abell, in values:

	1914	1915	Changes
India	£3,427,500	£2,335,500	D. £1,092,000
China	40,000	5,000	D. 35,000
Total	£3,467,500	£2,340,500	D. £1,127,000

The shipments in 1914 are the smallest recorded for a number of years.

Platinum—The market has been slightly more active but is still quiet. No change of any importance is noted. Dealers continue to ask $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

METAL EXPORTS AND IMPORTS

Exports and Imports of Secondary Metallic Products in the United States, three months ended Mar. 31, in pounds:

	Exports		Imports	
	1914	1915	1914	1915
Copper sulphate	4,855,277	6,737,029	.. ..	....
White lead	4,080,643	5,363,789	.	
Zinc oxide	7,506,591	10,616,321		..
Zinc dust	19,612	86,660	1,289,249	501,988
Zinc dross	572,477	2,836,500		......

The exports of zinc dust given above are reëxports of imported material.

British Imports and Exports of Metals, other than iron and steel four months ended Apr. 30, in long tons:

Metals:	Imports		Exports	
	1914	1915	1914	1915
Copper	57,527	62,569	22,312	12,894
Tin	13,359	19,018	14,935	15,144
Lead	77,265	80,935	20,066	19,041
Zinc	45,269	40,198	3,692	1,038
Quicksilver	773	658	282	67
Minor metals	3,099	1,799	8,959	5,892
Ores, etc.				
Tin concentrates	14,050	16,487	.	...
Pyrites	315,186	283,039	.....	...

Copper includes metallic contents of ore and matte. Exports include reëxports of foreign materials.

Zinc and Lead Ore Markets

JOPLIN, MO.—June 12

Blende, high price, $137.50; assay base price per ton of 60% zinc, premium ore, $120@135; Medium grades, $105@116; ore sale of low-grade was made at $78; average, all grades of zinc, $107.04 per ton. Lead, high price $73, base $72 per ton of 80% metal content; average, all grades of lead, $71.56 per ton.

SHIPMENTS WEEK ENDED JUNE 12

	Blende	Calamine	Lead	Values
Totals this week	14,026,770	1,091,180	1,539,620	$864,200
Totals this year	265,624,660	23,726,640	39,139,550	$10,361,750

Blende value, the week, $773,710; 24 weeks, $8,899,860.

Calamine value, the week, $35,420; 24 weeks, $476,470.

Lead value, the week, $55,070; 24 weeks, $985,420.

Sellers declined, for the bulk of ore, to consider any bid until 2 o'clock this afternoon, and some had previously declined $125. The price of $135 was made just after 2 o'clock, and is for next week's delivery of ore. On this account less than one-third of this week's output was sold.

PLATTEVILLE, WIS.—June 12

The base price paid for 60% zinc this week was $125 per ton. The base price paid for 80% lead ore was $63 per ton.

SHIPMENTS WEEK ENDED JUNE 12

	Zinc Ore Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,285,820	64,900	843,100
Year	84,012,970	3,040,090	**11,949,470**

Shipped during week to separating plants, 3,612,970 lb. zinc ore.

Iron Trade Review

NEW YORK—June 16

The iron and steel markets are still showing their favorable side and business is on the increase rather steadily. Foreign orders continue to be a prominent feature.

The growing production of pig iron and its absorption by buyers seem to show that the increase in business is on a solid basis. The recent gains in output have come from the steel-works furnaces rather than from the merchant stacks, but the latter seem to be doing at least fairly well, and the number in blast is increasing.

United States Steel Corporation reports a total of 4,264,598 tons of unfilled orders on the books May 31. This is an increase of 102,354 tons over Apr. 30. As compared with the high point reached this year on Feb. 28 it is a decrease of 80,773 tons.

Pig Iron Production in May again showed an increase. On June 1 there were 207 coke and anthracite stacks in blast having a total daily capacity of 72,600 tons; an increase of 1200 tons over May 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in May was 2,279,500 long tons; for the five months ended May 31 it was 9,839,900 tons. Of this total 7,190,000 tons or 7.31%, was made by the furnaces owned or operated by steel companies.

PITTSBURGH—June 15

Conditions in the steel trade continue to improve. Production is slightly heavier, bordering upon 80% of capacity, while the larger export and war business now being booked, as well as railroad business recently placed, but not yet entered on mill rolling schedules, promise a further increase in actual steel production before the close of the month. The opinion is gaining ground that by August the steel industry will be operating practically at capacity.

The Steel Corporation's report of unfilled obligations at the close of May proved more favorable than expected in the trade, the gain in May being 102,354 tons, while opinion had been about equally divided as to whether any increase at all would be shown. Contracting was not regarded as very active during May, while this month there is fairly heavy contracting, and a large increase in the corporation's unfilled obligations is expected for June.

Steel prices are showing a slight advancing trend. The Carnegie Steel Co. has withdrawn its 1.20c. price on bars, plates and shapes for prompt shipment, and other large mills are expected to take similar action in the next week or two. This would place the general market on the basis of 1.25c., the price that has lately been quoted on third-quarter contracts.

Under date of June 15 the National Tube Co. has published new steel boiler-tube discounts, effecting an advance of $2 a ton, following a similar advance on May 1. The discount on 3½- to 4½-in. is now 73% off list, large lots being understood to command four points greater discount.

FERROALLOYS

Recent English quotations are as follows: Ferrotungsten, 75 to 85% tungsten and not over 1% carbon, $1.08 per lb. Ferromolydenum, 70 to 80%, $4.32 per lb. Ferrochrome, 4 to 6% carbon, $131 per ton; 6 to 8% carbon, $126.50; 8 to 10% carbon, $121.50. Ferrosilicon, 45%, $68.50; 25%, $49 per ton.

FOREIGN IRON

British Foreign Trade in Iron and Steel four months ended Apr. 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel.	£10,925,322	£2,160,430	Exp. £8,764,892
Machinery, hardware, etc...	9,546,726	4,380,485	Exp. 5,166,241
Totals..................	£20,472,048	£6,540,915	Exp. £13,931,133
Totals, 1914.............	36,809,619	10,843,114	Exp. 15,966,505

Actual tonnage of iron and steel exported was 1,591,769 tons in 1914, and 916,405 in 1915, imported, 800,547 tons in 1914, and 260,179 tons this year.

The German Iron & Steel Union reports the total production of pig iron in April at 938,679 metric tons, almost exactly the same as in March, the difference being only 241 tons. It was, however, 595,750 tons less than in April, 1914. For the four months ended Apr. 30 the total make was 6,149,690 tons in 1914, and 3,554,873 tons in 1915; a decrease of 2,594,817 tons, or 42.2%, this year.

IRON ORE

Shipments of iron ore from the Lake Superior region in May were 5,012,359 tons. For the season to June 1 the shipments are reported by the "Iron Trade Review" as below, in long tons:

Port	1914	1915	Changes
Escanaba....................	495,917	528,566	I. 32,649
Marquette	121,873	183,365	I. 61,492
Ashland	341,766	557,664	I. 215,898
Superior......................	1,735,607	851,064	D. 884,543
Duluth.........................	734,090	2,149,310	I. 1,415,220
Two Harbors..................	692,496	1,246,222	I. 553,726
Total....................	4,121,749	5,516,191	I. 1,394,442

Out of the shipments of 5,516,191 tons of Lake ore up to June 1, a total of 3,765,794 tons, or 68.3%, went to Lake Erie ports.

Owing to the reduction of railroad freights from the mines to docks on June 1, the standard prices of Mesabi ores have been reduced by 5c. The schedule of ore prices is now: Old Range bessemer, $3.75; Mesabi bessemer, $3.45; Old Range nonbessemer, $3; Mesabi nonbessemer, $2.80 per ton, f.o.b. Lake Erie docks.

Arrivals at Baltimore for the past week included three cargoes, 16,200 tons, of manganese ore from Brazil.

OTHER ORES

Tungsten Ore prices as announced by buyers in Colorado, the schedule varying from $1 per unit for very low grade ore up to $8 per unit for 60% concentrates. The rise in price according to grade is variable; from 1 to 9% it increases $3.25 per unit; 10 to 19%, only 45c. per unit; 20 to 29%, the advance is 90c.; from 30 to 39% it is 45c. again; 40 to 49%, it is 45c.; while from 49 to 60%, it is $1 per unit. Prices are for ore delivered at Primos Mill, Lakewood, Colorado.

The price of tungsten ores has advanced sharply owing to various causes, the chief one being short supply, owing to interruption in mining in several countries by the war. The price for concentrates carrying 60% WO_3 is now at least $10 per unit.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 314,897 short tons; shipments, 321,144 tons. Shipments of Greensburg and Upper Connellsville coke were 33,789 tons.

Anthracite Shipments in May were 5,797,961 long tons, being 688,240 tons less than in April and 483,582 tons less than in May, 1914. For the five months ended May 31 the total shipments were 26,815,603 tons in 1914 and 26,279,202 in 1915, a decrease of 536,401 tons, or 2%, this year.

British Fuel Exports four months ended Apr. 30, in long tons:

	1914	1915	Changes
Coal.........................	22,614,387	14,989,490	D. 7,654,897
Coke	369,364	305,697	D. 63,667
Briquettes	666,276	388,907	D. 277,369
Steamer coal	6,559,730	5,154,395	D. 1,405,335
Total....................	30,239,757	20,838,489	D. 9,401,268

Imports are insignificant, being only 11,128 tons in 1914 and 803 tons this year.

Coal Exports from the United States in April showed a sharp increase over previous months this year; for the three months ended Mar. 31 there was a considerable decrease from 1914. For April and the four months ended Apr. 30 the total was as follows, in long tons, not including bunker coal:

	April		Four Months	
	1914	1915	1914	1915
Anthracite	396,260	[illegible]	[illegible]	949,241
Bituminous	772,037	1,1[illegible]	[illegible]	3,023,555
Total	1,168,297	1,566,[illegible]	[illegible]	3,972,796

The increase in foreign shipments of [illegible] coal in April was chiefly to Italy, Argentina and Brazil. [illegible] anthracite trade was chiefly with Canada.

SAULT STÉ. MARIE CANALS

The total freight passing through the Sault Ste. Marie canals in May was 7,348,566 short tons. For the season [illegible] June 1 the total freight was: West bound, 2,017,687, [illegible] bound, 6,765,615; total, 8,783,302 short tons, or 520,666 tons more than last year. The total number of vessel passages was 2995 showing an average cargo of 2933 tons. The mineral freights included in the totals were.

	1914	1915	Changes
Anthracite	287,938	378,221	I. 90,283
Bituminous coal	2,192,001	1,397,902	D. 794,099
Iron ore	3,765,007	5,318,633	I. 1,553,626
Pig and m'f'd iron	100,808	46,901	D. 53,907
Copper	9,169	26,118	I. 16,949
Salt, bbl	266,133	147,301	D. 118,832

Iron ore was 60.6%, and coal 20.2% of the total freight reported this year.

Chemicals

NEW YORK—June 16

The general markets show little change, except that they are slightly steadier, so far as heavy chemicals are concerned. Prices for many minor products are unsettled.

Arsenic—The market continues quiet with only a moderate business forward and supplies sufficient. Prices are about $4 per 100 lb., for both spot and futures.

Copper Sulphate—On a fair business the market is steady and prices unchanged. Quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is not specially active, but there are considerable sales from time to time. Quotations are a shade lower at 2.20c. per lb. for spot and for all positions this year.

Imports and Exports of Raw Material for chemical manufacture in the United States, three months ended Mar. 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	3,452	4,858	18,952	1,937
Pyrites	217,034	117,609		..
Chrome ore............	34,600	11,300		..
Magnesite	152,053	89,602	660	367

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total sulphur imported this year was 51,900 tons.

Imports and Exports of Fertilizing Chemicals in the United States, three months ended Mar. 31, in long tons

	Imports		Exports	
	1914	1915	1914	1915
Kainit.................	201,660	3,786		
Manure salts	46,683	4,159		
Other potash salts	78,819	62,098	688	945
Nitrate of soda	106,842	19,709	1,539	6,221
Sulphate of ammonia....	26,502	18,297		579
Phosphates			333,094	14,352

Exports include reëxports of foreign material. Some phosphates are imported, but are not given separately in the returns.

PETROLEUM

Exports of mineral oils from the United States in April were 170,944,615 gal., being 49,088,583 gal. less than in April, 1914. For the four months ended Apr. 30 the total exports were 708,120,790 gal. in 1914, and 641,201,669 gal. in 1915, a decrease of 66,919,121 gal., or 9.4%, this year.

The monthly report of the "Oil City Derrick" shows new wells completed in May as follows: Pennsylvania grade, 337; Lima-Indiana, 33; Central Ohio, 51; Kentucky, 19; Illinois, 52; Mid-Continent, 299; Texas-Louisiana, 147. In [illegible] wells were completed in the field covered by the [illegible] decrease of 40 from the April figures. New prod[illegible] amounted to 174,201 bbl., or 12,059 bbl. less than shown in the previous report. At the end of May there were [illegible] and 1449 wells drilling.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Ida., (post.)		July 1	$0.005
Belcher, Nev., (post.)	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Blue Bell, Ida.	July 5	Aug. 4	0.003
Blue Star, Ida.	June 19	July 10	0.01
Carbonate, Ida.	July 23		0.001
Cash Boy, Nev.	May 17	June 17	0.01
*Contact Copper, Mich.		July 14	0.50
Contact Copper, Mich.	May 15		0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida.	June 5	July 8	0.001
Glen Metal, Ida.	May 31	July 1	0.002
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich.	Jan. 3		1.00
Idora, Ida.	June 3	July 2	0.005
Iron Mask, Ida.	July 1	Aug. 10	0.002
Laclede, Ida.	May 24	June 14	0.003
Majestic-Idol, Nev.	Dec. 15	July 20	0.005
Mayflower, Ida.	June 15	July 17	0.005
Mineral Range, Utah	May 24	...	0.003
Monarch Pitts., Nev.	June 14	July 14	0.01
Moonlight, Ida.	June 5	July 8	0.005
Mullan, Ida., (post.)		June 24	0.002
New Arcadian, Mich.	June 1		0.50
New Arcadian, Mich.	Dec. 1		0.50
North Bunker Hill, Ida.	June 12	July 17	0.002
North Lake, Mich.	...	June 15	1.00
Ophir, Nev.	June 4	June 25	0.05
Rainbow, Ida.	July 7	Aug. 7	0.002
Raymond-Illinois, Utah	May 24	June 9	0.005
Raven, Ida.	May 15	June 14	0.0006
Rhode Island, Ida.	June 24	July 24	0.001
Royal, Ida.	June 1	July 6	0.0015
Selma, Utah	May 29	June 16	0.005
Silver Moon, Ida.	May 18	June 18	0.005
Silver Mountain, Ida., (post.)		July 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Sunset Dev., Ida.	June 30	July 24	0.0025
Treasure, Calif.			0.05
Union, Nev.	June 18	July 9	0.05
United Tintic, Utah	May 25	June 15	0.005
Virginia, Ida., (post.)		June 29	0.02
West Tonopah Con., Nev.	July 10	Aug. 10	0.01
Wisconsin, Ida.	May 15	June 15	0.003
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

The lead stocks continued their sky-rocket career upward. Other mining issues advanced somewhat during the week, but were by no means so strong.

COLO. SPRINGS June 15

Name of Comp.	Bid.
Acacia	.04
Cripple Cr'k Con.	.01
C. K. & N.	.03
Doctor Jack Pot	.10⅞
Elkton Con.	.39⅞
El Paso	90
Findlay	.04
Gold Dollar	.02
Gold Sovereign	.04½
Golden Cycle	1.76½
Isabella	.17⅞
Jack Pot	06½
Jennie Sample	.02
Jerry Johnson	04¼
Lexington	‡ 008
Mary McKinney	.35
Pharmacist	‡ 01
Portland	1.40
Raven B. H.	.02
Vindicator	1.65

SALT LAKE June 16

Name of Comp.	Bid.
Beck Tunnel	05½
Black Jack	.08½
Colorado Mining	.10½
Crown Point	.01
Daly-Judge	6.95
Gold Chain	.12½
Grand Central	.62
Iron Blossom	.74
Little Bell	.14
Lower Mammoth	.03
Mason Valley	3.00
May Day	.23
Opohongo	00¼
Prince Con.	.49½
Seven Troughs	.01
Silver King Coal'n	3.55
Silver King Con.	2.20
Sioux Con.	.03
Uncle Sam	05½
Yankee	.03

TORONTO June 15

Bailey	02½	Dome Exten.	09½
Conlagas	05	Foley O'Brien	30
Peterson Lake	27½	Hollinger	25.75
Right of Way	04½	Imperial	05¼
Seneca Superior	1.10	Jupiter	09⅜
Silver Queen	01½	McIntyre	40
T. & Hudson Bay	18.50	Pearl Lake	01⅞
Timiskaming	35½	Porcu. Crown	77
Wettlaufer-Lor.	03½	Preston E. D.	02
Big Dome	15.25	Rea	11

SAN FRANCISCO June 16

Comstock Stocks		Misc. Nev. & Cal.	
Alta	04	Belmont	4.50
Andes	05	Jim Butler	.90
Belcher	20	Lone Star	.06
Best & Belcher	06	MacNamara	03
Caledonia	.4	Midway	17
Challenge Con.	[illegible]	Mont.-Tonopah	.30
Confidence	07	North Star	.16
Con. Virginia	06	Rescue Eula	.09
Gould & Curry	03	West End Con.	87
Hale & Norcross	03	Atlanta	31
Julia	02	Booth	51
Mexican	35	C. O. D. Con.	04
Occidental	79	Comb. Frac.	09
Ophir	11	Jumbo Extension	1.52½
Overman	06	Pitts.-Silver Peak	08
Potosi	03	Round Mountain	[illegible]
Savage	.03	Sandstorm Kendall	07
Sierra Nevada	05	Silver Pick	10
Union Con.	18	Central Eureka	16
Yellow Jacket	30	So. Eureka	[illegible]

N. Y. EXCH. June 15

Name of Comp.	Clg.
Amalgamated	76½
Am. Sm. & Ref., com.	81¼
Am. Sm. & Ref., pf.	107⅞
Am. Sm. Sec., pf. B	‡80
Anaconda	37
Batopilas Min.	1⅛
Bethlehem Steel	165
Bethlehem Steel, pf.	118
Chino	46⅞
Colo. Fuel & Iron	30
Federal M. & S., pf.	59
Great Nor., ore., ctf.	36¼
Guggen. Exp.	65⅞
Homestake	117¼
Inspiration Con.	32½
Mex. Petroleum	77
Miami Copper	27¼
Nat'l Lead, com.	66
National Lead, pf.	110⅞
Nev. Consol.	15½
Ontario Min.	3¼
Quicksilver, pf.	4¼
Ray Con.	25⅛
Republic I&S, com.	29¼
Republic I&S, pf.	87
SlossSheff'd, com.	35
Tennessee Copper	38¼
Utah Copper	69
U. S. Steel, com.	59⅞
U. S. Steel, pf.	108¼

N. Y. CURB June 15

Name of Comp.	Clg.
Alaska Juneau, w.i.	13¾
Alta Con.	.70
Beaver Con.	30
Big Four	05
Blue Bell	03
Braden Copper	7½
Buffalo Mines	.60
Can. Cop. Corpn.	$1\frac{1}{16}$
Can. G. & S.	.03
Caribou	.50
Cashboy	.07
Chambers Ferland	15
Con. Ariz. Sm.	$\frac{13}{16}$
Con. Coppermines	2½
Con. Nev.-Utah	$\frac{7}{16}$
Davis-Daly	1⅛
Diam'field-Daisy	04
Dia. Black B.	04
Florence	.52
Goldfield Con.	$1\frac{9}{16}$
Goldfield Merger	23½
Greene Cananea	42
Kerr Lake	4⅜
La Rose	.50
McKinley-Dar-Sa.	32
Mines of Am.	2⅞
Nevada Hills	23
New Utah Bingham	3⅞
Nipissing Mines	6
Ohio Copper	$\frac{3}{16}$
Oro	25
South Utah	¼
Stand'd Oil of N.J.	402
Standard S. L.	$1\frac{9}{16}$
Stewart	$2\frac{7}{16}$
Tonopah	7⅛
Tonopah Ex.	2⅛
Tonopah Merger	.40
Tribullion	⅛
Tularosa	$\frac{7}{32}$
West End Ex.	‡ 04
Yukon Gold	2¼

LONDON June 2

	£	s	d
Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	15	0
Camp Bird	0	5	6
El Oro	0	7	3
Esperanza	0	7	6
Mexico Mines	3	12	6
Oroville	0	12	0
Santa Gert'dis	0	7	6
Tomboy	1	4	6
Tough Oakes	0	9	0

BOSTON EXCH. June 15

Name of Comp.	Clg.
Adventure	2¼
Ahmeek	400
Alaska Gold M.	37⅞
Algomah	3
Allouez	57
Am. Zinc	52½
Ariz. Com., ctfs.	8¼
Bonanza	.50
Butte-Ballaklava	3½
Butte & Superior	71½
Calumet & Ariz.	66¼
Calumet & Hecla	595
Centennial	20
Cliff	1½
Copper Range	57¼
Daly West	4⅞
East Butte	13¾
Franklin	10¼
Granby	89½
Hancock	20¼
Hedley	28½
Helvetia	50
Indiana	7
Island Cr'k, com.	46
Island Cr'k, pfd.	89½
Isle Royale	30
Keweenaw	2½
Lake	14½
La Salle	6¾
Mass	14
Mayflower	5
Michigan	1¾
Mohawk	79
New Arcadian	11⅞
North Butte	33½
North Lake	2¾
Ojibway	2¼
Old Colony	4
Old Dominion	56½
Osceola	90¼
Quincy	88
Santa Fe	$2\frac{15}{16}$
Shannon	9
Shattuck-Ariz.	28
Superior	30
Superior & Bost.	‡3¾
Tamarack	38
Trinity	5½
Tuolumne	42
U. S. Smelting	48⅞
U. S. Smelt'g, pf.	47¾
Utah Apex	4⅞
Utah Con.	15¼
Victoria	3
Winona	4
Wolverine	62½
Wyandot	1

BOSTON CURB June 15

Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	.10½
Boston Ely	.30
Butte & Lon'n Dev.	.23
Calaveras	$1\frac{15}{16}$
Calumet-Corbin	.07
Chief Con.	1¼
Corbin	.75
Cortez	.50
Crown Reserve	.75
Eagle & Blue Bell	2⅛
First Nat. Cop.	2¼
Houghton Copper	4
Iron Cap Cop., pf.	6¼
Majestic	70
Mexican Metals	19
Nevada-Douglas	.50
New Baltic	3½
Oneco	1¼
Raven Copper	.10
Smokey Dev.	.20
So. Lake	6⅛
Tonopah Victor	32
Trethewey	13
United Verde Ext.	$4\frac{5}{16}$

‡Last Quotations

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver. London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.49	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.99	18.506	63.182	77.600	67.786	*
June	13.603		61.336		66.274	
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year	..				.....	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301		.....	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	...	3.810		19.411	
July	3.891	....	3.738		19.051	
August	3.875	.....	3.715	....	‡	
September	3.828	......	3.658		‡	
October	3.528	......	3.384	....	‡	
November	3.683	.....	3.585		18.500	
December	3.800	.....	3.662	...	19.097	
Year	3.862		3.737		.....	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.06			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.15		13.83	
Year	$14.88		$13.78	...	$14.01	

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The Rainbow Mill, Oregon

By W. M. Dake, Jr.*

SYNOPSIS—A cyanide mill equipped for all-slime treatment and using Pachuca tanks for agitation. The usual features accompanying such a mill are present. Zinc-dust precipitation is practiced, the melting being done in oil-fired tilting furnaces. Extraction reaches 95.6% of the original ore content. The ore is quartz and andesite carrying gold.

The Rainbow mine is situated in the eastern part of Oregon, 23 miles southwest of Huntington and 40 miles southeast of Baker, in the Mormon Basin.

The property was located by a native of the Basin about 15 years ago, and a three-stamp mill was erected and operated intermittently for several years. The property changed hands in 1901, and a two-stamp mill was built nearer the mine for the purpose of sampling and testing the ore.

In 1906 an operating company was formed, and [illegible] two-stamp batteries and plates, supplied by an aërial tram of the single-cable type, were installed at a point half a mile from the mine. To this installation was later added a five-stamp battery, and one Wilfley and two Standard concentrators. The mill was operated for four years and made an extraction of from 75 to 80%.

In 1910 a lease was given on the tailings which had been impounded, and a small sand plant was erected by the lessees. This plant was operated with varying success up to the time the property passed under the management of the present company.

Construction, Buildings and Ore

The construction work was commenced in May, 1912, and the first ore was milled in the latter part of November of the same year.

All buildings are of wood, roofed with corrugated iron. All foundations for machinery and all retaining walls are of concrete. The buildings are heated with steam supplied by a low-pressure boiler on the lower floor of the mill.

The Rainbow Mill, Rye Valley, Oregon

The vein matter treated is composed of quartz, with intrusions of andesite and small stringers of gouge. The valuable metal is gold, little silver being present. The specific gravity is [illegible] on ore of average [illegible].

Ore is delivered from the mine through a vertical shaft by a cage carrying 1-ton cars and is trammed 75 ft. to a 5-ton crusher bin, passing over a Fairbanks track scale where the weight is recorded.

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*Mill superintendent, Rainbow mine, Rye Valley, Ore.

The ore is drawn from the crusher bin over a 10-ft. grizzly, having ¾-in. bars spaced 1 in., to a Denver Engineering Co.'s Blake-type 11x18-in. jaw crusher. The crusher is driven at 300 r.p.m. by a 35-hp. motor.

The fines from the upper half of the grizzly are conveyed by two steel-lined chutes to the front part of the 210-ton battery bin. The ore, which is crushed to pass a 1½-in. ring, falls directly into the battery bin. Manganese-steel jaws are used, the present set having been in use for 18 months. All crushing is done on day-shift work, one man attending to it.

From the battery bin the ore is drawn through rack-and-pinion gates to three Challenge feeders. These feeders were of the old pall-and-ratchet type, but have been converted to the monkey-wrench-grip type to enable a closer feed and to do away with excessive repair costs.

From the feeders the ore falls into three mortars, arranged as one ten-stamp and one five-stamp battery, placed on reinforced-concrete blocks. These mortars were designed for inside amalgamation, which difficulty has been overcome to a certain extent by installing false dies, 6 in. thick.

All stamps are 1050 lb.; the ten-stamp battery dropping 106 per min. through 6¾ in., and the five-stamp battery, 102 per min. through 7 in. Canda cams are used with 6-in. camshafts. Pacific guides are carried on the ten-stamp battery and Hendy-type guides on the five-stamp battery.

Square-opening 4-mesh No. 16 wire screens are used on all batteries, lasting from two to three weeks. The ore is stamped in mill solution averaging 1 lb. KCN and 0.6 lb. protective alkalinity, with a ratio of 3½ solution to 1 of ore. From 2- to 3-in. discharge is maintained on all batteries.

Chrome-steel shoes and dies are used, the shoes wearing from 80 to 90 days and the dies from 100 to 120 days. A 35-hp. motor is belted to the line shaft which drives the batteries. Swinging belt-tighteners are used. The average stamp duty, based on possible running time, is 6.78 tons per stamp per day.

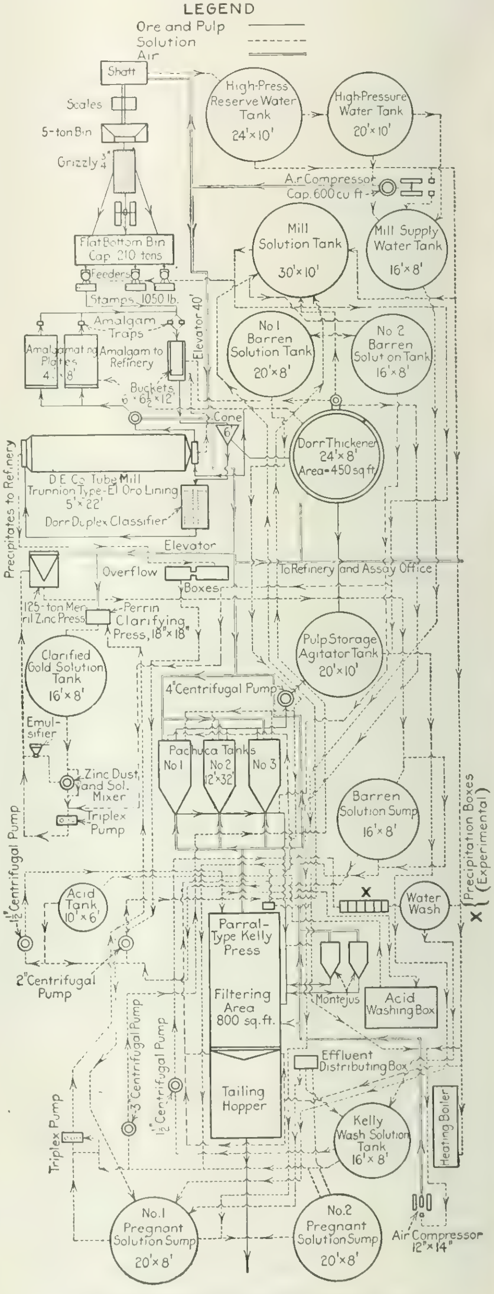
From the batteries the pulp passes to the concrete boot of a 40-ft. elevator equipped with 12x6x5-in. buckets, spaced 10 in. on a 12-in. rubber belt traveling at 300 ft. per min. The average life of the buckets is from three to four months, and of the elevator belt, from five to six months. The pulp is discharged from the elevator into a 5-ft. cone, the overflow of which passes directly to the Dorr thickener. Screen tests on cone overflow average 95% minus-200 mesh. The underflow from the cone is discharged into a Dorr duplex classifier. The slime from the classifier, giving average screen tests of 85.73% minus-200 mesh, 13.68% on 200-mesh and 0.58% on 100-mesh, is sent to the Dorr thickener.

TUBE MILLING

The sand discharge from the classifier, with 40% moisture, is passed to a Denver Engineering Co.'s trunnion-type 5x22-ft. tube mill with El Oro lining, revolving at 30 r.p.m. and driven by a 75-hp. motor.

It was found that the hard dike material from the mine would serve the purpose of flints, and only one shipment of pebbles was used. The mine rock is broken to pass into the feed dipper, at which point all rock is added. Mine-rock consumption averages 30 lb. per ton of ore milled.

The outside and center end liners, having been cast 1½ in. thick, were found to wear more quickly than the side liners, and it was necessary to change them after six months' use. The second set installed were cast 2½ in. thick, and the thin tongue on each outside end liner,


LEGEND
Ore and Pulp
Solution
Air
Shaft
Scales
5-ton Bin
Grizzly ¾"
Flat Bottom Bin Cap. 210 tons
Feeders
Stamps, 1050 lb.
Amalgam Traps
Amalgamating Plates 4'×8'
Amalgam to Refinery
Buckets 6"×6½"×12"
Elevator 40'
High-Press Reserve Water Tank 24'×10'
High-Pressure Water Tank 20'×10'
Air Compressor Cap. 600 cu ft
Mill Solution Tank 30'×10'
Mill Supply Water Tank 16'×8'
No 1 Barren Solution Tank 20'×8'
No 2 Barren Solution Tank 16'×8'
Cone 6'
Dorr Thickener 24'×8' Area=450 sq ft
D. E. Co. Tube Mill Trunnion Type-El Oro Lining 5'×22'
Dorr Duplex Classifier
Precipitates to Refinery
Elevator
Overflow
Boxes
To Refinery and Assay Office
125-ton Merril Zinc Press
Perrin Clarifying Press, 18"×18"
Clarified Gold Solution Tank 16'×8'
Pulp Storage Agitator Tank 20'×10'
4" Centrifugal Pump
Emulsifier
Zinc Dust and Sol. Mixer
Triplex Pump
Pachuca Tanks No 1 No 2 No 3 12'×32'
Barren Solution Sump 16'×8'
1½" Centrifugal Pump
Acid Tank 10'×6'
X
Water Wash
X { Precipitation Boxes (Experimental)
Parral-Type Kelly Press
Filtering Area 800 sq. ft.
Montejus
Acid Washing Box
2" Centrifugal Pump
3" Centrifugal Pump
1½" Centrifugal Pump
Effluent Distributing Box
Tailing Hopper
Triplex Pump
Kelly Wash Solution Tank 16'×8'
Heating Boiler
No. 1 Pregnant Solution Sump 20'×8'
No. 2 Pregnant Solution Sump 20'×8'
Air Compressor 12"×14"

FLOW SHEET OF THE RAINBOW MILL

hich was intended to fit between the side liners and the ead, was left off. Using this liner, it is not necessary remove one set of side liners at each end of the mill hen replacing outside end liners.

The center end liners were cast of manganese-steel for e feed end of the mill, and a screen with ½-in. open-gs, was cast 2½ in. thick for the discharge end. The anganese-steel liners have been in use for eight months d show no appreciable wear.

The side liners were changed after 13 months' run. he ones nearest the feed end were discarded, and the mainder—amounting to about 50%—were stored. The mplete relining, including unloading, removing old lin-s, replacing a new set and loading, required 11 hr. When becomes necessary to reline, a set of side liners will be ade up from the two sets of old liners, and from three four months' run is expected from them. This will ve an average of about 15 months' life to each set.

AMALGAMATION

The tube-mill discharge, showing 78% minus-100 mesh, lls into the suction box of a 4-ft. air lift, where it is di-ted to 60% moisture. It is then raised and distributed two 4½x7-ft. soft-copper plates. The plates are ar-nged so that the pulp may be switched to either one d are set with a grade of 2¼ in. per ft. Both plates are essed twice each shift, using fiber brushes, whisk brooms d scrapers cut from rubber belting. It has been found at if the plates are allowed to build up with hard amal-m, the extraction drops off and they are therefore kept clean as possible.

Plate consumption is rather high, due to the dissolv-g action of the solution—a plate lasting from three to ur months—and for this reason silver-plated plates are t used. There has been no noticeable difference in plate traction on this account. The copper from the plates is ecipitated and is found with the base bullion.

The mill was originally designed for amalgamation llowing the batteries, and for six months after com-encing operations this method was used. Due to the ts that the lime in solution blackened the mercury to ch an extent that after three or four hours amalgama-n was impossible and that it was necessary to dress the ates at least twice a shift, the stamp-hours lost amounted 10% of the total running time.

With the idea of increasing tonnage and also amalga-ation extraction, tests were made on pulp leaving the be mill, at a point in the closed classifier circuit where e pulp from the plates would again be elevated to the ssifier. It was found that the extraction was increased out 10% by the fine grinding of the tube mill.

As the slime discharge from the Dorr classifier gives screen test of 99.41% minus-100 mesh, it may be seen at any particle of free gold in the circuit that is too rge to dissolve readily in subsequent treatment would held in the circuit until finally broken up or amal-mated.

By this change the mill tonnage was increased 28%, it made possible the use of larger-mesh battery screens d decreased the stamp-hours lost to time required for cessary repairs. From the plates, the pulp passes rough two amalgam traps into the boot of the elevator d from there into the closed classifier circuit.

The pulp from the Dorr classifier enters the Dorr thick-er at about 81% moisture and is there thickened to 1 : 1 consistency. The clear overflow, titrating 1 lb. KCN and from 0.6 to 0.8 lb. protective alkalinity, is returned by a 3-in. centrifugal pump to the mill-solution tank—30 ft. in diameter by 10 ft. deep—and is there distributed to lines running to the batteries, classifier, tube mill, plates, etc.

The underflow from the thickener is discharged by gravity into the pulp-storage tank, which is equipped with a mechanical agitator revolving at 6 r.p.m. This tank is 20 ft. in diameter by 10 ft. deep and has a capacity of one Pachuca tank.

From this tank the pulp is elevated by a 4-in. centrifugal pump and distributed by pipes to the three 12x30-ft. Pachuca agitators.

These tanks are arranged for intermittent agitation. Air is supplied at 30 lb. pressure from the mill compressor. At the agitators, sodium cyanide is added to bring the solution up to 1.5 lb. KCN per ton. Lead acetate is also added here. The protective alkalinity of the tank charge is regulated by titration of the thickener overflow and addition of lime to the batteries. The charges are given a 12-hr. agitation, resulting in 80% extraction in the tanks. Cyanide consumption is 0.851 lb. NaCN per ton of ore milled. Lime consumption is 8.852 lb., and lead acetate is 0.130 lb. per ton milled.

FILTRATION

At the end of the agitation period the pulp is drawn through 6-in. pipes from the bottom of the Pachuca tanks to a Parral-type Kelly filter having 10 leaves with a filtering area of 800 sq.ft. The filter is equipped with montejus of sufficient capacity to hold a charge for the press. Monteju pressure for making cake, returning, etc., is supplied from the mill air compressor at 30 lb. The accompanying table shows an average cycle, making a 1¾-in. cake with pulp of 1.4 sp.gr., a total time of 59 minutes.

AVERAGE FILTRATION CYCLE

Filling	2 minutes
Making cake	12 minutes
Returning excess pulp	3 minutes
Washing with solution	16 minutes
Washing with water	6 minutes
Returning excess wash	3 minutes
Drying	5 minutes
Discharging	12 minutes
Total time of cycle	59 minutes

The cake is discharged at 25% moisture and is sluiced through an inclined launder to the tailings dam. Acid washes are given to the leaves in the shell every sixth day, using a 10-lb. solution of muriatic acid. The solution is carried from the acid tank by a 1½-in. centrifugal pump into the water-discharging manifold of the press head, the press filled and the overflow returned to the acid tank. Acid washes are of 2 hr. duration.

In case a leak is found in a leaf, it is removed to an acid-washing tank and a new leaf substituted. The leaky leaf is then acid-washed and scrubbed with fiber brushes, marked, dried, patched and placed in readiness for the next change. With proper care leaves should last for two years.

PRECIPITATION

The solution from the Kelly filter is discharged into a collecting box and from there is run to one of three tanks, two of which are used for high- and medium-value solution and the third for wash water. For the first 30 min. of the filter cycle, the effluent from the press is run into the No. 1 gold tank, 20 ft. in diameter by 8 ft. deep.

During the following 20 min. of the cycle, the solution is run into the No. 2 gold tank, of the same size as No. 1, and is pumped from there by a 3-in. centrifugal pump into the mill-solution tank. The solution from the last part of the cycle is run into the wash-water tank and is returned to the water-wash tank above the filter by a 1½-in. centrifugal pump.

The solution from No. 1 gold tank is drawn off through a 2-in. pipe to a 4x6-in. Goulds triplex pump. This pump forces the solution through a 22-frame, 18x18-in. Perrin clarifying press, fitted with 10-oz. canvas leaves covered with commercial filter paper. By using the paper, the press can be cleaned by one man in 15 min. From the clarifying press, the solution is piped to the clarified-solution tank, 16 ft. in diameter by 8 ft. deep, and is then drawn through a mixing tank, where the zinc-dust emulsion is added, to a 4x6-in. Goulds triplex pump.

This pump forces the solution through a 10-frame Merrill precipitation press carrying 10-oz. canvas leaves, and from there is run to a barren-solution sump 16 ft. in diameter by 8 ft. deep. From this sump the solution is pumped by a 3-in. centrifugal pump to the two barren tanks or into the mill-solution tank at the top of the mill.

Zinc is fed by a Merrill zinc-dust feeder, at 0.25 lb. per ton of solution. Zinc consumption is 0.531 lb. per ton of ore milled.

The Merrill press is cleaned tri-monthly. After the precipitating pump has been shut down, all ports at the bottom of the press are opened, and air at 80 to 90 lb. pressure, supplied from the mine compressor, is turned on for 2 hr. The press is then opened, leaves scraped with spatulas, and the precipitate at 20% moisture falls into sheet-iron pans. Leaves are then examined for leaks, press closed, pans removed and precipitation started. The press is cleaned by two men in less than an hour. Canvas leaves are changed once each month and the old leaves are burned in the retort furnace and the ashes added to the precipitate. Precipitate is carried to the refinery, weighed and fluxed without further drying in a large fluxing box. After it is weighed and the moisture determined, the precipitate is fluxed as shown in the accompanying table:

FLUXING THE PRECIPITATE

	Per Cent.
Dry precipitate	37.8
Borax glass	12.2
Soda	10.8
Niter	8.2
Fluorspar	4.0
Silica	27.0

Fluxed precipitate is charged into a No. 200 Steele-Harvey tilting oil-fired crucible furnace. Oil and air are fed through a Monarch burner at 80 lb. pressure. As the precipitate is melted down, more is added until the crucible is filled to within [illegible] in. of the top. When zinc fumes cease to be given off—after about 3 hr.—the charge is poured into conical molds. The time of melting for one crucible charge averages 6 hr.

When the preliminary melt has been finished, all buttons are melted in the crucible with borax, soda, a little niter and fluorspar, and the charge is poured into bullion molds.

Molds are cooled, bars turned out and hammered free from slag, scrubbed with weak acid, drill-sampled on top and bottom, stamped with bar number and weight and shipped. The bars average 531 fine.

The average weight of dry precipitate cleaned up is 300 lb. and the average number of crucibles used per melt is 1. An average of four pours is secured from ea crucible. All slag from the refinery is crushed, pulveri and ground in a ball mill with strong cyanide solut and mercury, effecting an extraction of 85%.

The amalgam is recovered by panning and is retor and the sponge added to the precipitate buttons ea month. The pulp and solution from the ball mill are pi to the elevator boot and into the mill circuit. Amalg is checked in to the refiner tri-monthly, retorted in wood-burning Hendy retort and melted down in the c cible furnace into bars. These bars are sampled, stam and shipped separately. Amalgam bars average 805 fi

All scrapped amalgam plates are hammered free fr hard amalgam, cut up, folded and melted down in crucible furnace, poured into conical molds, sampled shipped to the smelting plant. The average extract obtained is 95.6%.

SAMPLING AND ASSAYING

Solution and pulp sampling is attended to by the lution man on each shift. Solution samples are bott and tagged, and pulp samples cut down and dried in electric drier and sacked. All samples are entered the assay report book before being carried to the as office.

The assay office is about 50 yd. from the mill and sists of four rooms. The crusher room contains a 4 in. jaw crusher and a Braun planetary-disk pulveri driven by a 5-hp. motor; a buck-board, cutting-do floor, Jones samplers, sized screens, etc. The furn room contains a brick double-muffle oil-fired furnace ing a Case low-pressure fan and burner; a cupel machi sample-filing cases, pulp balances, etc. The solution ro is equipped with a hooded hotplate, filter stands, si and apparatus for wet determinations. The balance ro is fitted with a Thompson analytical balance and a Kel button balance.

All samples from the mine and mill are delivered the office each morning, and the results are reported three o'clock in the afternoon.

The average number of fusions per day from the m is 32, and from the mill, 14. Cupellations average per day. This figure includes 20 solution samples and bullion assays. Aside from the regular daily samp from mill and mine, all analyses on mill solutions, z dust, lime, etc., are made here. Analyses average ab 45 determinations per month.

The mill crew consists of three men, a solution m in charge of the shift, a battery man and a filter operat On day shift there is a crusherman, general millman, finer, assayer and helper. Total labor, including sup intendence, is 15 men.

Electric power is supplied from the Idaho-Oregon Lig & Power Co. over a 20-mile line from the substation Gypsum, at 23,000 volts. The power is received at mine in a transformer house, 200 ft. from the mine bui ings, and is carried through three transformers, where is stepped down to 440 volts, and delivered to the m through a low-voltage release switch. Current is tra formed for lighting purposes to 220- and 110-volt c cuits. All motors are equipped with fuse blocks a starting compensators of the low-voltage release type. T average power consumption for total mill operations 2988 kw.-hr. per day, or 1.23 kw. per ton of milled.

Shaft-Rockhouse Practice in the Copper Country--II

By L. Hall Goodwin*

SYNOPSIS—In this installment are described the several operations carried on in the shafthouse, as distinguished from the rockhouse, with the different methods of conducting them. Three skip-dumping devices. Methods of changing shaft conveyances. Duties of the lander. Handling poor rock. Handling timber and steel.

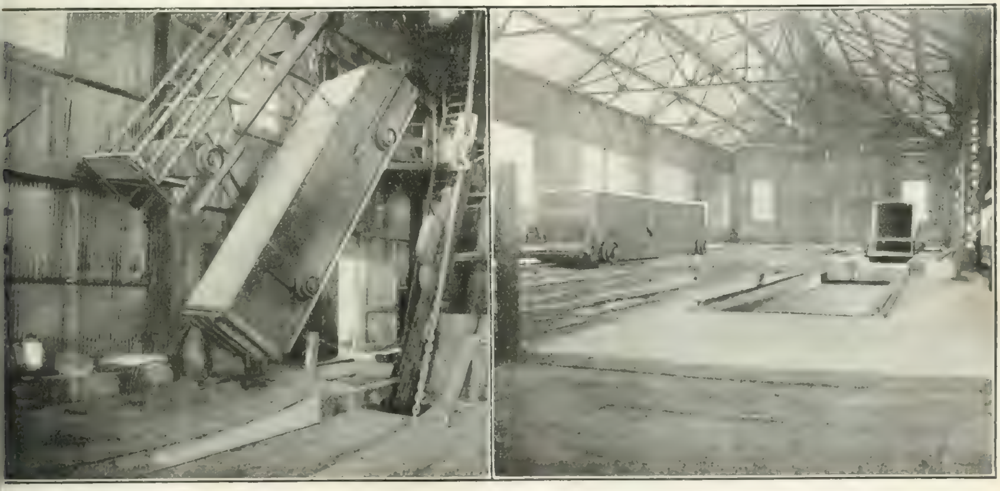
In the deep, low-grade mines of the Copper Country e hoisting problem is exceedingly important. It inlves expensive equipment and costly operations, which rm a large item in the cost of a pound of copper. It is sential that rock-hoisting operations shall be interfered th as little as possible; the ore skip is referred to as e "moneymaker," and every minute that it is idle ans lost revenue. For this reason the shafthouse must well equipped with devices intended to minimize the ne lost in dumping the skip, in substituting the skip the man-car on the hoisting rope and in similar operans.

Skip Dumping Devices

All of the skip-dumping devices used in the incline afts depend upon one general principle—that of allowg the narrow-tread front wheels to take a track which ns downward from the track followed by the broad ads of the rear wheels, thus raising the rear end of the p with respect to the front end and dumping it.

Originally the front wheels took an auxiliary track running horizontally, while the rear wheels continued on the main track, which continued the inclination of the shaft. Modifications of this simple case have been adopted which need further explanation. In Fig. 5, *A*, *B*, *C* and *D* will serve to illustrate diagrammatically the points made in this connection. With the introduction of longer skips of large capacity it was found to be an advantage to raise the rear end of the skip from the main track, as well as to allow the front end to drop away from it—that is, both sets of wheels take auxiliary tracks, one going up, the other down from the main track. This has no advantage over the first system in so far as the operation of dumping is alone concerned, but it is economical of space, since the nose of the skip does not project so far into the dump. The Copper Range Consolidated Co. has gone still farther and has adopted the Angove dump, in which the front wheels remain on the main track, while the rear wheels are lifted away from it by auxiliary rails, the rear wheels thus performing the whole operation of dumping. The Angove dump is applicable to short skips only; it also requires a roller for the nose of the skip to rest on while in a dumping position in order to prevent the skip from turning over completely.

Comparing these three types of dump from the standpoint of operation, the one illustrated in *A*, Fig. 5, is the best, since gravity aids in dumping, and the pull of the engine is less just before the skip reaches a dumping position than at any other time. The Angove dump, shown in *C*, lies at the other extreme, as the engine must exert a considerable additional pull just before the skip dumps.



Cranes at the Quincy

Storage Tracks at the North Kearsarge

Fig. 4. Devices in the Shafthouse for Changing Shaft Conveyances

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*Assistant with Allen H. Rogers, 201 Devonshire St., Bos-, Mass.

This would appear to be a serious disadvantage of the Angove method; but as a matter of fact it causes little trouble. The original dump was undoubtedly the best as far as the operation of dumping is concerned. That it is little used at present is due to the fact that it has been thought best to sacrifice its good qualities to other factors, such as the saving in space noted in the foregoing.

Because of the different products hoisted, it is necessary to have several skip dumps, and these must be placed at different points on the same inclined track. The copper-rock dump is always the highest, and some arrangement must be made to allow the skips to pass over the other dumps. The simplest way of accomplishing this is by the sliding-rail method illustrated in *D*. Sections of the steel plate which forms the skip tracks are cut and made to slide in such a way that when they are open they will not engage the narrow treads of the front wheels but allow them to take the horizontal track. The sliding sections are held in place by pins which pass through them and into the track stringer. At the Quincy mine this method has been elaborated so that the sliding sections are operated by a mechanism controlled by levers in the lander's "shanty." Thus when the underground bell signals indicate that poor rock or mass copper is to be hoisted, the lander simply pulls the proper lever, and no time is lost in changing the dump.

It will be noticed that in the case of the Angove dump, if the tailpiece of the auxiliary rail is made to swing on a pivot at *P* and raised to clear the main wheels, the main track at that point will be entirely free, just as if there were no dump there. This is an excellent feature in the Angove, as it permits a dump to be placed at any point in the main track without cutting the track stringer or otherwise affecting the track in the least.

There are other interesting and ingenious devices for accomplishing this purpose, but a discussion of them is beyond the scope of this paper.

CONVEYANCE-CHANGING METHODS

What might be referred to as the rolling stock consists, at those shafts where hoisting is carried on in balance, of two rock skips and two man-cars. Certain of the deep mines also have water skips, and in a few instances a special skip is used for the purpose of lowering timber. In the ordinary type of shafthouse it is not unusual, therefore, to have six conveyances, and four of these must at all times be stored. It is evidently important that the change from hoisting rope to storage shall be easily and expeditiously made.

Broadly speaking, two methods of storing and changing are employed, as illustrated in Fig. 4. The one most used provides storage capacity in an extension of the shafthouse, or rather what in most cases amounts to a detached building connected with the main building only by the skip tracks. In the usual two-hoisting-compartment shaft this building contains four horizontal tracks for holding the conveyances; two of these tracks are in line with the skip road in the shaft; the other two are blind tracks, one on each side of the two main tracks and parallel to them; they may be connected to the main tracks by switches, but it is more common to transfer cars from one track to another by means of a transfer car running on tracks at right angles to the others, such as is commonly used for transferring cars from one track to another in street-railway carbarns. To transfer the conveyances from the inclined-skip tracks to the horizontal tracks use made of a short piece of track curved in vertical sectio one end of it hinged where it joins the horizontal track the other end being lowered to the main skip tracks whe ever a conveyance is to be changed. In changing, the co veyance on the rope is lowered slowly over this curv section to the horizontal tracks. While the operation changing is performed partly by the hoisting engine, large amount of time is wasted in transferring the conve ances from one horizontal track to another, since at lea one of these operations must be gone through every tim a change is made. Another disadvantage is that th tracks and the conveyances stored on them are in the wa of any operations which may be carried on in the shaf house. At many mines in and near Calumet, where th skip tracks at the surface are inclined 40° or flatte this is the only method applicable, because it would n be practicable to secure in the low shafthouses the ove head clearance necessary for the crane or trolley syste It is also used at some mines of steep dip where the hois ing problem is not all important.

The other system, which is used at shafts having a stee dip and making a large output, suspends the conveyanc either on cranes swung from the heavy framing of th sides of the shafthouse or from overhead trolleys ru

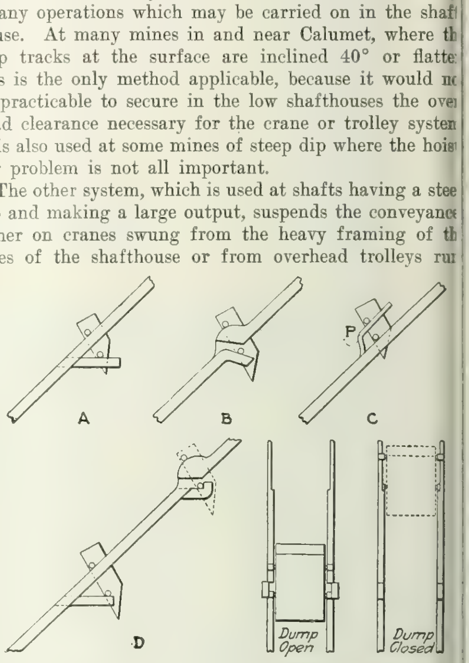

FIG. 5. TYPES OF INCLINED SKIP DUMPS

A, Ordinary dump. B, Combination dump. C, Angove dum
D, Two-point dump

ning on I-beams carried by the roof trusses. In eith case the conveyances are suspended at such a height abo the floor of the shafthouse as not to interfere with an work that may need to be done, such as handling tin ber. This is one of the advantages of the system; th other advantage is the speed with which a change ca be made.

The Copper Range and Ahmeek companies employ tro leys, but their mines have to furnish storage space f only four conveyances, as they do not use water skip Usually the I-beams, on which the trolley wheels operat run diagonally out from the shaft; but at certain of th Baltic shafthouses, where the distance between the sk tracks is in the neighborhood of 14 ft., the I-beams ru straight across the shafthouse in a line parallel to th plane of the skip tracks. In this case only two I-beam are used. One runs across the whole width of the shaf house and carries the two man-cars near its extremiti at the sides of the shafthouse; the other extends o over the skip tracks and carries the two skips between the tracks. The operation of substituting the skip for the man-car on the hoisting rope is as follows: The man-car being on the rope, the engineer raises it slightly higher than is necessary, and two hooks on chains carried by the trolley are placed in eyes on the car; the engineer then slowly lowers the car until the chains begin to take its weight, the I-beams being placed at such a distance from the shaft that when the chains carry the whole weight of the car the latter will swing clear of the track; the hoisting rope is then made fast by a special device and the clevis removed from the bail of the car; the car is pulled out of the way by means of a wire rope attached to the trolley and wound on a drum operated on the floor of the shafthouse by hand. The skip is next pulled into position over the track and the clevis is adjusted on it; the engineer hoists carefully so that the hoisting rope slowly takes the weight of the skip, which is guided by the men to hit the rails squarely; the chains are removed from the skip, and the operation is complete.

The Quincy employs cranes, and has to provide six at each shaft—two each for rock skips, water skips and man-cars. This is the only mine using the crane system, the construction of its shafthouses being such that there is not room for the trolleys that would be required to store six conveyances. The cranes have no disadvantage as against trolleys, except perhaps that all of the weight on each crane must be supported by one member of the framing, whereas the I-beam trolleys are carried by the roof trusses and the weight is distributed.

HANDLING POOR ROCK

Handling poor rock is essentially a shafthouse operation, as it has been proved inadvisable to try to sort out much waste rock in the rockhouse. It has been attempted at mines where a large amount of picking is done; but it is easier for the rockhouse men to let the poor rock go through the crusher than to pick it out, and that is what usually happens.

At some mines little poor rock is hoisted to the surface, except during the development stage; but a certain amount of it is always handled. Most of the mines have auxiliary crushing plants to crush waste rock for use about the mine, or for sale for roadmaking and other purposes; but this of course absorbs only a small part of the total amount hoisted. With the large companies it is sometimes the practice to crush all of the poor rock from a certain shaft or shafts and none of it from the others. Thus at the Red Jacket shaft of the Calumet & Hecla all poor rock hoisted is crushed; but as a rule the system is made more flexible so that only the desired amount is crushed at any shaft. The Copper Range Consolidated has a novel method for securing inexpensive crushed rock. At its mines more waste is hoisted than is usual, and provision is always made for dumping it back into old stopes through raises to the surface. The poor rock is trammed over a trestle to these raises from the bin in the shafthouse; when these trestles are of sufficient height, bins are built near their ends, about 6 ft. back from the raise, and 1½-in. grizzlies are so placed that when the waste rock is dumped it slides over the grizzly, the oversize going into the raise, the undersize into the bin, whence it is drawn off as needed. The Copper Range mines also have an excellent method of disposing of waste rock without hoisting it to the surface. The steep dip of its lode enables it to have underground poor dumps back of the shaft which deliver the rock to raises connected with old stopes. Thus at the Baltic No. 3 shaft, which is at present 20 levels deep, the poor dump is located at the 14th level.

This practice of dumping poor rock back into the mine has also been followed by the Calumet & Hecla. All waste which could not be sold as crushed rock was disposed of by hauling it in trains to a raise near Osceola No. 13 shaft, which connects with old stopes. This method will doubtless find a wider application as more of the mines get deep.

Where the surplus poor rock is not dumped back into the mine it is usually feasible to tram it to a poor dump near the shafthouse; this is an advantage when the mine is being developed, as the poor rock may always be used to good purpose in doing necessary, or at least desirable, grading. The accompanying flow sheet, Fig. 6, illustrates a typical method of handling waste at the northern end of the district. The copper-rock dumping plate is hinged along its lower edge so that when it is raised the skip discharges directly into a bin; two chutes from this bin deliver to a small tramcar, which is connected by a trestle with the poor-rock dump and to a small crusher. Waste picked out on the crusher floor, consisting of poor rock, broken pieces of timber, etc., is thrown into a chute, which when full is discharged directly into the car. The crushed-rock bin may be kept full at all times and the surplus trammed to the dump. In the later stages of mining operations it is often necessary to haul this material some distance to a suitable dumping place. To adapt this flow sheet to this contingency, it is simply necessary to substitute for the tramcar and trestle another bin alongside the crushed-rock bin which delivers to the main-line cars. Owing to different designs, it is not always possible to use the same skip dump for both copper and poor rock. In this case the poor-rock dump is lower, but otherwise the flow sheet need not be changed.

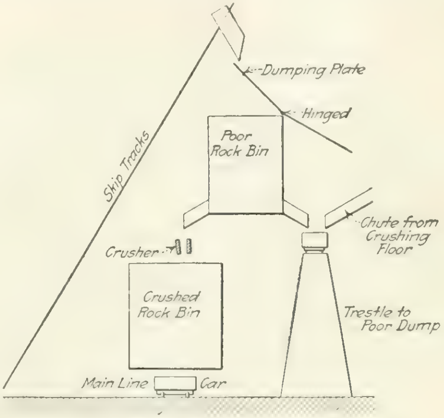

FIG. 6. FLOW SHEET FOR POOR ROCK

HANDLING TIMBER AND SUPPLIES

At some shallow mines with a firm hanging wall, of which the Wolverine may be taken as typical, little timber is used underground, but all deep mines require large quantities of it. At the mines in Calumet special timber skips are used. These are loaded in the stull yards outside of the shafthouse and transferred to the skip tracks, a small winding engine being used to pull them into the shafthouse. This method is used only where arrangements have been made for readily transferring the skip from the horizontal to the inclined tracks. Where this has not been done the timber is lowered in the regular rock skip. In this case it may be loaded on a larry in the stull yard, then wheeled into the shafthouse and "up-ended," piece by piece, into the skip; or it may be dragged to the door of the shafthouse by horses and then lifted and swung into the skip with a tackle operated by a pony engine in the shafthouse. One advantage of using the rock skip for lowering timber is that an empty timber skip does not have to be hoisted; but rock may be hoisted on the return trip, a point which may not be fully appreciated by those unacquainted with the exigencies of mining at the depth of a mile.

The only item of supplies which merits consideration is drill steel. It is the practice to place sharp steel in racks along the side of the shafthouse, which are numbered to correspond to the several levels. At the Quincy dull drills are placed in a sling underground, the sling consisting of an iron ring 5 in. in diameter, into which the drills are wedged with small wooden wedges. The full slings are thrown into the rock skip, which discharges them automatically at the mass-copper chute just above the collar of the shaft. This chute starts off at a slope of 30° and gradually changes to a horizontal platform, from which the drills are easily loaded into a wagon. At the Copper Range Consolidated mines the drill steel is sent up loose in the man cages, and is loaded directly into a steel box on a wagon in summer or on a sled in winter, each shaft having its own wagon and sled; and its box is always in place to receive the drills.

The Lander

At these mines the engine-houses are set at a distance from the shaft, sometimes as much as 500 ft. For this reason the hoisting engineer cannot see the skip when it dumps, as is the case in some mining districts, and it is customary to have a man in the shafthouse to signal the engineer when the skip has dumped. This man is called the "lander," and his services are considered necessary to the proper operation of the mine. Outside of the abovementioned duty, however, the field of the lander is varied and his functions differ widely at different mines. It is almost the universal custom for him to relay all of the underground signals, which are transmitted to him either by bell cord or electrically. At a few mines all underground signals go directly to the hoisting engineer, and in such cases there is, properly speaking, no lander, although his prime function is performed by one of the rockhouse men, who signals the engineer when the skip has dumped. The lander is usually stationed in the upper part of the shafthouse, near the copper-rock dump. At a few mines he is near the grizzly, and it is one of his duties to clean down the grizzly after each skip has dumped. At all of those mines where a hopper bin is not used to receive the rock from the skip it is necessary that he give warning to the rockhouse men of the approach of a skip, so that they may get out of the way of flying rock.

At the mines near Portage Lake it is the custom to have the lander's "shanty" near the collar of the shaft—that is, on the ground floor. The lander then attends to the lowering of timber and other supplies; changes the skips on the hoisting ropes and greases them; keeps various records of operations; has in some cases three telephones to attend to, one underground, another to the engineer and the other long distance, and is more of an official in general than is usually the case. At most of the older mines the landers are experienced and responsible men who have at some time worked underground and are acquainted with the underground end of hoisting. They are regarded as a sort of flywheel acting between the underground signals, which may be carelessly rung, and the hoisting engineer, who has troubles enough without being bothered with careless signaling.

At the Superior mine is found, it is believed, the only exception to the rule of having a man whose duty it is to ring a signal to the engineer when the skip has dumped. In its only operating shaft-rockhouse, the skip, as it passes the brace, trips a lever, which blows a whistle in the rockhouse to warn the men of its approach. The hoisting engineer simply goes by the mark on the drum to know when the skip is in a dumping position. Only rarely does it happen that the skip does not dump because of the wedging of large rocks at its mouth. In such cases the rockhouse men ring it back. When men are being lowered, one of the surface hands stands at the brace and acts as a temporary lander.

(To be continued)

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Newly Discovered Phosphate Deposit in Tennessee

By Henry V. Maxwell*

A recent discovery of phosphate rock in Johnson County, Tenn., adjacent to the Virginia line, while as yet entirely undeveloped, promises to prove of great importance and value.

By accident, as is frequently the case, Donnelly & Donnelly, attorneys, of Mountain City, Tenn., submitted to a chemist what was supposed to be zinc, but which proved to be phosphate of the very highest grade. I have just traversed the field, and find that the field test of ammonium molybdate moistened with dilute nitric acid shows the ore to exist in immense quantities, covering a wide range of territory. Taking Mountain City as a base, the ore occurs three miles east in the smaller hills of the valley proper, this ore being the result of later origin than that of the general field, and while possibly in smaller deposits than the more massive bodies, is proved by analyses to be of high commercial value. While no prospecting has been done, cropping and surface indications warrant the belief that in this alone profitable operations will result.

Eight miles southwest from this point the ore is encountered in massive stratified bodies, forming one of the layers of the southern slope of Iron Mountain, while from Mountain -City, eight miles southwest, the ore is again encountered in massive form, here forming one of the strata of Stone Mountain, the mineral presenting a face of some 30 ft., standing almost vertical, and in its northeast and southwest trend conforms to the strike of the mountain range, but is exposed in a gap through which passes one of the prongs of Roans Creek.

At this point, as shown by Keith's United States geological survey, the granite and quartzite form a contact, while at the first-named point occurs an isolated intrusion of granite, thus creating the impression that owing to unusual metamorphic action noticeable at both points the phosphorus is largely due to that cause.

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*Butler, Tenn.

In the absence of analyses of the separate bodies, no assurance is given that the larger bodies will be of high enough grade for shipment crude, but undoubtedly they will furnish almost limitless quantities of material for grinding, for use in its crude state.

In my opinion, the rock will be found for good distances along the mountain ranges and extending on into Virginia. Much interest is being taken in the field, which will soon result in determining the extent and value of the deposits as yet not analyzed.

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Norwegian Copper and Pyrites in 1914

SPECIAL CORRESPONDENCE

The total pyrites production for 1914 in Norway was about 430,000 tons, which was taken from the Sulitelma, Stordoe, Bossmo, Foldal, Roestvangen and Röros mines. Of this amount 358,114 tons was exported, or about 70,000 tons less than during 1913. For home consumption about 60,000 tons was reserved, and 42,852 tons of purple ore was exported. The total amount of metallic copper produced in the country in 1914 was 2867 tons, and if the copper content of the pyrites shipped to Sweden, Germany, England and other countries be included, the copper total would be about 11,000 tons—about 1% of the world's output. The total value of the copper and pyrites at Norwegian ports was about 14,000,000 kroner ($3,752,000). Professor Vogt estimates that the Norwegian pyrites exported is about one-tenth of the total of European shipments. He also estimates the German annual production of copper from Norwegian ores in normal times at 25,500 tons, and that of Austria at 3850 tons.

The total number of men employed in the cupriferous mines in Norway during 1914 was 4250. The profits of the Swedish Sulitelma Aktiebolag for 1914 amounted to 1,638,000 kroner ($438,984), and a dividend of 7% was declared, after 30% had been written off. Owing, however, to this company's large holding in the Swedish Helsingborg copper-extraction works, where the Sulitelma purple ores are dealt with, the actual profits of the company are much higher. In 1913 the net profit of the Helsingborg Kopparverket was 1,132,000 kroner ($303,376), of which only 450,000 kroner ($120,600) was shown on the books as for Sulitelma account; but as Sulitelma owns nearly the whole of the shares the actual net earnings of the Sulitelma company in 1913 was 2,320,000 kroner ($621,760) or 32% of the share capital. Of purple ore 80,000 tons was exported to Helsingborg; of pyrites 125,610 tons was shipped, as against 125,014 tons in 1913; of Elmore concentrates, 13,376 tons, as against 11,472 tons in 1913; and of bessemer copper 1173 tons, as against 1385 tons in the previous year.

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Skinner's Mining Manual and Year Book

The first line of the notice of W. R. Skinner's Mining Manual and Year Book which appeared in the JOURNAL of May 15, 1915, p. 870, should have read "for 1915," instead of "for 1914." Elsewhere the book was correctly designated.

The Porphyry Coppers

BY PERCY E. BARBOUR

In the JOURNAL of July 15, 1911, was published a table of the porphyry coppers similar to Table 1 published herewith. At that time the total tonnage of developed and partly developed ore by these large porphyry companies totaled 417 million tons. At this time, four years later, the present table shows this figure to be 1125 million tons. This table, however, includes the Braden and the Chile Copper, both of South America, which were not included in the previous estimate. Deducting these reserves, amounting respectively to 78 million and 303 million, leaves nearly 800 million tons, which is almost double the ore reserves of the companies as given in the table published four years ago. This statement is only approximate, as will be seen by glancing at the table, but is close enough to furnish some very interesting food for thought, viz., that despite the enormous production of the last four years, the ore reserves of these copper mines in this country alone have been practically doubled.

TABLE 1. ORE RESERVES

	Tonnage Developed and Partly Developed	Copper Tenor of Reserves, %	Date of Estimate	Total Copper Contents, Tons	Total Copper Recoverable at 70% Extraction	Nominal Mill Capacity, Tons per Day
Utah Copper	342,500,000	1.45	12/31/14	4,966,250	3,476,375	21,500
Nevada Con.	41,020,296	1.68	12/31/14	689,141	482,399	9,500
Chino	90,270,000	1.75	12/31/14	1,579,725	1,105,808	6,300
Ray Con	74,765,789	2.214	12/31/14	1,655,315	1,158,721	6,650
Consolidated Copper Mines *a*	21,624,236	1.153	4/30/14	249,327	174,529	None
Miami	36,500,000*e*	1.85	3/19/15	675,250	472,675	4,200
Inspiration *b*.	**97,143,000**	**1.63**	**12/31/14**	**1,583,430**	**1,266,745*d***	**7,500*c***
New Cornelia (C. & A.)...	40,258,000*g*	1.51		607,896	425,527	4,000*h*
Braden *f*.	78,000,000	2.5	1/31/14	1,950,000	1,365,000	4,500
Chile	303,303,000	2.0	6/1/15	6,066,060	4,246,242	10,000*i*
Totals....	**1,125,384,321**	**1.779**		**20,022,394**	**14,174,021**	**74,150**

a Includes Giroux. *b* Includes New Keystone and Live Oak. *c*. To be increased to 15,000 tons by end of 1915. *d* Figured at 80%, extraction as indicated by company's experimental flotation mill. *e* Does not include 6,000,000 tons 2% oxidized ores for which treatment has not yet been worked out. *f* It is expected that an official report to be issued at an early date will show reserves to be 110,000,000 tons with copper tenor slightly above 2.5%. *g* Of this total, 11,954,400 tons carbonate ores average 1.54% and 28,303,600 tons sulphide ores average 1.50% copper. *h* Mill being designed. Treatment worked out. *i*. First unit being tuned up, construction of another 10,000-ton unit in hand.

The ore reserves and their copper tenor are all taken from the annual reports of the various companies except the Braden and the Chile, which figures are from personal communications.

The total tonnage of developed and partly developed ore is 1,125,384,321 tons and contains 20,022,394 tons of copper, which makes the average copper content 1.779 per cent. Estimating an average mill recovery of 70% of the copper available, gives a total of 14,015,675 tons of recoverable copper. By referring to Table 2, it will be seen that the five large porphyry copper mills in this country at the present time are obtaining from 66.04 to 69.93% recovery. These recoveries are all made on wet concentration. The 7500-ton Inspiration mill is about to begin operation using oil flotation, and it is the expectation to obtain at least 80% extraction. A large leaching plant is being designed for the New Cornelia, which is expected to show a better recovery than is now being obtained by wet concentration, and the same is true, as to expectations, of the Chile Copper leaching plant, which is just now being tuned up. So that, assuming a total average recovery of 70%, although higher than the actual recovery in the five mills operating today, is not an unreasonable or unconservative estimate.

The total mill capacity today, either operating or building, is 74,150 tons daily. At this rate of production, the stated ore reserves would last about 42 years. Of this milling capacity, the Inspiration, New Cornelia and Chile are not yet producing, and they comprise one-third of the total. This means that when these three new mills are in operation, they will increase our copper production 50% over what it is now. It is true that the Chile Copper is in South America, but it is an American corporation, and its production will be handled through American channels. These figures do not take into account the fact that the Chile expects to duplicate its 10,000-ton plant at an early date. With this total milling capacity of 71,150 tons per day, turning out copper, the total annual production resulting will be 675 million pounds of copper from these sources alone, compared to our total production in 1914, which amounted to 1135 million pounds, of which more than 800 million pounds came from other copper-producers than these mentioned in this table.

Table 2 gives operating figures compiled from the annual reports of the companies named, for the year 1914.

TABLE 2. MILLING RESULTS

	Utah Copper	Ray Con.	Chino Copper	Nevada Con.	Miami Copp r
Tons ore handled in 1914	6,470,166	2,429,330	1,907,300	2,640,294	1,096,633
Gross pounds copper produced........	121,779,401	59,044,700	56,841,977	....	35,048,445
Net pounds copper produced after smelter and other deductions......	115,690,445	57,004,281	53,999,928	49,244,056	
Ratio of concentration	19.33	16.11	12.89	6.05	17.2
Mill recovery, %	66.04	67.88	67.858	68.48	69.93
Milling cost, cts per ton.......	35.36	49.88	55.01	52.30	49.96
Total net cost, cts. per lb....	7.245	8.763	7.35	8.91	9.20

Owing to the derangement of the copper situation because of the war, these mills did not run at capacity, so that it may properly be expected that these nominal capacity figures will be exceeded for the current year.

The Ohio Copper, which was included in the table published four years ago, is omitted in the present instance because of the fact that the Ohio is tied up in litigation, which, in addition to its unfortunate operating career, makes futile any estimate of when it will again be a factor in copper production*; and its affairs are in such shape that only an unsatisfactory statement of ore reserves and the copper tenor can be obtained. It is probable that the Ohio has something over 10 million tons of ore that will average between 1.0 and 1.5% copper.

*

The Price of Gasoline

A recent Chicago news dispatch is authority for the statement that the Standard Oil Co. has been caught red-handed in the act of not charging enough for its wares, says the New York *Sun*, which then continues as follows:

> In the Western states, where gasoline is a vital factor in so many farm and village operations, pumping, sawing wood and all the other many uses to which the gasoline engine can be put, to say nothing of vast consumption in the thousands of automobiles in use among farmers and even red Indians, the Standard company has been steadily squeezing down the price until this modern elixir of rural life is now selling at 9½c per gal.
>
> Independent dealers either cannot or will not meet these figures, and they are going to "have the law on" the octopus about it. One independent is quoted as saying that every attorney-general in the Western states will be appealed to. The strong arm of state law is to be invoked to compel the Standard Oil Co. of Indiana to raise its price for gasoline. Failing in that quarter, there is to be a move on Washington. The national Department of Justice is to be put in motion. It is proposed to ascertain definitely, once for all, whether the purchasing public is to be deprived of the privilege of paying more for the gasoline it uses than producers ask for it.
>
> On its face there would seem to be a pretty good chance of the octopus having for once some degree of public sentiment on its side of a controversy. If gasoline were the plutocrat's luxury instead of the poor man's necessity the matter might assume another complexion. Forcing malefactors of great wealth to pay a tax to support possible competitive inefficiency or incompetence in the production of a given article is one thing. Levying for that purpose a tax that hits nearly everybody is quite another. The plain people's sympathy with the tribulations of an octopus competitor is very likely to become purely academic at precisely the point where removal of such tribulations begins to rap the plain people's pocketbook.
>
> The tendency to a callous indifference to their right to pay more than they have to for things has been manifested on every occasion when the question was brought up. It was strongly in evidence when this same gasoline issue was raised against the Standard Oil Co. in New Jersey. Although the octopus triumphed in that case the Jersey masses have gone right on paying their 9 and 10c. per gal., instead of 15, 16, or 18, without so much as a murmur of protest. If the iron heel of the oppressor is on their necks even elementary regard for veracity compels the admission that they seem to like it.

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Production of Mica in 1914

There was a marked decline both in the production and in the importation of mica in the United States in 1914. According to Douglas B. Sterrett, of the U. S. Geological Survey, the value of the mica produced in the United States in 1914 was $328,746, a decrease of $107,314 from 1913. The production came from 13 states. The output of sheet mica amounted to 556,933 lb., valued at $277,330, as compared with 1,700,677 lb., valued at $353,517 in 1913; and the production of scrap mica in 1914 amounted to 3730 short tons valued at $51,416, as compared with 5322 short tons valued at $82,543 in 1913. The output of sheet mica in 1914 fell considerably below the average for the preceding four years, but the production of scrap mica compared more favorably with the average production during these years. There was also a decline in imports of unmanufactured and trimmed sheet mica in the United States, the value for 1914 being $625,396, as compared with $943,018 in 1913. Sheet mica is principally used as insulation in the manufacture of electrical machinery and for glazing in stove doors and gas-lamp chimneys. Ground mica is extensively used in certain wall papers, in tar-roofing paper, and in concrete facing to give a natural-rock finish.

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Silver King Consolidated

For the year ended Feb. 1, 1915, the Silver King Consolidated Mining Co. of Utah, Park City, Utah, shows a profit of $76,645 and dividend payments aggregating $251,032 for the year, thereby decreasing quick assets $174,387 during the year. The total receipts for the year were $413,025 and the expenditures $336,380. The ore statement shows that 9987 dry tons of ore were sold, containing 503,784 oz. of silver, 513,763 oz. of gold, 5,593,786 lb. of lead and 257,912 lb. of copper. This ore was sold for $346,990 at the mine, which represents a net price after paying freights, smelting charges, smelting losses and selling charges. The average price received per ton was $37.74. Total dividends to date amount to $559,923. Development work to the amount of 10,127 ft. was performed. According to the report of the consulting engineer, the mine is well equipped and has a good ore reserve developed.

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*Since this was written the General Exploration Co. has been incorporated, has assumed a lease of all the Ohio property and promises early resumption of operations.

Structure of the Cuyuna Iron-Ore District of Minnesota

By Charles A. Cheney, Jr.*

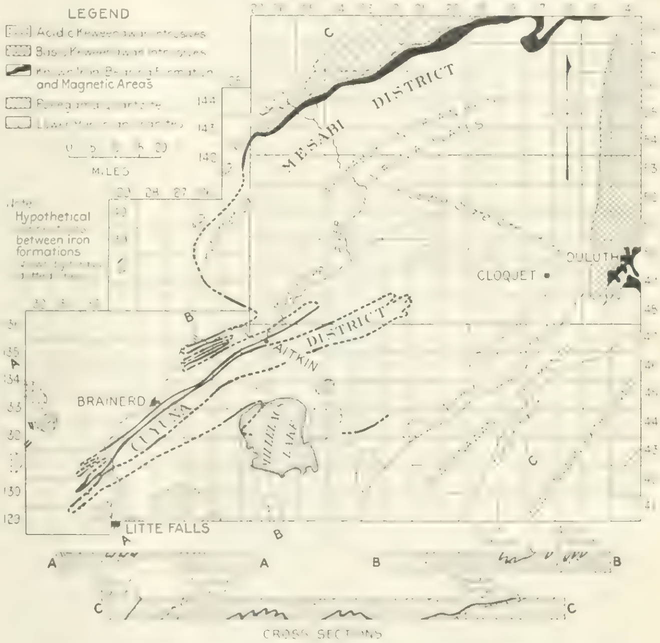
SYNOPSIS—Working out of the structural geology of the Cuyuna Range connecting it with the Mesabi and Gogebic. Effect of chemical composition and preëxisting topography on location of ore bodies. Bearing of quartzite, slate and schist members in various ranges correlated and the presence of greenalite in Mesabi and its absence in Cuyuna discussed.

Since the discovery of the Cuyuna iron-ore district in 1903 it has been considered as a connecting link between the Mesabi district of Minnesota and the Penokee-Gogebic district of Michigan and Wisconsin. The exact structural relations of the Cuyuna district to the other two districts, have not, however, been determined. This has been due to the lack of rock outcrops and to the fact that development work has not yet been extensive enough in the Cuyuna district from a geological standpoint.

In view of the fact that many years may elapse before the structure of the Cuyuna district becomes known with any degree of certainty, the writer has endeavored to indicate on the accompanying map one plausible solution of the structure and the possible relations of that district to the Mesabi district. Iron-bearing formation may be absent in a large part of the area where its trace is indicated on the map as a guide to the structure, but its absence may be explained by the fact that it may have "lensed out" or that it may have been obliterated by the differential movement between the beds above and below.

The magnetic lines in northern Cass County have been considered by many as indicative of the presence there of the Biwabik formation of the Mesabi district thrown to the north by faulting or folding, but the results of private work to the north and east seem to indicate clearly that these magnetic lines are caused by a formation of Keewatin age. Furthermore, the sharp southward trend of the Biwabik formation of the western Mesabi district is indicative of a connection of this formation with the iron-bearing formation of the Cuyuna district.

Therefore it seems logical to assume that the iron formation reported in township 138 range 26, township 137 range 26, and the iron-bearing formation in township 137 range 25 are portions of the fold connecting the north range of the Cuyuna and the western Mesabi.



Map Showing Probable Structure of Cuyuna District and Relation to the Mesabi District

Folding of the Cuyuna District

The folding of the Cuyuna district [illegible] both the general Keweenawan folding of the whole Lake Superior region and more locally the intrusion of Keweenawan igneous rocks to the south of the district. Since the main axis of the Lake Superior syncline is southeast of the district and since the main intrusive mass is to the south it follows that by far the greater thrust which caused the deformation of the district was from the southeast. This has resulted in the formation of a series of roughly parallel folds with axes striking about N55E. The folding on the south range of the Cuyuna differs from the north range folding, however, for reasons which will appear.

The present location of the Biwabik formation of the Mesabi district is probably due to the fact that the large mass of Lower Huronian granites constituting the Giant's Range was not covered by the Upper Huronian sea, and formed to the south a shore line. It is plausible therefore to assume that the location of a gently curving formation extending from the western Mesabi to township 137 range 25 may be due to the presence in this region of Lower Huronian granites below and to the west. The presence of Lower Huronian granites in township [illegible] range 25 and in township 140 range 26 [illegible] are significant.

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*Geologist, Madison, Wis.

Furthermore, the protecting presence of such a mass or core must have been necessary to save this portion of the Upper Huronian from the general close northeast and southwest folding of the rocks of the Cuyuna district proper.

Against this granite mass the formations of the north range of the Cuyuna district were crumpled in a series of close-repeated folds pitching toward the northeast.

On the other hand, the formations of the south range were subjected to a largely dominant thrust from the southeast without the tension to the northeast, which acted as a drag in the north range folding. Moreover, the rocks of the south range were relatively much freer from compression from the northwest. For this reason the folds of the south range formation are more open and gentle and of very low pitch. It follows that pitching-drag folds are relatively unimportant in the iron-bearing formation of the south range.

On the north range, drag folding has probably been the principal factor in determining the locations of the orebodies. This is evidenced by the relatively great depth of concentration of some orebodies; by the fact that linear dimensions are not so great in proportion to width as on the south range; by the brecciated character of the ores; by the areal distribution of the orebodies; and by the fact that the orebodies are often concentrations within the iron-bearing formation, namely, bounded by iron-bearing formation rather than slate.

EFFECT OF CHEMICAL COMPOSITION AND ANCIENT TOPOGRAPHY

On the south range the original chemical composition, the degree of metamorphism and the effects of a preëxisting topography have probably been the principal factors governing the locations of the orebodies, and not pitching-drag folds. There is much evidence to support the former theory. The orebodies are apparently all relatively shallow; they all possess distinctly linear characteristics; the formation is not brecciated to a large degree; the orebodies are in general clearly defined concentrations between slate walls; and the barren areas are generally areas of amphibole-magnetite rock rather than ferruginous cherts. Broken and relatively offset magnetic lines have been considered as indicating the locations of drag folds, although the best orebodies of the south range have not been found in such places, but rather where the presence of the iron-bearing formation is indicated by a continuous, unbroken magnetic line.

THE QUARTZITE MEMBER

Objection may be made to placing the iron-bearing formation of the Cuyuna district at the same horizon as the Biwabik formation on the ground that an underlying quartzite formation has not been traced in the Cuyuna district. As a matter of fact, quartzite has been penetrated by drills at several places on the north range along the outlines of the folds as shown. Furthermore, exploration work has been localized along magnetic lines, and this has tended to prevent the discovery of a quartzite member, if it were present throughout the district.

If the quartzite is present in the district, the slates underlying the iron formation may be considered as having been deposited during the time the lower portion of the Biwabik formation of the Mesabi was being deposited. Furthermore it is unnecessary to assume an erosion interval such as is represented by the thin conglomerate at the base of the Biwabik formation of the Mesabi. It is extremely unlikely that conditions of deposition should have been the same contemporaneously over such a large area. In this connection it may also be noted that the Biwabik formation is characteristically interstratified with slates at certain horizons, and that these slates are chemically and texturally similar to the Virginia slates.

SLATES AND SCHISTS

If the quartzite member is absent in the Cuyuna district, the slates underlying the iron-bearing formation may be considered as the equivalents of the Pokegama quartzite. It is not unreasonable to assume that the quartzite of the Mesabi district may grade into slates along the strike.

Furthermore, the absence of slates and schists of Lower Huronian age in the Cuyuna district has not been proved. The Morrison County schists in the vicinity of Little Falls have been correlated with the Upper Huronian slates of the Cloquet-Carlton area largely because of the presence of carbonate nodules in both and because of an apparent geographic continuity. The latter factor can be as well explained, perhaps better, by considering the Morrison County schists as of Lower Huronian age. The fact that these schists are metamorphosed to such an extent that their sedimentary characteristics are practically obliterated is further evidence that they may be of Lower Huronian age. Spurr so correlated these schists.

In view of these facts it may be that the cores of anticlines in the Cuyuna district are largely composed of Lower Huronian slates and schists.

It may be argued that the Cuyuna iron-bearing formation is not an extension of the Biwabik formation, but lies at a higher horizon, namely, that the Cuyuna iron-bearing formation consists of lenses of iron formation within the Virginia slates. If this is the case it is remarkable that traces of a formation which might then be correlated with the Biwabik formation have not been found outlying the Cuyuna formation, and also that to the south of the Biwabik formation of the Mesabi range and hence at higher horizon, no evidences have been found of the existence of an iron-bearing formation which might be correlated with the Cuyuna.

In this connection the log of a deep diamond-drill hole sunk in section 30, T58N—R15W may be of interest. This hole* was located approximately four miles south of the south edge of the Biwabik formation and therefore penetrated a great thickness of the Virginia slates. The formations passed through were as follows: Glacial drift, 183 ft.; black slate (the Virginia slate), 1974 ft.; taconite (the iron-bearing formation), 569 ft.; quartzite, 19 ft.

PRESENCE OF GREENALITE

It is noticeable that in the entire distance sunk in the slate no lenses of iron-bearing formation were encountered, or if so, no mention is made of the fact. The fact that no evidence of the existence of greenalite has been found in the rocks of the Cuyuna iron-bearing formation has also been cited as indicating that this formation is, stratigraphically, distinct from the Biwabik formation.

In Monograph LII of the U. S. Geological Survey, "The Geology of the Lake Superior Region," p. 516, the following statement is made: "In general the parts of the iron-bearing formations originally consisting of carbonate seem to be related to the indirect contribution from the igneous rocks through the agencies of weathering, and the parts of the iron-bearing formations originally consisting of greenalite, or iron silicate, seem to have been contributed in the main directly to the waters without intervening atmospheric or organic agencies. The locally close association of these two types of the original iron-bearing rocks indicates the close association of direct and indirect methods of contribution of iron-bearing materials."

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*"Deep Diamond-Drill Hole with Light Equipment." By P. W. Donovan, "Eng. & Min. Journ.," Mar. 28, 1914.

Whether, in a given case, greenalite or iron carbonate would be precipitated may also be dependent on the relative amounts of carbon dioxide present. An abundance of carbon dioxide would result in the ultimate precipitation of the carbonate. Therefore the fact of the presence of greenalite in the Biwabik formation of the Mesabi district and its apparent absence in the Cuyuna iron-bearing formation may merely indicate a difference in conditions of contemporaneous deposition of the same formation.

Centrifugal Mine Pumps on the Rand*

On account of the high cost of pumping at the Durban Roodepoort Deep, where it was necessary to handle 10,000,000 gal. of water per month against a total head of 2490 ft., Sulzer centrifugal pumps were installed with interesting and gratifying results.

Operations are through a five-compartment compound shaft, the depth of the vertical part being 1586 ft. and the length of the incline part being 1174 ft. The water column is of Mannesman solid-drawn pipe 8 in. diameter throughout, with wood lining 1 in. thick, thus making the effective diameter 6 in. The thickness of the piping is 7 mm. in the lower half of the shaft and 6 mm. in the upper half, where the pressure is less. The guaranteed factor of safety on the material of the piping is not less than 3.75. Piping was in standard lengths of 21 ft., and the pipe-joints used were the double-border type shown in Fig. 1.

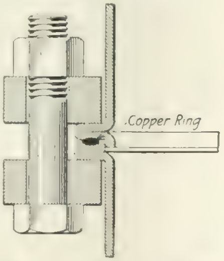

FIG. 1. DETAIL OF JOINT IN WATER COLUMN

At every 500 ft. in the shaft the piping was carried on two channel-bearers hitched into the foot and hanging wall. Cast-steel pipe supports, shown in Fig. 2, were inserted in the pipe-line and bolted to the channels, thus insuring that the weight of the pipe was not carried in any way by the timbering of the shaft. Between these main supports, light steel joists every 90 ft. were hitched into the shaft, and the pipe clamped to them with wrought-iron straps.

OBJECTIONS TO CENTRIFUGAL PUMPS

One of the principal objections to the use of centrifugal pumps on the part of the company had been the difficulty previously experienced in handling gritty and dirty water. In order to provide clear water for these pumps, a system of sumps was provided so that the water ran first into a settling sump, then overflowed through an overflow launder into the main sump and overflowed this again into a suction sump, from which the pump took its supply.

In addition to the water column being wood-lined to make it acid-resisting, the water is neutralized with carbonate of soda at a cost of approximately 5.2c. per 1000 gal. pumped. A log book is used in the pump station in which hourly records are kept of the [illegible] of the water and of the percentage acidity. The result of this systematic attention has been that the water which the pumps are handling is practically free from solids and free from acid. The sludge which is cleaned from the settling sump periodically is dewatered by being put through a filter press, after which it is a clean product for handling and goes to the regular underground and surface bins and chutes.

PUMPING AND MAINTENANCE COSTS

The net cost of pumping for a period of 12 months is at the rate of 64.6c. per 1000 gal.; the pumping cost with the old plant was $1.012 per 1000 gal. These figures do not show the actual cost of centrifugal pumping, because in the first case there were some of the old pumps used in connection with the new centrifugal units, but they show the saving by using the two centrifugal units. The pumping costs are interesting further, as it is not common to find costs per gallon given. A complete record of costs of maintenance and repairs was kept for a period of 12 months, during which time 111,650,000 gal. of water was pumped. The total cost for this period amounts to only 0.77c. per 1000 gal. Sixty days after the pumping plant was put in operation a test was made to ascertain if the efficiency was equal to that guaranteed by the manufacturers. A year later another test was made to determine how much the efficiency had fallen off during the period. The two pumping units gave such close results that the figures given in the table are the average for the two pumping units:

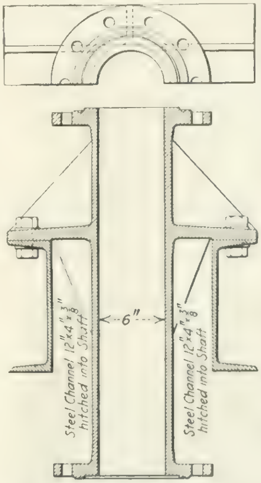
6"
Steel Channel 12"×4"×5/8" hitched into Shaft
Steel Channel 12"×4"×5/8" hitched into Shaft

FIG. 2. STEEL SUPPORTING SECTION IN WATER COLUMN

RESULTS OF TWO PUMP TESTS

	Guaranteed Figures	First Tests	Second Tests
Head in feet	2490	2520	2549
Gallons per minute	375	449	406.5
Input hp into motors (integrating watt-meter readings ÷ time)	....	[illegible]	528.5
Hp input into pumps, based on 92% motor efficiency	...	[illegible]	[illegible]
Average efficiency of pump	62	[illegible]	[illegible]
Overall efficiency of pump and motor	57	[illegible]	[illegible]

Of course, the principal point in the table is the over-all efficiency of the pumping unit, which was 59.8% when installed and which was 2.8% greater than the guarantee. After a year's operation, the efficiency of the unit was 58.3%, showing a loss during the year of 1.5%, but still showing an over-all efficiency of 1.3% more than the original guarantee. This speaks well for both the efficiency of the operation and the excellence of the construction, allowing of course due credit for the care given by the mine management to provide water which is free from grit, dirt and acid.

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*Abstract of paper by E. G. Izod (member) and A. P. Rouillard, in the "Journal" of the South African Institution of Engineers, January, 1915.

Cost of Pumping 1000 Gal.

Careful records were kept of actual metered units into the pump and the water quantities delivered at the collar of the shaft during a period of seven months; these records show that the cost of power was 0.642c. per 1000 gal. per 100-ft. lift. An independent test to determine this same factor checked these results, and they are also confirmed by results obtained at the Crown mine using similar pumps.

At the Knights Deep, using reciprocating pumps and pumping 14,000,000 gal. per month against a head of 2150 ft., under conditions similar to the duty required of the centrifugal pumps described, the net cost of pumping was 0.578c. per 1000 gal. per 100-ft. lift. This shows a saving in power cost of 10.8% in favor of the reciprocating pump, but the mine management contends that the saving in maintenance of the centrifugal pumps fully compensates for this increased cost of power.

Reasons for Choosing Centrifugals

The particular reasons which induced this mine to install centrifugal pumps were as follows:

1. Initial Cost.—The complete cost of the centrifugal pumping plant, including motor, starter, bed-plate, etc., delivered, was approximately 60% of the cost of a reciprocating plant with a similar capacity, 800 gal. per min. against 2500-ft. head. For a 2000-gal. per min. plant against 2250-ft. head, the centrifugal pumping equipment would have cost only 40% of the reciprocating equipment.

2. Weight of Plant.—The centrifugal equipment weighs approximately 70 lb. per gal. of water pumped per min. A reciprocating equipment would have weighed approximately 350 lb. per gal. per min.

3. Reliability.—This was an unknown figure when the pumps were installed, but it was the opinion of the engineers that the figures would be in favor of the centrifugal, and the results of the year's run have confirmed this opinion, as there has been no trouble of any sort experienced with the pump.

4. Cost of Maintenance.—This also was an unknown figure, but the maintenance costs for the period of operation have proved a big item in favor of using centrifugal pumps and have justified the judgment in their installation.

5. Cost of Excavations for Pump Chamber. The larger the quantity of water to be handled, the bigger is the proportional saving by using centrifugal pumps. The excavation of rock for the pumping equipment in this particular instance was 8000 cu.ft., while a reciprocating equipment of similar capacity would have required 55,000 cu.ft. of excavation. For a 2000-gal. per min. plant the excavation for a centrifugal equipment would be approximately only 10% of the cost of excavation for a reciprocating equipment. The following interesting table shows these figures as compiled and calculated from several makers' drawings for the reciprocating pumps, from which were selected those pumps which occupy the smallest space for their capacity.

COMPARATIVE SIZES AND COSTS OF PUMP CHAMBERS

	—Centrifugal Pumps—		—Reciprocating Pumps—	
Capacity of Plant, Gal. per Min.	Cubic Feet of Excavations	Total Cost of Chamber at 12c. per Cu.Ft.	Cubic Feet of Excavations	Total Cost of Chamber at 12c. per Cu.Ft.
800	8,000	$1,000	55,000	$6,875
2,000	13,000	1,625	130,000	16,000

Other Advantageous Features

In addition to what has already been said, the results of a year's experience with this particular plant have impressed upon the management the merit of centrifugal pumps for high lift, in the simplicity of repairs and replacement, smoothness of running and minimum of attention required during operation.

Anaconda Enters Chile

There has been much speculation for a long time past among mining men as to the identity of the interests controlling the Andes Exploration Co., which for a good many months has been carrying on not only exploration work, but also actual developments on properties situated in Chile, under the direction of William Braden and a staff of engineers. Mr. Braden, who is a well-known mining and metallurgical engineer, was the discoverer and developer of the property now owned by the Braden Copper Co.

It is stated upon reliable authority that the Andes Exploration Co. is controlled by the Anaconda Copper Mining Co. This report is of more than passing interest, inasmuch as it will be the first time that the Anaconda Co. has actively engaged in mining operations outside the United States. If it succeeds in developing suitable properties, this should mean much to South America, for the Anaconda company is especially well equipped to bring to a successful outcome any undertaking, no matter how great. It is stated that the investigations which are being conducted by the Andes Exploration Co. are not confined to copper mines alone, but that its engineers are also very active in the tin fields of Bolivia, not looking toward the purchase of developed tin mines, but rather toward the development of promising prospects on its own account.

We understand that a copper deposit near Portrerillos that is being extensively drilled gives promise of becoming a large mine that will be profitably worked. Portrerillos is about 50 miles southeast from Pueblo Hondido in northern Chile. A railway connects Pueblo Hondido with the port of Chañaral.

Portugal Prohibits Tin Exports

A decree has been issued prohibiting the exportation and reëxportation of tin from Portugal to foreign countries, according to the *Iron and Coal Trades Review*. The decree also prohibits the transit and transshipment of the metal (when intended for foreign countries) if the consignments are described in the manifests or bills of lading as being "to order," or if there is no clear indication entered on the documents at the place of shipment as to the name of the consignee and the destination of the goods.

* * *

Asbestos Production of the United States in 1914 was 1247 tons, an increase of 13% over 1913

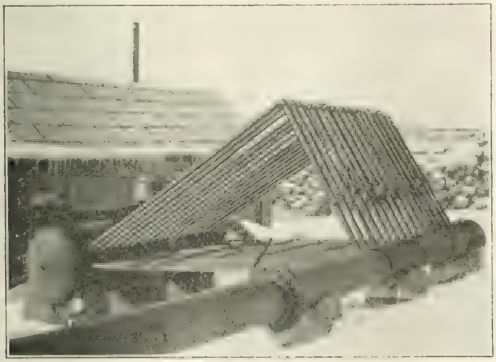
Details of Practical Mining

Novel After-Cooler for the Compressor Plant

By F. H. Armstrong*

Because of the trouble from rock drills freezing underground, it was decided to install an after-cooler ahead of the air receiver of the compressor plant. As it was a nuisance to pipe water to the cooler and maintain it in winter weather, an air-cooled after-cooler was thought advisable.

The discharge from two 3100-ft. compressors for about 300 ft. was made from some old Cornish-pump columns 17 in. in diameter. The end of this line was blanked, and thirty 3-in. pipes connected from it to the receiver, as shown in the accompanying illustration.



After-Cooler for Compressor Plant

The cooling is perfect when only one compressor is running, but not quite so good as is desired when both compressors are in use. During a snowstorm, when only one machine is running, there is snow on the discharge pipes leading from the receiver to the mine, while the 17-in. line is steaming.

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How to Prolong the Life of Steam-Shovel Hoisting Chains

A very severe and apparently unavoidable wear on the outside of links on steam-shovel chains takes place when the second wrap of chain starts winding on the drum. The chain climbs on the under wrap and in slipping down to a bearing causes a tearing action, which wears the chain on the outside of the links, while the ends show but little wear. If the following simple method is adopted it will greatly relieve this condition:

Attach with a "missing link" a piece of old chain long enough to make 1½ wraps around the drum. After the chain has been in use a sufficient time to show considerable wear on the outside of the links where the second wrap begins, remove the old piece of chain and attach the end of hoisting chain to the drum. This will bring the wearing faces on new sections, which are [illegible], and double the life of the links at this point.

This method is suggested by the Columbus Chain Co., according to the *Excavating Engineer,* but holds good, of course, for any make of chain.

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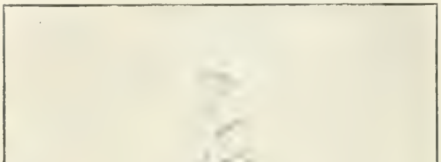
A Steel Diamond-Drill Derrick

The accompanying illustration shows a steel derrick over a diamond drill, belonging to the Cleveland-Cliffs Iron Co., at work in the heart of the City of Negaunee on the Marquette range, Michigan. The frame is 60 ft. in height and permits the use of 50-ft. drill rods; while the wooden tripods, which are generally in use, can handle only 30-ft. rods. It is built entirely of light steel angle-iron and is so constructed that it can be easily moved. It is the only steel derrick of its kind in the Lake Superior district and was constructed by the Sullivan Machinery Co., of Chicago. The [illegible] almost 3000 ft. deep. A hole put down in the same vicinity a few years ago disclosed a considerable [illegible] of ore.



A Steel Diamond-Drill Derrick

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*Mechanical engineer, Vulcan, Mich.

Efficiency of Air Compressors and the Measurement of Air Flow[*]

Some foreign compressor builders have been converted from the common practice of stating the output of their compressors on calculation based on piston displacement and indicator-card diagrams to the more accurate method based on actually measuring the output by direct means. This ought to be adopted by all air-compressor manufacturers. The difference shown by the two methods, as the result of tests in one instance, was that the measured efficiencies were about 10% below those guaranteed by the manufacturers, which were based on calculation. The guarantee for large compressors was 68.8% at full load, while the figure on actual test was only 58.8%. The larger part of the difference was stated to be due to the method of estimating the output of the air by calculation as against direct measurement. The volume of free air at atmospheric pressure delivered by reciprocating compressors is generally not more than 88.5% of the piston displacement, and is often less. Calculations from indicator cards generally show 92 to 95%.

By inserting a sharp-edged orifice-plate in a straight length of the delivery pipe, and by making the diameter of the orifice about three-quarters of the diameter of the pipe, the pipe diameter being chosen so that the difference in pressure across the orifice is equivalent to about 24 in. of water, very reliable results are obtained by the following formula:

$$W = 0.735\, a \left(\sqrt{\frac{2g}{R}}\right)\left(\sqrt{\frac{Ph}{T}}\right), \text{ where}$$

W = pounds of air flowing per second.

a = area of orifice in sq.in.

g = acceleration due to gravity (ft. per sec. 32.11).

R = gas constant for air. This is calculated according to the relative effects of the constant for dry air and the constant for steam gas in the proportion which the weight per cu.ft. of dry air bears to the weight per cu.ft. of aqueous vapor in the air entering the compressor. The constant for dry air is taken as 53.22, and the constant for steam gas as 85.6.

P = pressure on the downstream side of the orifice in lb. per sq.in., absolute.

h = difference of pressure between the two sides of the orifice in lb. per sq.in. (as shown by manometer).

T = absolute temperature of the air on the upstream side of the orifice = 460.7 + deg. F.

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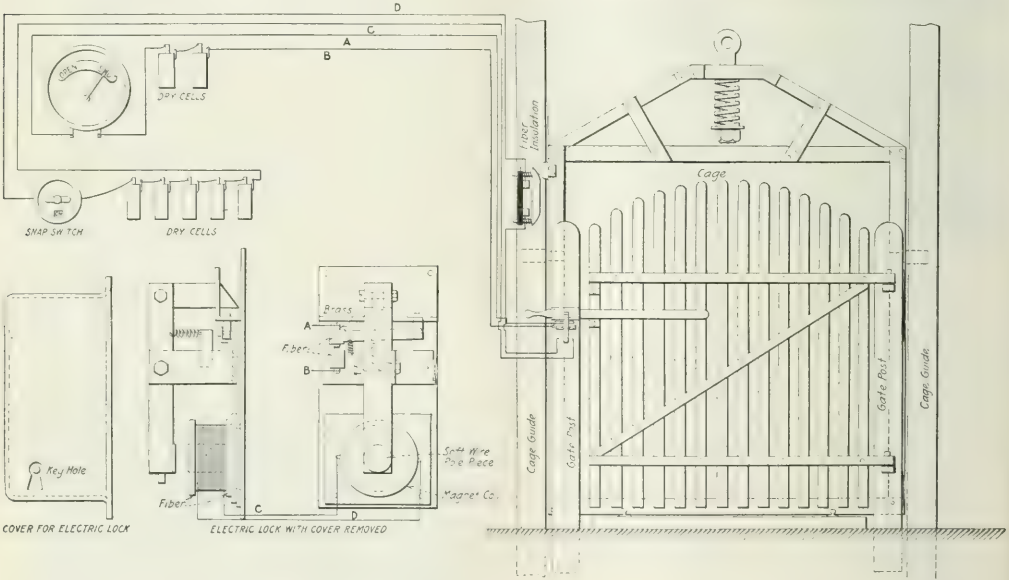
Automatic Safety Lock and Indicator for Shaft Gates

An automatic safety lock for shaft gates, together with a dial indicator showing whether the gate is open or closed, has been invented by W. A. Williams, of Barton, Ohio. The object of this device is automatically to lock and unlock the gates of elevator shafts, particularly those on the hoisting shafts of coal mines, during the time that men are being hoisted or lowered, says *Coal Age.*



Electrical Connections for Shaft-Gate Lock and Indicator

The accompanying drawing shows a cage at the shaft landing and a gate hinged to a post. On the gate a bar is pivoted which extends through a keeper and is movable vertically at one end. On the face of the adjacent gatepost is a plate with a suitable catch for holding the locking bar.

An electromagnet is introduced into the locking mechanism in such a way that when it is energized a bolt is withdrawn from the lock, allowing the locking bar to be swung out of contact with its catch, thus permitting the gate to be opened.

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[*] Extracted from a paper presented by J. H. Rider before the Institution of Electrical Engineers, London.

The coils of this electromagnet are included in and form a part of an open electric circuit, one side of which leads from a source of electric energy, while in the other is a bridge-piece or switch. When the cage is approaching the position at the landing, a contact mounted upon it closes the circuit, thus energizing the magnet, withdrawing the bolt in the lock and allowing the locking bar to be elevated. If the cage is but slightly moved, however, the contact is broken and the locking bar cannot be moved.

A snap switch is also introduced into the circuit whereby the latter may be broken, rendering the latch bolt inoperative, so that the gate is held in a closed and locked position. This snap switch may be located at any convenient point, usually in the engine room.

The electric lock is provided with a cover and so arranged that the introduction of a suitable key will open the lock independently of the electric circuit. This key of course permits of the gate being opened when the cage is not at the landing. It should be carried by some person in authority, so that the gate may not be opened and left open by some irresponsible individual.

In the engine room a dial indicator is placed which shows at all times the movement of the latch bar through suitable electrical connections. When the latch bar is disengaged from the locking mechanism, the dial stands at the open position, while when the gate is closed and the latch bar dropped into its place, the dial stands at shut.

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Shaft Timbering and Headgear on the Mesabi Range

Typical shaft-sinking practice on the Mesabi range is shown in the accompanying illustrations.[1] In this particular instance it was necessary to build up the collar of the shaft in order to get dump room; and as the ground was soft, top bearers were used, and to increase their strength they were trussed as shown in Fig. 1. Using the temporary headframe shown in Fig. 2, the shaft was sunk at a total cost of $42.49 per ft., the labor amounting to $27.70 and supplies to $14.79 per ft. The temporary headframe, which it was necessary to guy, was subsequently replaced by a standard type A frame (Fig. 3), which in use has proved entirely rigid and satisfactory. The hoist is 150 ft. back from the shaft.

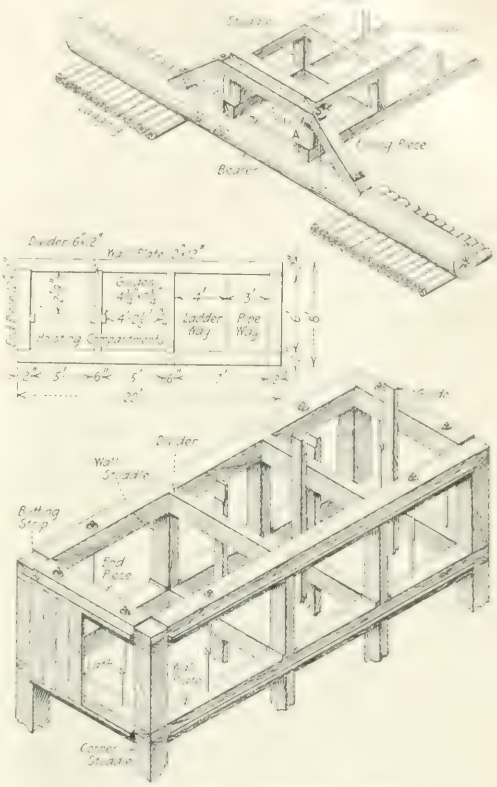

FIG. 1. SHAFT TIMBERING DETAILS

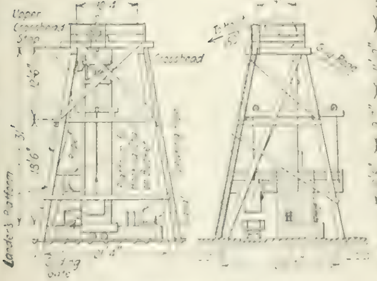

FIG. 2. TEMPORARY HEADFRAME

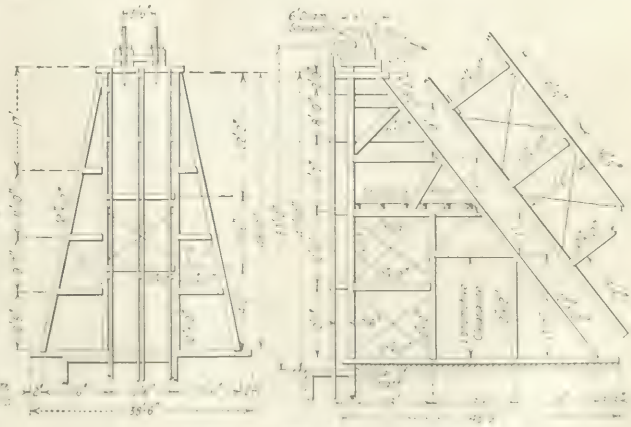

FIG. 3. PERMANENT HEADFRAME

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[1] From the "Wisconsin Engineer," April, 1915.

Details of Milling and Smelting

Phillips Process for Treating Cobalt-Silver Ores

A new process for treating cobalt-silver ores has been suggested by William Phillips, of Swansea, Wales (U. S. pat. 1,127,506). According to this process the cobalt-silver ores are smelted in the raw state in a blast or reverberatory furnace, together with a mixture of raw iron matte and the copper residue which remains after the extraction of silver by the well-known Ziervogel process, when speiss, argentiferous copper matte and slags are produced. About 82% of the silver in the ore passes into the copper matte, and about 17% passes into the speiss and about 16% of the copper in the matte passes into the speiss. The argentiferous copper matte containing sulphides of copper and iron will contain between 2000 and 3000 oz. of silver per ton, and the matte, 25% of copper.

The silver and copper in the speiss is extracted by smelting it in a reverberatory furnace together with raw iron matte, when about 60% of the silver and copper into the speiss passes into the iron matte on the first melting. The melting is repeated with fresh portions of iron matte three or more times until the speiss is practically free of silver and copper and in a condition suitable for treatment for the separation of the nickel and cobalt contained in the original ore. The iron matte, which now contains the silver and copper that were in the speiss, is utilized in the raw state in the smelting of the silver ores and copper residue, using the necessary proportion to reduce the copper oxide in the residue to a sulphide and producing the same weight and percentage of copper in the matte formed that the residue contained, thus enabling the same copper to be used indefinitely for the collection of the silver.

The oxide of iron in the residue combines with the silica in the ore, producing the required slag. The silver in the argentiferous copper matte is extracted by the Ziervogel process. The matte is crushed to a fineness such that it will pass through about a 16-mesh screen, then calcined and the calcined matte again crushed, this time to about 40 mesh, and further calcined. Calcining is continued until the silver is converted into the sulphate. It is then leached with hot water, which dissolves the silver sulphate, the solution being passed over copper plates, where the silver is deposited.

After the depositing of silver the solution passes through a tank containing scrap iron, precipitating the copper. Copper and silver are cleaned up and refined according to well-known methods. The copper residue, consisting principally of copper oxide from the argentiferous copper matte after washing out the silver, is smelted with the cobalt-silver ore and raw iron matte, when the copper oxide is converted into raw matte again.

The argentiferous copper matte formed on smelting the silver ore mixture contains from 1% to 6% of nickel and cobalt. The iron matte, after removing the silver and copper from the speiss, will contain about 2% of nickel and cobalt, all of which again combines with some form of the excess arsenic in the ore and forms speiss, being thus recovered without additional cost. The arsenic, so objectionable in most processes, is said to be an advantage in this process, since it retains nearly all of the nickel and cobalt without interfering with the separation and recovery of the silver and copper.

Etching Reagents Suitable for Particular Metals and Alloys

The following list from O. F. Hudson's paper before the Iron & Steel Institute, March, 1915, gives the principal reagents which have been found especially suitable for different metals and alloys:

Copper.—Ammonia (sp.gr. 0.88, diluted 1:1 with water), ammonium persulphate (10% aqueous solution), bromine (followed by a wash with ammonia), copper-ammonium chloride (5 grams of copper-ammonium chloride in 100 c.c. of water, add ammonia until precipitate just dissolves).

Brasses.—Ammonia, ammonium persulphate, copper-ammonium chloride, electrolytic etching, ferric chloride (slightly acidulated with HCl), chromic acid (saturated or nearly saturated solution), nitric acid (strong acid, followed by water), Tinoféef's reagent (94 grams HNO_3 and 6 gm. Cr_2O_3, a few drops are used in 50 c.c. of water).

Bronzes.—Ammonia, ammonium persulphate, ferric chloride.

Copper-Aluminum Alloys (Aluminum Bronzes).—Ammonium persulphate, ferric chloride, copper-ammonium chloride, nitric acid.

German Silver.—Ammonium persulphate, ferric chloride.

Nickel-Copper Alloys, Monel Metal.—Electrolytic etching.

Gold and Rich Gold Alloys, Platinum and Its Alloys.—*Aqua regia* (dilute, 1 part HNO_3, 5 parts HCl, 6 parts distilled water, used at 15° C.)

Aluminum and Light Aluminum Alloys.—Caustic soda, hydrochloric acid, hydrofluoric acid (1 part fuming HF to 10 or 20 parts of water, clear after treatment by a few seconds' immersion in HNO_3).

Lead, Tin and Their Alloys (White Metal, etc.).—Chromic acid in nitric acid, ferric chloride, hydrochloric acid, nitric acid, silver nitrate (5% solution).

Zinc and Alloys Rich in Zinc.—Caustic soda, iodine (1 part iodine, 3 parts KI and 10 parts water).

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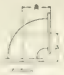
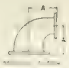
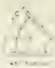
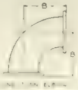
The Oxygen Efficiency in Pyritic-Smelting Furnaces at Mt. Lyell, Tasmania, was announced some years ago as practically 100%. As this was higher than at other plants doing similar work, it was suggested by various metallurgists that oxygen in the furnace gases might have been taken up by the iron pipe used in collecting the samples. At the meeting of the New York Section of the American Institute of Mining Engineers, in New York, Robert Sticht stated that further tests had been made with apparatus that removed all possibility of oxygen being absorbed, and that the results were the same, practically no free oxygen going out of the furnace at any rate, nothing like 2 or 3%, as had been suggested by various people. At the same meeting George A. Guess stated that an oxygen efficiency of about 87.5% had been attained at the furnaces of the Granby company at Anyox, B. C., in a test extending over a period of about six days. The oxygen efficiency of the Tennessee Copper Co.'s furnaces has been repeatedly calculated at from 70 to 72%.

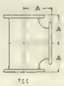
THE 1915 U. S. STANDARD SCHEDULE OF FLANGED FITTINGS AND FLANGES



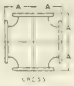




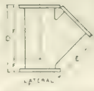




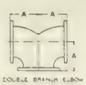
TEE



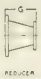
CROSS



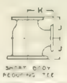
LATERAL



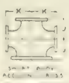
DOUBLE BRANCH ELBOW



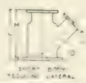
REDUCER



SHORT BODY REDUCING TEE



SHORT BODY REDUCING CROSS



SHORT BODY REDUCING LATERAL

STANDARD WEIGHT 125 LBS. WORKING PRESSURE

SIZE	A	B	C	D	E	F	G	Size of Outlets	J	K	Size of Branches	L	M	N	O	Flanges Diameter	Flanges Thickness	Bolts Diameter of Bolt Circle	Number of Bolts	Size of Bolts	Minimum Metal Thickness
1	3½	5	1¾	7½	5¾	1¾										4	7/16	3⅛	4	7/16	7/16
1¼	3¾	5½	2	8	6¼	1¾										4½	½	3⅜	4	7/16	7/16
1½	4	6	2¼	9	7	2										5	9/16	3⅞	4	½	7/16
2	4½	6½	2½	10½	8	2½										6	⅝	4¾	4	⅝	7/16
2½	5	7	3	12	9½	2½										7	11/16	5½	4	⅝	7/16
3	5½	7¾	3	13	10	3	6									7½	¾	6	4	⅝	7/16
3½	6	8½	3½	14½	11½	3	6½									8½	13/16	7	4	⅝	7/16
4	6½	9	4	15	12	3	7									9	15/16	7½	8	⅝	½
4½	7	9½	4	15½	12½	3	7½									9¼	15/16	7¾	8	¾	½
5	7½	10¼	4½	17	13½	3½	8									10	15/16	8½	8	¾	½
6	8	11½	5	18	14½	3½	9									11	1	9½	8	¾	9/16
7	8½	12¾	5½	20½	16½	4	10									12½	1 1/16	10¾	8	¾	⅝
8	9	14	5½	22	17½	4½	11									13½	1⅛	11¾	8	¾	⅝
9	10	15¼	6	24	19½	4½	11½									15	1⅛	13¼	12	¾	11/16
10	11	16½	6½	25½	20½	5	12									16	1 3/16	14¼	12	⅞	¾
12	12	19	7½	30	24½	5½	14									19	1¼	17	12	⅞	13/16
14	14	21½	7½	33	27	6	16									21	1⅜	18¾	12	1	⅞
15	14½	22¾	8	34½	28½	6	17									22¼	1⅜	20	16	1	⅞
16	15	24	8	36½	30	6½	18									23½	1 7/16	21¼	16	1	1
18	16½	26½	8½	39	32	7	19	12 in.	13	15½	9 in.	26	25	1	27½	25	1 9/16	22¾	16	1⅛	1 1/16
20	18	29	9½	43	35	8	20	14 "	14	17	10 "	28	27	1	29½	27½	1 11/16	25	20	1⅛	1⅛
22	20	31½	10	46	37½	8½	22	15 "	14	18	10 "	29	28½	½	31½	29½	1 13/16	27¼	20	1¼	1 3/16
24	22	34	11	49½	40½	9	24	16 "	15	19	12 "	32	31½	½	34½	32	1⅞	29½	20	1¼	1¼
26	23	36½	13	53	44	9	26	18 "	16	20	12 "	35	35	0	38	34¼	2	31¾	24	1¼	1 5/16
28	24	39	14	56	46½	9½	28	18 "	16	21	14 "	37	37	0	40	36½	2 1/16	34	28	1¼	1⅜
30	25	41½	15	59	49	10	30	20 "	18	23	15 "	39	39	0	42	38¾	2⅛	36	28	1⅜	1 7/16
32	26	44	16				32	20 "	18	24						41¾	2¼	38½	28	1½	1½
34	27	46½	17				34	22 "	19	25						43¾	2 5/16	40½	32	1½	1 9/16
36	28	49	18				36	24 "	20	26						46	2⅜	42¾	32	1½	1⅝
38	29	51½	19				38	24 "	20	28						48¾	2⅜	45¼	32	1⅝	1 11/16
40	30	54	20				40	26 "	22	29						50¾	2½	47¼	36	1⅝	1¾
42	31	56½	21				42	28 "	23	30						53	2⅝	49½	36	1⅝	1 13/16
44	32	59	22				44	28 "	23	31						55¼	2⅝	51¾	40	1⅝	1⅞
46	33	61½	23				46	30 "	24	33						57¼	2 11/16	53¾	40	1⅝	1 15/16
48	34	64	24				48	32 "	26	34						59½	2¾	56	44	1⅝	2
50	35	66½	25				50	32 "	26	35						61¾	2¾	58¼	44	1¾	2 1/16
52	37	69	26				52	34 "	27	36						64	2⅞	60½	44	1¾	2⅛
54	39	71½	27				54	36 "	29	37						66¼	3	62¾	44	1¾	2 3/16
56	41	74	28				56	36 "	29	39						68¾	3	65	48	1¾	2¼
58	42	76½	29				58	38 "	31	40						71	3⅛	67¼	48	1¾	2 5/16
60	44	79	30				60	40 "	33	41						73	3⅛	69¼	52	1¾	2 7/16
62	45	81½	31				62	40 "	33	42						75¾	3¼	71¾	52	1⅞	2½
64	47	84	32				64	42 "	34	44						78	3¼	74	52	1⅞	2 9/16
66	48	86½	33				66	44 "	35	45						80	3⅜	76	52	1⅞	2⅝
68	50	89	34				68	44 "	35	46						82¼	3⅜	78¼	56	1⅞	2 11/16
70	51	91½	35				70	46 "	37	47						84½	3½	80½	56	1⅞	2¾
72	53	94	36				72	48 "	40	48						86½	3½	82½	60	1⅞	2 13/16
74	54	96½	37				74	48 "	40	49						88½	3⅝	84½	60	1⅞	2⅞
76	56	99	38				76	50 "	42	50						90¾	3⅝	86½	60	1⅞	2 15/16
78	58	101½	39				78	52 "	43	52						93	3¾	88¾	60	2	3
80	59	104	40				80	52 "	43	53						95¼	3¾	91	60	2	3 1/16
82	60	106½	41				82	54 "	44	54						97½	3⅞	93¼	60	2	3⅛
84	62	109	42				84	56 "	47	56						99¾	3⅞	95½	64	2	3 3/16
86	63	111½	43				86	56 "	47	57						102	4	97¾	64	2	3¼
88	65	114	44				88	58 "	48	58						104¼	4	100	68	2	3 5/16
90	67	116½	45				90	60 "	50	61						106½	4⅛	102¼	68	2⅛	3⅜
92	68	119	46				92	60 "	50	62						108¾	4⅛	104½	68	2⅛	3 7/16
94	69	121½	47				94	62 "	52	63						111	4¼	106¾	68	2⅛	3 9/16
96	71	124	48				96	64 "	53	64						113¼	4¼	108½	68	2¼	3⅝
98	73	126½	49				98	64 "	53	65						115½	4⅜	110¾	68	2¼	3 11/16
100	74	129	50				100	66 "	55	67						117¾	4⅜	113	68	2¼	3¾

EXTRA HEAVY 250 LBS. WORKING PRESSURE

SIZE	A	B	C	D	E	F	G	Short Body Red. Tees & Crosses: Size of Outlets	J	K	Short Body Red. Laterals: Size of Branches	L	M	N	O	Flanges Diameter	Flanges Thickness	Bolts Diameter of Bolt Circle	Number of Bolts	Size of Bolts	Minimum Metal Thickness
1	4	5	2	8½	6½	2										4½	11/16	3¼	4	½	½
1¼	4¼	5½	2½	9½	7¼	2¼										5	¾	3¾	4	½	½
1½	4½	6	2¾	11	8½	2½										6	13/16	4½	4	⅝	½
2	5	6½	3	11½	9	2½										6½	⅞	5	4	⅝	½
2½	5½	7	3½	13	10½	2½										7½	1	5⅞	4	¾	9/16
3	6	7¾	3½	14	11	3	6									8¼	1⅛	6⅝	8	¾	9/16
3½	6½	8½	4	15½	12½	3	6½									9	1 3/16	7¼	8	¾	9/16
4	7	9	4½	16½	13½	3	7									10	1¼	7⅞	8	¾	⅝
4½	7½	9½	4½	18	14½	3½	7½									10½	1 5/16	8½	8	¾	⅝
5	8	10¼	5	18½	15	3½	8									11	1⅜	9¼	8	¾	11/16
6	8½	11½	5½	21½	17½	4	9									12½	1 7/16	10⅝	12	¾	¾
7	9	12¾	6	23½	19	4½	10									14	1½	11⅞	12	⅞	13/16
8	10	14	6	25½	20½	5	11									15	1⅝	13	12	⅞	13/16
9	10½	15¼	6½	27½	22½	5	11½									16¼	1¾	14	12	1	⅞
10	11½	16½	7	29½	24	5½	12									17½	1⅞	15¼	16	1	15/16
12	13	19	8	33½	27½	6	14									20½	2	17¾	16	1⅛	1
14	15	21½	8½	37½	31	6½	16									23	2⅛	20¼	20	1⅛	1⅛
15	15½	22¾	9	39½	33	6½	17									24½	2 3/16	21½	20	1¼	1 3/16
16	16½	24	9½	42	34½	7½	18									25½	2¼	22½	20	1¼	1¼
18	18	26½	10	45½	37½	8	19	12 in.	14	17	9 in.	34	31	3	32½	28	2⅜	24¾	24	1¼	1⅜
20	19½	29	10½	49	40½	8½	20	14 "	15½	18½	10 "	37	34	3	36	30½	2½	27	24	1⅜	1½
22	20½	31½	11	53	43½	9½	22	15 "	16½	20	10 "	40	37	3	39	33	2⅝	29¼	24	1½	1 9/16
24	22½	34	12	57½	47½	10	24	16 "	17	21½	12 "	44	41	3	43	36	2¾	32	24	1⅝	1⅝
26	24	36½	13				26	18 "	19	23						38¼	2 13/16	34½	28	1⅝	1¾
28	26	39	14				28	18 "	19	24						40¾	2 15/16	37	28	1⅝	1⅞
30	27½	41½	15				30	20 "	20½	25½						43	3	39¼	28	1¾	2
32	29	44	16				32	20 "	20½	26½						45¼	3⅛	41½	28	1⅞	2⅛
34	30½	46½	17				34	22 "	22	28						47½	3¼	43½	28	1⅞	2¼
36	32½	49	18				36	24 "	23½	29½						50	3⅜	46	32	1⅞	2⅜
38	34	51½	19				38	24 "	23½	30½						52¼	3 7/16	48	32	1⅞	2 7/16
40	35½	54	20				40	26 "	25	31½						54½	3 9/16	50¾	36	1⅞	2 9/16
42	37	56½	21				42	28 "	26½	33½						57	3 11/16	52¾	36	1⅞	2 11/16
44	39	59	22				44	28 "	26½	34½						59¼	3¾	55	36	2	2 13/16
46	40½	61	23				46	30 "	27½	35½						61½	3⅞	57¼	40	2	2⅞
48	42	64	24				48	32 "	29	37½						65	4	60¾	40	2	3

EXPLANATORY NOTES

1. Standard and Extra Heavy Reducing Elbows carry same dimensions center to face as regular Elbows of largest straight size.
2. Standard and Extra Heavy Tees, Crosses and Laterals reducing on run only carry same dimensions face to face as largest straight size.
3. If Flanged Fittings for lower working pressure than 125 lbs. are made they shall conform in all dimensions except thickness of shell to this standard and shall have the guaranteed working pressure cast on each fitting. Flanges for these fittings must be standard dimensions.
4. Where long turn fittings are specified it has reference only to Elbows which are made in two center to face dimensions and to be known as Elbows and Long Turn Elbows, the latter being used only when so specified.
5. All standard weight fittings must be guaranteed for 125 lbs. working pressure and extra heavy fittings for 250 lbs. working pressure, and each fitting must have some mark cast on it indicating the maker and guaranteed working steam pressure.
6. All extra heavy fittings and flanges to have a raised surface 1/16 high inside of bolt holes for gaskets. Thickness of flanges and center to face dimensions of fittings include this raised surface.

   Standard weight fittings and flanges to be plain faced.

   Bolt holes to be ⅛ larger in diameter than bolts.

   Bolt holes to straddle center lines.
7. Size of all fittings scheduled indicates inside diameter of ports.
8. Square head bolts with hexagonal nuts are recommended.
9. Double Branch Elbows, Side Outlet Elbows and Side Outlet Tees, whether straight or reducing sizes, carry same dimensions center to face and face to face as regular tees and elbows.
10. Bull Head Tees or Tees increasing on outlet will have same center to face and face to face dimensions as a straight fitting of the size of the outlet.
11. Tees, Crosses and Laterals 16 inches and smaller, reducing on the outlet, use the same dimensions as straight sizes of the larger port.

    Sizes 18 inches and larger, reducing on the outlet, are made in two lengths depending on the size of the outlet as given in the table of dimensions.
12. For fittings reducing on the run only a long body pattern [illegible]

    Y's are special and made to suit conditions.

    Double Branch Elbows are not made reducing on the run.
13. Steel Flanges, Fittings and Valves are [illegible] superheated steam.

This schedule, superseding all previous issues, was adopted Mar. 20, 1914, by a Joint Committee of the National Association of Master Steam and Hot Water Fitters, the American Society of Mechanical Engineers and the Committee of Manufacturers on Standardization of Fittings and Valves, and became effective [illegible] 1915. All dimensions are in inches. Copies of the original chart, of which this is a reproduction, on heavy paper, 24x36 in., can be secured for $1 by addressing the National Association of Master Steam and Hot Water Fitters, 260 Broadway, New York City.

The Cost of Doing Things

Operating Costs at a Small Mexican Mine

By Roy Hutchins Allen*

The cost of mining with so-called "cheap labor" as compared with skilled American labor has been a topic of frequent discussion; therefore, the following exact costs at a small mine in Mexico may be of interest. The labor employed is entirely native and is under the direction of two Americans. The average daily production is about 100 tons of crude ore. The costs are not considered low, but are representative under the conditions of decreased efficiency of labor that have prevailed since the revolutionary disturbances began in 1910.

A brief description of the mine and methods of operation is necessary in order to make the figures of value.

UNIT COST OF LABOR PER 9-HR. SHIFT

Shift bosses	$1 2425 to 1.86⅜	Powder boys	$0 497 to 0 62125
Miners	.7455	Hoistmen	1 2425 to 1 36675
Timbermen	.994	Topmen	.994
Helpers	7455	Blacksmith	1 36675
Trammers	.7455	Boss ore sorter	1 2425
Underground laborers	37275 to 62125	Ore sorters	.310625 to .62125
		Surface laborers	.37275 to .62125

UNIT COSTS OF SUPPLIES

Dynamite, 40%, per 50-lb case	$8 75	Handles, hammer, 32-in , each	.176
Dynamite, 60%, per 50-lb. case	9.95	Handles, pick, 32-in., each	.185 to .219
Fuse, double tape, per 1000 ft.	3.375	Handles, axe, each	209 to 258
Blasting caps, 5X, per 1000	3 872	Handles, adze, each	219
Candles, No. 15L, per box of 320	2.623 to 3.255	Nails, wire, per 100 lb.	5.670 to 7.229
Carbide, per 100 lb.	7.229	Bar iron, per lb.	.0384
Pine lumber, sawed, per 1000 ft. b.m.	24.85	Drill steel, ⅞-in., octagon, per lb.	.0881 to .0949
Pine lumber, sawed, culls, per 1000 ft. b.m.	19.88	Oils, engine, per gal.	234
Slabs, per metric ton (2204.6 lb.)	7.207	Oil, gas cylinder, per gal.	.353
Poles, pine, 16 ft. long, 6 in. diameter	895	Oil, black, for ore cars, per gal.	.199
Poles, pine, 16 ft. long, 7 in. diameter	1 044	Oil, kerosene, per gal.	.236 to 306
Poles, pine, 16 ft. long, 8 in. diameter	1.193	Cup grease, per lb.	060
Poles, pine, 16 ft. long, 9 in. diameter	1.566	Axle grease, per lb	045
Shovels, No. 2 D, each	.810 to .994	Gasoline, per gal.	2659 to 3106
Picks, A.E. No. 4, each	477	Coal, blacksmith's, per metric ton	7.207
Picks, A.E. No. 5, each	.508	Ropes (sogas), 40 ft. long, each	.199 to .249
Picks, Collins, No. 5, each	.939	Wheelbarrows, No. 4 A, each	4 722
Hammers, 8-lb., each	.681	Rails, 12-lb , per 15-ft rail	1 655
Hammers, 6-lb., each	.611	Rail spikes, 3-in., each	.0046
Hammers, 4-lb., each	.464	Corn, per bu. shelled	.832 to 1.138
Axes, each	.820	Wheat straw, per av. ton	9.036 to 13.555
Adzes, each	1 160	Alfalfa, per av. ton	22.60
Handles, hammer, 14-in , each	.070	Electric power for hoist, per kw-hr.	05964

The property is in the State of Chihuahua, one mile from the railroad, with which it is connected by a surface tramway and over which the ore is shipped to the smeltery. The vein is continuous, but of irregular width, varying from 10 to 80 ft., and lies between a foot wall of hard, dense rhyolite breccia and a hanging wall of badly broken andesite. A large part of the ore is either soft or cut by many clay seams, so that but a small amount of explosive is required to break it. All drilling is done by hand with ⅞-in. octagon steel. In the stopes 40% dynamite is used, while 60% dynamite is employed in driving drifts and crosscuts in the foot wall. Double-tape fuse and 5X blasting caps are used throughout the mine.

Overhand stoping methods are employed, the stopes being carried up in vertical slices 15 to 24 ft. in width. These stopes are all timbered with square-sets and are filled with waste or low-grade material, the filling being kept to within one floor of the back. The stope sets are framed of round timbers, 7 to 8 in. in diameter at the smaller end of 16-ft. poles, and are lagged with 6-ft. slabs. The posts are 6 ft. 2 in. in height and placed 4 ft. 8 in. center to center, so that one 16-ft. pole is required for a set. Operating tests showed that it was absolutely necessary to fill the stopes and that the timbers need not

COST OF MINING

(a). Cost of Breaking Ore (17,253 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Broken
Shift bosses (part)	236 85	0138	72.8	$367 89	$0.0213
Miners	3488.33	.2021	4 94	2621 22	.1519
Shovelers in stopes	1382.40	0802	12.48	828 57	.0480
Powder boys	311.25	.0180	55.4	153 38	.0089
Blacksmiths	163.50	0095	105.5	187 73	.0109
Total labor	5582.33	.3236	3.09	$4158.79	$0.2410

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Broken
Dynamite, 40%	1194.3 lb.	0 0692	14.49	$208 94	$0.0121
Fuse	7826 ft.	454	2.20	26.41	.0015
Caps, 5X	4162	241	4.15	16.11	.0009
Candles, No. 15L	28800	1.67	.60	240.05	.0139
Carbide	98 lb.	.0057	176	7.11	.0004
Drill steel	110 lb.	.0064	155.3	20.08	.0012
Pick steel	3.6 lb.	.0002		.89	.0000
Hammers	4			2.52	.0001
Shovels, No. 2D	34	.0020	507	27.45	.0016
Picks	6	.0004		3.10	.0002
Handles				11 68	.0007
Blacksmith's coal	4090 lb.	.237	4.22	13.37	.0008
Total supplies				$577 71	$0.0334
Total cost of breaking ore				$4736.50	$ .2744

(b.) Cost of Timbering Stopes

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Broken
Shaft bosses (share)	52.63	0.00304	327.8	$81.75	$0.0047
Timbermen	662 7	.03842	26.1	664.26	.0385
Helpers	625.25	.03624	27.6	464.64	.0269
Carpenters (contract)	146	00846	118.1	214.63	.0125
Total labor	1486.58	0.08616	11.61	$1425 28	$0.0826

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Broken
Lumber				$1935.10	$0.1121
Candles, No. 15L	9493	0.556	1.83	78.93	.0046
Axes	3			2.15	.0001
Adzes	2			2.32	.0001
Bar iron	273 lb.	.0158	63.8	10.48	.0006
Nails	205 lb.	.0119	91.7	12 10	0007
Lag screws				2 98	.0002
Washers				1.47	.0001
Ropes, 40-ft	39	0023	442	8 77	.0005
Files				2.38	.0001
Total supplies				$2056 62	$0.1191
Total cost of timbering stopes				3481 90	.2017

COST OF UNDERGROUND TRAMMING

(15,531 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Trammed
Shift bosses (share)	26 32	00169	590	$40 88	$0 0029
Trammers	1217 5	07839	12 575	911 03	.0647
Total labor	1243 82	08008	12 486	$951.91	$0.0676

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Trammed
Candles, No. 15L	8800	567	1.76	$72 61	$0 0051
Axle grease	65 lb.	00418	239	2 93	0002
Rails and spikes	30 ft.			3 93	0003
Total cost of supplies				$79 47	$0.0056
Total cost of underground tramming				1031 38	0732

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*Mining engineer, Jamesburg, N. J.

be larger than those mentioned, though 6-in. poles were not strong enough. Round poles 7 to 8 in. in diameter were as satisfactory as 8x8-in. sawed timbers and cost but half as much. Drift sets are 7 ft. in height and of 8- to 12-in. poles; though, as far as possible, the main drifts are in the hard foot wall, which requires no timbering, crosscuts being driven to the vein at regular intervals.

During the period of seven months covered by these data, all of the ore was broken and trammed by hand, the average tramming distance being 270 ft. With the exception of two development levels, the ore was loaded from shaft pockets into a skip of 23 cu.ft. (three-fourths of a metric ton) capacity and raised to the surface through

COST OF LOADING SKIPS

(18,301 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Loaded
Skip loaders	720	0.03934	25 42	$822 14	$0 0449
Total labor	720	0 03934	25 42	$822.14	$0 0449

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Loaded
Candles	6995	0.382	2 62	$58 14	$0 0032
Kerosene	4 gal			1 01	0001
Torches and wicking				37	
Total cost of supplies				$59 52	$0 0033
Total cost of loading skips				881 66	0482

COST OF HOISTING

(18,301 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Hoisted
Hoistmen	378 25	0.02067	48.38	$480 26	$0 0262
Machine work on hoist				89 51	0049
Total cost of labor				$569 77	$0 0311

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Hoisted
Valves and pipe fittings				$8.17	$0 0004
White lead				17	
Engine oil	61 7 gal	0 00337	297	14.44	0008
Cylinder oil	41 8 gal	0 00228	439	14.77	0008
Cotton waste	79 lb.	.00432	231	6.24	0003
Grease for skip	131 lb	0 00716	140	5 85	.0003
Rivets				23	0000
Carbide	98 3 lb	0 00537	186	7 11	0004
Kerosene	16 gal	0 00088	1143	4 05	0002
Torches and wicking				1 48	.0001
Power, electric	6834 kw -hr			409 63	0572
Gasoline	2300 gal			635 38	
Total cost of supplies				$1107 52	$0 0605
Total cost of hoisting				1677 29	0916

COST OF DELIVERING ORE FROM HEADFRAME TO PATIO

(18,301 tons)

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Delivered
Topmen	380 5	0 02073	48 10	$353 17	$0 0193
Total labor	380 5	0 02073	48 10	353 17	0193
Kerosene				$1 02	$0 0001
Torches and wicking				.37	
Rivets				.23	
Total cost of supplies				$1 62	$0 0001
Total cost of delivering ore from headframe to patio				354 79	0194

SURFACE EXPENSES CHARGED TO COST OF MINING

(15,531 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Trammed
Laborers	24 5	0 00158	633 9	$11 88	$0 0010
Watchmen	183	01178	84 87	121 37	0080
Burro freight				3 18	0002
Surface trammers (d[illegible]), contract				51 11	0033
Total labor				$193 84	$0 0125

Supplies

	Total Cost	Cost per Ton Trammed
Tacks	$0 87	$0 0000
Wrenches	2 29	0001
Express	97	0001
Freight	10 01	0007
Tramway royalties	7.13	0005
Total cost of supplies	$21 30	$0 0014
Total surface expenses charged to cost of mining	215 14	0139

COST OF SORTING ORE

(17,0[illegible] tons of crude ore)

Labor	Total Cost	Cost per Ton	Supplies	Total Cost	Cost per Ton
Boss ore-sorter, 181.1 days	$199 64	$0 0117	H[illegible]	$2 47	$0 0001
Ore-sorters (contract)	2004 30	1179	H[illegible]	[illegible] 00	0003
Screening at R R platform	36 22	0021	Sh[illegible]	[illegible] 99	0021
Blacksmith	3.23	0002	Screens	[illegible] 73	0032
Carpenters and helper	9 91	0006	Wh[illegible]	11 33	0007
Laborers	19.63	0011	Lum[illegible] track	26 08	0015
			Nails	2 19	0001
			Bar iron	0 42	0000
Total cost of labor	$2272 93	$0 1336	Total cost of supplies	[illegible]	[illegible]
			Total cost of sorting ore	2410 [illegible]	[illegible]

COST OF DELIVERING SORTED ORE FROM MINE BINS TO RAILROAD PLATFORM

(9363.776 tons)

	Total Cost	Cost per Ton		Total Cost	Cost per Ton
Trammers (no other labor)	$425 32	$0 0454	Flake graphite	$1.19	$0.0001
Mules (2)	74 92	0080	Torches and wicking	3.03	.0003
Corn	357 06	0382	Kerosene	4.27	.0005
Straw	68 51	0072	Ore sacks	3 48	0004
Alfalfa	14 85	0016	Freight on supplies	15 67	0017
Cottonseed meal	2.97	.0003	Express on supplies	3 89	0004
Bran	1 37	0001	Total cost of supplies	$598.43	$0.0638
Mule shoes and nails	6.54	.0007	Tramway royalties	413 87	0442
Harnesses	14 21	0015	Total cost of delivery	1437 62	1534
Ropes (40-ft)	7 34	0008			
Axle grease	22	0000			
Oil for car wheels	18 91	.0020			

COST OF LOADING ORE INTO RAILROAD CARS

(8882.508 tons)

Labor	Total Cost	Cost per Ton	Supplies	Total Cost	Cost per Ton
Car loaders	$463 14	$0 0521	Shovels	$8 87	$0 0010
Transferring ore	9 06	0010	Wheelbarrows	2 83	0003
			Tacks	12	0000
Total cost of labor	$472 20	$0 0531	Total cost of supplies	$11.82	$0.0013
			Total cost of loading	484 02	0544

COST OF SAMPLING AND ASSAYING

(9134.531 tons dry weight)

Labor	Total Cost	Cost per Ton	Supplies	Total Cost	Cost per Ton
Assayer	$350 00	$0 0388	Gasoline	$64 51	$0 0071
Sampler	131.71	.0146	Assay supplies	64.04	.0070
Total cost of labor	$481 71	$0 0534	Stove pipe for furnace	79	0001
			Brooms	70	0001
			Comparison assays	.99	.0001
			Umpire Assays	21 74	0024
			Total cost of supplies	$152.77	$0.0168
			Total cost of sampling and assaying	634 48	0 0702
			Credit, assays for others	109 64	0121
			Net cost of sampling and assaying	$524 84	$0 0581

DEVELOPMENT

	Total Feet	Total Cost	Cost per Foot Maximum	Cost per Foot Minimum	Cost per Foot Average
Drifts	464 57	$1412 71	$3 5217	$1 0671[1]	$3 0409
Crosscuts	363.35	822.02	4 5187[2]	1 2793[3]	2 2623
Raises	47 24	65 53	1 6272	1 0526	1 3873
Total and averages	875 16	$2300 29	$4 5187	$1 0526	$2 6284

[1] In vein, not timbered

[2] Through loose boulders

[3] In vein, not timbered

The drifts were for the most part in the footwall, a hard, dense rhyolite breccia requiring no timbering. The crosscuts were timbered where they passed through the vein, but not in the foot- or hanging-wall rock. The raises were in the foot wall or in firm vein matter, and required no timbering.

COSTS OF DEVELOPMENT

(875.16 ft.)

	Total Cost	Cost per ft.		Total Cost	Cost per ft.
Shaft bosses (share)	$57 57	$0 0658	Topmen	[illegible]	[illegible]
Miners	367 53	4200	Blacksmiths	[illegible]	0163
Contractors (labor and supplies)	1140 01	1 3026	Total cost of labor and contractor supplies	[illegible] 71	$2 1547
Timbermen	72 56	0 0829	Supplies, including lumber	414 55	4737
Helpers	52 93	0605	Total cost of development	$2300 29	$2 6284
Laborers	35 87	0410			
Powder boys	8 52	0097			
Trammers	49 71	0568			
Skip loaders	12 38	0184			
Hoistmen	10 17	0116			

a single-compartment shaft having an inclination of 52°. The average depth from which the ore was raised was 425 ft. on the incline, the least depth being 300 ft. and the greatest 625 ft. During the first two months a 52-hp. electric hoist was used, while during the remaining five months a 22-hp. Fairbanks-Morse gasoline hoist was employed.

The average distance from the headframe to the sorting patio was about 80 ft. On this patio the pieces of ore larger than 4 in. in diameter were broken by hand and the waste and low-grade material thrown out, while the finer ore was screened on a 1⅛-in.-mesh woven-wire screen—the oversize sorted and the fines rejected. About 55% of the ore sorted was thrown into the bins and sent over the tramway to the loading platform at the railroad. Three mules were occupied continuously during the day shift, hauling the ore in trains of two or three cars, each car holding about 1650 lb. of ore. The three mules at work in the morning were replaced at noon by three others, each mule working one-half day six days in the week. The mules were fed morning and night with 2½ liters of corn and 1 liter at noon, and were given all the wheat straw they would eat. The ration was altered occasionally by feeding alfalfa instead of straw and cutting down the amount of corn.

At the railroad platform it was necessary to screen again a part of the ore on account of the considerable amount of moist clay which could not be removed by the screening at the mine patio. This rescreening was included in the cost of sorting. The railroad cars were loaded by wheelbarrow under contract.

The costs given are in United States currency and are calculated from the costs in Mexican currency using the average rate of exchange 0.4970. The weights are in avoirdupois tons of 2000 lb. The figures cover an operating period of seven months in 1912, the mine being closed during the other five months on account of the destruction of the railroad by the native "nonconformists" and the inability to obtain supplies.

* * *

Milling at the Nipissing Mines Co.

According to the report of the Nipissing Mines Co. for 1914, there was produced a total of 4,689,333.04 oz. of silver, the gross value of which was $2,516,064.85. The net receipts amounted to $1,587,621.16. The production cost was 19.8c. per oz. Silver sold for an average price of 55.36c. per oz. Shareholders received $1,200,000 in dividends during the year. The ore reserves contain more than 10,000,000 oz. of silver. A summary of shipments in 1914, not including custom production, is shown in the accompanying table.

NIPISSING SHIPMENTS IN 1914

Dry tons shipped	434 2124	Gross silver and cobalt value	$2,221,194.68
Silver contained, oz	3,000,862 51	Marketing charges	$18,791 06
Gross value of silver	$2,214,626 60	Net receipts from sales	$2,202,400 62
Average price received per oz., cents	55 365	Total silver produced, oz.	4,689,333 04
Received from sales of cobalt	$6,568 08		

As can be seen, the stock of silver on hand at the mines more than doubled in 1914, probably in some measure due to the difficulty experienced in marketing silver during the continuance of the war. This stock, 1,110,272.15 oz., was taken at a gross value of 48.5c. per oz., and a net value of 47.1c., so that the figures given by the Nipissing company may be considered conservative. In this connection it is interesting to note that the grade of material on hand has increased, along with the quantity—from 3251 oz. per ton on Dec. 31, 1913, to 5364 oz. per ton on Dec. 31, 1914.

The cost of silver production is shown in the accompanying table:

COST OF SILVER AT NIPISSING

Based on production of 4,689,333 04 oz and 80,037 tons milled.

	Total	Per Ton Ore	Per Oz. Silver
Hydraulicking	$46,578 98	$0 582	$0 0099
Diamond drilling	3,005.00	.037	0006
Development and exploration	220,799 48	2 759	0471
Stoping	136,326 32	1 703	0291
Loading and shipping ore	1,628.53	.020	0003
Assaying and engineering	11,571.54	.144	.0025
Administration and office	27,611.09	.345	0059
Boarding-house and camp maintenance	20,719 94	259	0044
Insurance and taxes	37,443 67	468	0080
General and legal	23,877 10	298	0051
High-grade mill	36,327 17	454	.0077
Low-grade mill	315,650.59	3.944	0673
Depreciation	54,242.41	.678	.0116
Marketing product	24,894 48	.311	.0053
Corporation, New York and traveling	13,692 29	.171	.0029
	$971,111 53	$12 133	$0 2071
Less rents and interest	42,667 84	533	0091
Total cost of production	$928,443 69	$11 600	$0 1980

The production record for 1914 is shown in the accompanying table:

NIPISSING PRODUCTION IN 1914

	Dry Tons	Silver, Oz	Gross Value	Net Value
Shipments in 1914	434.2124	3,000,862.51	$2,221,194.68	$2,204,400.62
On hand at mine, Dec. 31, 1914	206 9650	1,110,272 15	538,481 99	523,913 03
	641 1774	5,110,134 66	$2,759,676 67	$2,726,313 65
On hand Dec. 31, 1913	129 4210	420,801 62	243,619 81	239,515 37
	511.7564	4,689,333.04	$2,516,056.86	$2,486,798.28
Difference between estimated and actual returns			7 99	7 99
	511.7564	4,689,333.04	$2,516,064.85	$2,468,806 27

The high-grade mill treated 929 tons of Nipissing ore having an average of 2439 oz. per ton and 965 tons of custom ore averaging 2421 oz. per ton. The refinery treated the precipitates from the low-grade mill. Total shipments of bullion during the year amounted to 6,300,177 fine oz. Total shipments of residues amounted to 1060 tons, giving a net return of $12,344.06. The low-grade mill treated 79,009 tons of ore and 116 tons of byproduct, recovering 2,261,024 oz. of silver, 89.64% of the total content. In the accompanying tables the consumption of supplies and treatment costs at the low-grade mill are given.

CONSUMPTION OF SUPPLIES AT NIPISSING LOW GRADE MILL

	Lb.	Lb. per Ton	Cost per Lb.	Cost per Ton Ore
Cyanide	421,813	5 331	$0 1555	$0 8292
Lime	454,876	5 749	0042	.0242
Caustic soda	242,014	3 059	0211	.0647
Aluminum dust	46,836	592	3382	.2002
Aluminum plate	41,858	529	2467	.1305
Aluminum ingots	13,586	172	.1925	.0331
Flint pebbles	302,695	3 826	.0084	.0321
Coal for heating	2,532,100	32 001	.0029	.0933
Power, kw.-hr	4,264,000	53.889	.0118	.6384
				$2 0457

TREATMENT COSTS AT NIPISSING LOW GRADE MILL

	Total Cost	Cost per Ton		Total Cost	Cost per Ton
Crushing at mine	$10,124 44	$0 128	Cyanide treatment	85,130 68	1.706
Aerial tramway	5,142 23	065	Cyanide filter	10,892 15	.138
Surface tramway	5,469 79	069	Classifying and precipitation	22,819 56	288
Picking plant	16,118 17	204	Refining	8,785 21	111
Crushing and conveying	3,804 73	048	Heating	9,317 46	.118
Battery	21,782.20	.275	Water supply	2,878 40	036
Tube mills and classifiers	45,457.57	575	Construction	26,437 33	334
Desulphurizing and slime collecting	24,093.68	.304	Residue dam	4,632 97	059
Intermediate filtering	8,776.46	.111	Consulting	3,987 56	050
				$315,650 59	$3.989

Correspondence and Discussion

California Safety Rules

The draft of the safety rules made by the California Commission, published in the JOURNAL of June 12, seems to me to contain some strikingly bad provisions in an otherwise admirable set of safety rules. The fact that the first section of these rules provides that they shall not apply to mines when, in the opinion of the chief mine inspector, they would work an undue hardship on the operator, starts them off with a pernicious provision.

Rules of this sort are necessary or they are unnecessary; and if they are necessary and proper, there should be no discretion left to any one man as to their enforcement.

The compulsory provision for artificial breathing apparatus at each mine employing more than 30 men underground is unwise. The mines at Cripple Creek are the only metal mines in the United States where noxious gases emanate from the ground. In any mine in which there are old workings or workings which have been long submerged the odors from decayed timbers may indicate lack of oxygen in the air and require better ventilation. But rotten timbers certainly do not justify a legal provision for the compulsory furnishing of artificial breathing apparatus, and gases in Cripple Creek mines certainly do not call for legislation on the subject by California. The one general source of danger from dangerous gases in a mine which would require artificial breathing apparatus more at a small mine than at a large one is not touched upon in the rules at all; namely, going back to a round of holes too soon after the shooting. Knockouts by powder smoke are common and frequent, and more so in a small mine than in a large one, because in the larger ones there are more means of ventilation, more system about the shooting and less anxiety on the part of the individual workman about his particular round of shots.

Another section provides that dust from drillings or chutes must be allayed, the necessary devices and appliances therefor being furnished. That is some proposition to put up to the mine operators: "Must be allayed." There are a great many mine operators who would be glad to allay the dust in their mines if somebody would tell them how it can be done. Several of our own drill manufacturers have been struggling with this problem for many years and the South African operators have been working on it still longer, and after a great expenditure of both talent and money the problem is still unsolved for them.

That section which provides that in no case shall explosives be exposed to heat of more than 80 deg. F. will give an officious mine inspector a chance to make a great deal of trouble for the operator. It is 20 deg. lower than the maximum temperature the United States Army regulations allow for their magazines containing dynamite, and while 90 deg. is, 80 deg. is not, a particularly warm day for the sunny side of a mountain slope in California in the middle of summer. The clause making compulsory the use of powder cartridges covered with bright red wrappers is going to cause trouble, mitigated only by the opening section which provides that the mine inspector can abrogate these rules at his discretion.

The section which provides that no explosive that evolves a more noxious gas than gelatin dynamite shall be used, will make almost any mining operator "throw a fit." If this provision is enforced there never will be any more straight dynamite used in mining operations in California. Gelatin dynamite is not always adapted to the blasting problem of a miner, and in general it does not meet the requirements for average mining operations as well as nitro-glycerin dynamite. The one big argument which justifies its use in the face of less-to-be-desired results from nitro-glycerin dynamite is the fact that it produces very much less noxious gas on detonation than does nitro-glycerin dynamite. Straight nitro-glycerin dynamite produces from 26 to 35% of carbon monoxide on detonation and gelatin dynamite produces only about 3%. This provision is therefore equivalent to specifying that nothing but gelatin dynamite shall be used in California mining operations.

New York, N. Y., June 15, 1915. W. R. PERCY.

Finnegan Mines

My attention has been called to a report on the Finnegan and Finnegan Extension Mines, situated at Carson Hill, Calaveras County, Calif., signed "Edwin N. Hawkins, E. M.," and dated Denver, Colo., Oct. 1, 1914. This report contains several unfounded and erroneous statements regarding the Melones Mining Co. which operates the adjoining property, and as the management is quoted as authority for these statements, I wish to correct the false impression which they might cause.

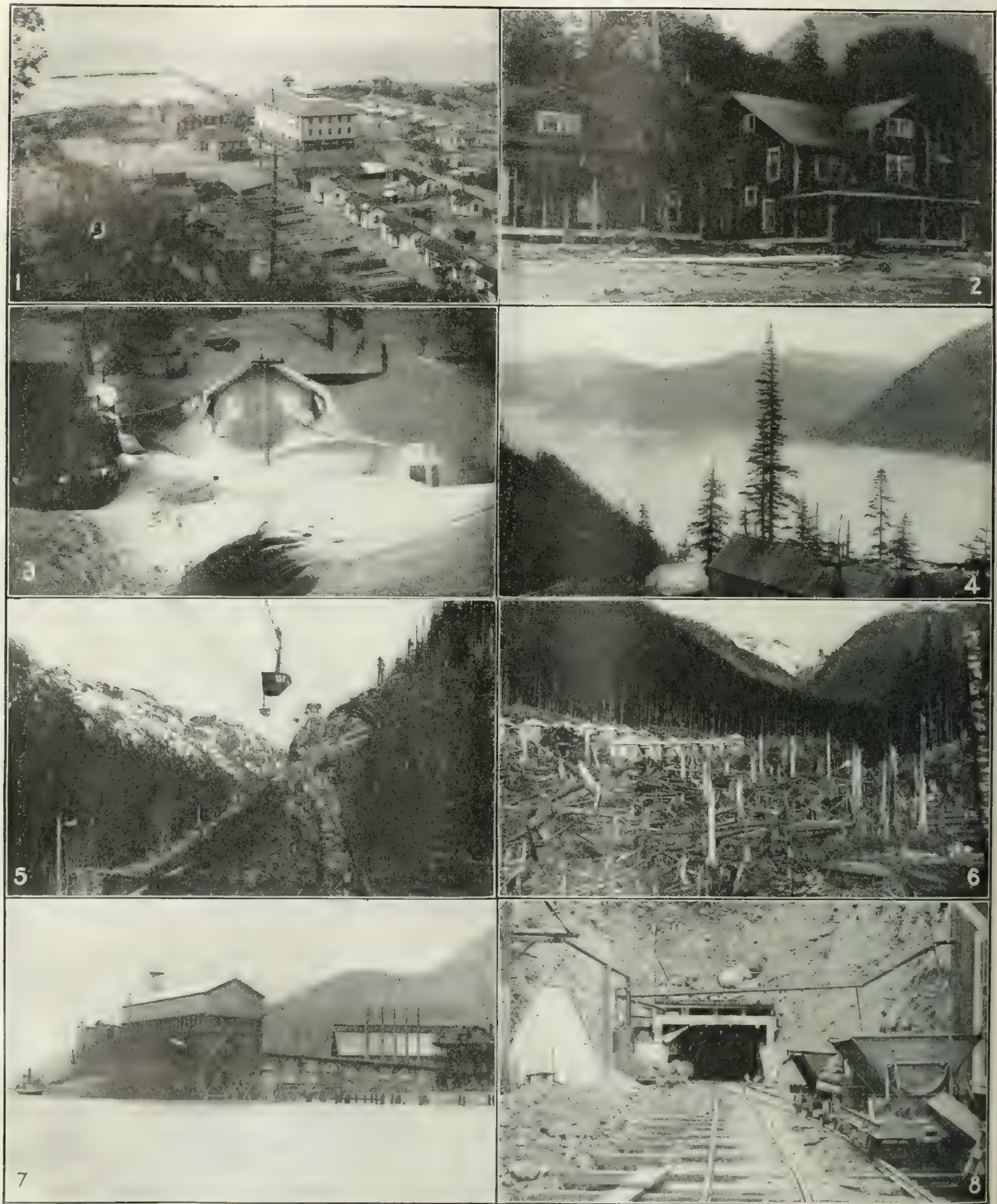
The report states: "It is estimated by the Melones company that it has ore reserves good for 75 years." The Melones company has never had ore reserves of this size at any time in its history and it would be absolutely impossible ever to have them. The company has had ore reserves in sight for as much as three years, but usually has only two years' supply blocked out. It is further stated: "Pocket or nugget value of ore (not included in above, or run of mine ore) is $150,000 to $200,000 annually." As a matter of fact the average annual returns from this source are about $1500, notwithstanding the fact that in 1911 one pocket was discovered which contained about $5000 in coarse gold. This is the only occurrence of the kind of importance since operations were started in 1903.

It is also stated: "Present annual net profits of Melones company, as stated by those in authority at mine and mill, are $400,000." This is untrue and no one in authority ever made such a statement. The Melones Mining Co. has never paid a dividend and has paid no interest on its bonds since 1906; consequently its operations have been unprofitable. The management of the Melones Mining Co. cannot, in fairness to itself or the public, let statements of this character pass without correcting them.

WILLIAM C. [illegible].

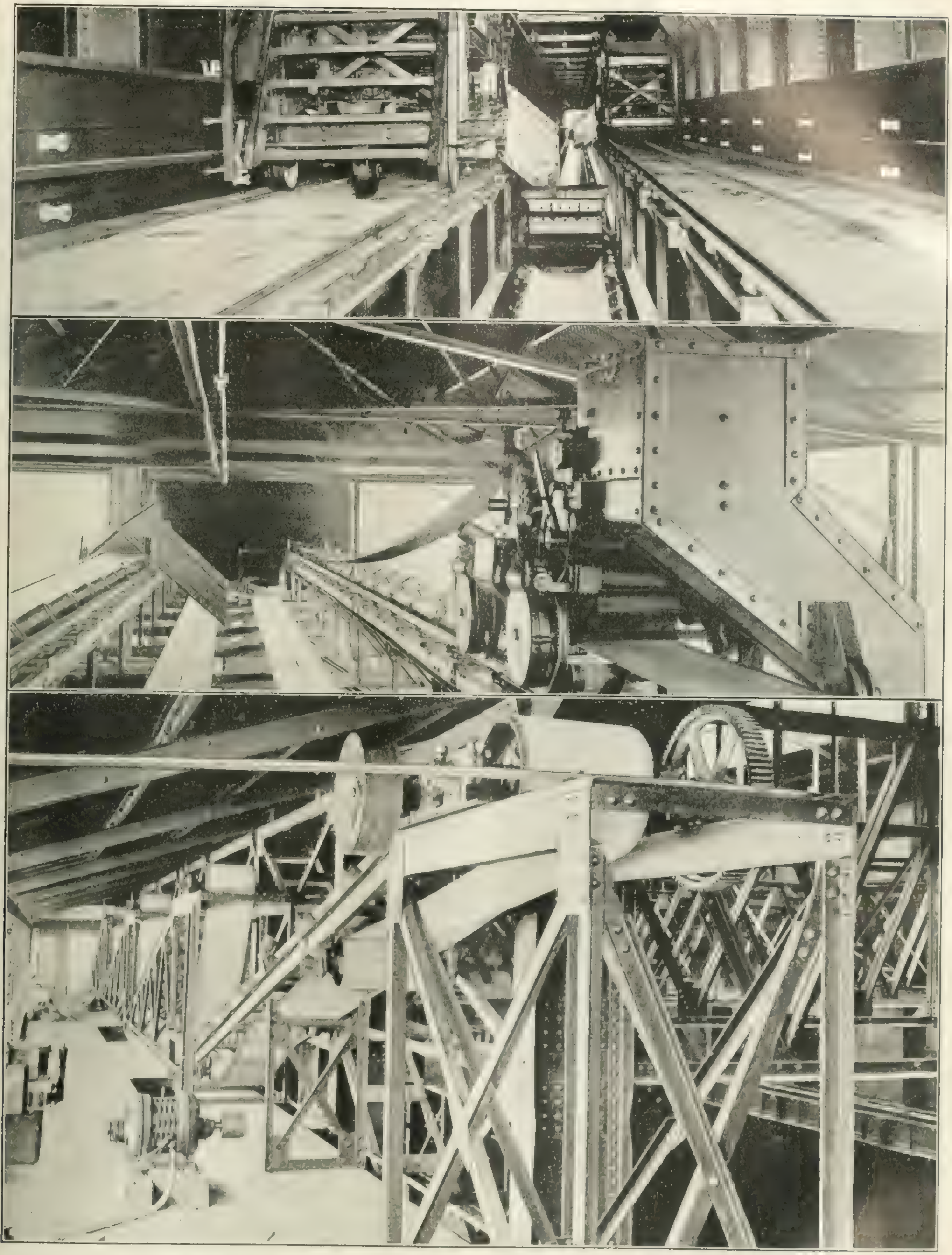
Melones, Calif., June 3, 1915.

Photographs from the Field



BRITANNIA MINES, BRITANNIA BEACH, B. C.

1—Townsite and company store 2—The hospital. 3—Mountain moonlight in winter. 4—Above the clouds in the upper camp. 5—Aerial tramway from the mine 6—The beginning of Halfway townsite. 7—Shipping dock and old mill. 8—The 220-ft. adit, 1336 ft long, main mine entrance.



NEW CONVEYING SYSTEM OF UNITED VERDE COPPER CO., CLARKDALE, ARIZ.

Upper view—Self-propelled feeder supplying conveyor belt. Middle—Fines conveyors with automatic trippers. Lower—Conveyor over silica hoppers. Discharge effected by stationary [illegible]. The system was supplied by the Webster Mfg. Co., Tiffin, Ohio

A New Era in Mining Education

By Charles F. Willis*

For many years it has been observed that there was something lacking in the methods of mining education; only a few were being served and men were not being trained for other than leadership. Even at that the training was faulty, for the men lacked the distinct training in administration. They also lacked the practical training necessary for the positions in the middle of an organization. The College of Mines of the University of Arizona has put forward a plan, which is the result of several years' observation of the needs of the mining industry, to remedy this.

Workers in the mines, mills and smelteries may be divided into three distinct classes; first, the young man having only a common-school education. These are the men to fit for shift bosses, for floor foremen in the mills, for furnace foremen and the many men on the third to the sixth rungs of the ladder of progress.

The second class includes the young men having an advanced grammar- or high-school training. These are the men who should be trained for mine foremen, mill foremen, and the many positions requiring a partial technical training coupled with sound practical experience. The third class includes the men of scientific institutions being trained expressly for the administrative offices. The work designed by the Arizona College of Mines for the first class is for the man that is unable to attend school for any great length of time. It is a short course in mining, but applied in a totally original manner. There are to be 18 two-week short courses, each subject to be given alone and intensively for two weeks with the theory and practice, lecture and laboratory, and with work in the necessary affiliated subjects. Affiliated subjects will follow each other in regular order and the student may spend two, four, six, eight or any number of weeks, each course being distinctly related to the course before and after it. Instruction will be given in the following order: Elementary mineralogy and blowpipe analysis, elementary surveying, elementary geology and petrography, field geology, prospecting, assaying, cyanidation, concentration, mine blacksmithing, mine timbering, practical mining other than underground, practical underground mining, use and care of rock drills, electricity applied to mining, mechanics applied to mining, gas engines, cost accounting and management and copper-smelting practice.

This system allows for a more efficient training for the men in class 1, giving them a method for more rapid advancement at practically no cost to them. The University of Arizona, being a state institution, can go ahead on these lines where a privately endowed institution cannot.

The method for more efficient preparation for the men of class 2 offered more difficulties. One cannot get far away from the present four-year course of the majority of the mining schools. A too broad training only partially fitted them for the niche they were to fill, while a too practical training was not sufficient to fit them for the work they should be able to do. Here the advantageous geographical position of Tucson was utilized.

The need for class 2 men is not so much an additional quantity of practical training as it is more practical training in successful mines and reduction works, as it is the positions of practical men with theoretical knowledge that they have to fill. During the senior year the classes will attend regular college work for the first half of the week, and the last half of the week will be taken up in the practical application of their theory and taught at successful properties. Cyaniding will be studied at Tombstone, Pearce and Wickenburg; smelting practice at Douglas, Hayden, Globe and Miami; mining methods at Bisbee, Tombstone, Pearce, Ray and many other places. Ore dressing will be observed at Hayden, Globe and Miami; flotation and copper leaching may be studied at Ray, Miami and Ajo. This work will give the student a more practical insight into the industry he is choosing as his profession and allow him to live in the atmosphere of the mining industry. The men represented by class 3 need research and administration in a graduate school, and to this end has been organized the Arizona State Bureau of Mines, a research bureau and a graduate department in mining and engineering administration. The men represented in this group will have passed through the stages of the first and second groups, will have had their practical training and will be ready to specialize and train for the highest positions.

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*Director, Arizona State Bureau of Mines, Tucson, Ariz.

Mining Royalties at Cobalt

In the report of the Temiskaming & Northern Ontario Ry. Commission upon the mining industry in that part of northern Ontario served by the Ontario Government Ry., there is an explanation of the royalties payable by certain mines at Cobalt. Since there has been a rather general lack of information on the subject, some excerpts from this report may be of interest.

When the Temiskaming & Northern Ontario Ry. was started, the government placed the management under a commission. The railway was granted a right-of-way and also certain townsites along the line of location. Later on, the government also granted to the railway the minerals underlying the right-of-way and under the townsites except where these had already been disposed of. In the vicinity of Cobalt these mining rights proved valuable in the case of the right-of-way itself and also under the townsites. Instead of undertaking mining operations the railway commission divided its mining lands into convenient lots or parcels and leased them to companies or individuals who acquired them by public tender. In this way four lessees have worked and made returns to the railway. These are the Cobalt Townsite Mining Co., the City of Cobalt Mining Co., the Right of Way Mining Co., and the Nancy Helen Mines, Ltd. The company acquiring a lease paid a cash bonus to begin with, and thereafter a royalty on shipments. Originally the royalty was based on the value of the ore at the collar of the shaft, but this was later changed to a percentage of the net profit. The policy of the commission has been to assist the lessees from time to time by a gradual reduction of royalties as the resources of the mine were exhausted. This has worked out satisfactorily, both to lessor and lessee.

Each lease began by paying 25% royalty on the value of all shipments at the collar of the shaft, with the one exception of the Townsite company, which was supposed to pay 50% royalty on all ore assaying over $1000 per ton and 25% on ore assaying lower than that amount.

This was early considered unsatisfactory, and the uniform royalty of 25% on the gross value was adopted. The next reduction was to 25% net—that is, on profits calculated under what is now called the "Mining Tax Act." Further successive reductions have been to 20%, 17%, 15%, 12½%, 10% and 7½%. On July 1, 1914, all leases from the railway commission were reduced to 7½%, and the agreement now stands that this will be the royalty until Sept. 1, 1915, on which date all royalties will be reduced to 5% on the profits.

The royalties received by the T. & N. O. Ry. Commission from its mining leases up to Oct. 31, 1914, are:

Cobalt Townsite	$270,483
City of Cobalt	100,791
Right-of-way	272,109
Nancy Helen	6,127
Mining Corporation of Canada	8,406
Total	$666,916

A number of other mines at Cobalt pay royalty directly to the government on certain special arrangements, but these have nothing to do with the T. & N. O. Ry. Commission. Thus, when the Crown-Reserve company's mine was sold by the government, a clause was attached to the deed of sale whereby that company paid a certain amount of cash for the property and in addition a royalty of 10% on all ores shipped, the valuation being the gross value at the collar of the shaft. A similar clause was attached to all sales of lots in the Gillies Limit.

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The Alleged Zinc Smelters' Combination

The *Boston News Bureau* gives the following summary of conditions:

> Attorney-General Parker, of Missouri, has filed an information in the Supreme Court of that state against the 28 companies alleged to be interested in the purchase of zinc ore in the Missouri district, stating he had reasons for believing that they were in an unlawful combination to control prices.
>
> This action is believed to have been brought at the behest of Missouri ore operators who are smarting under what to them is an irritating price margin between the finished spelter and the ore from which it is produced, which at the moment is very greatly in favor of the smelting companies.
>
> The suit is brought against practically every zinc smelter in the United States. In this connection it is interesting to note that back in 1906 Missouri produced 65% of the zinc ore mined in this country, and the ore operators of that state were the dictators of ore prices. In other words, out of 200,000 tons, Missouri produced 130,000. In 1913, however, the total ore production of the United States had grown to 337,000 tons, but of this Missouri produced even less than it did in 1906, or 129,000 tons, or but 30% of the total. [These figures are manifestly erroneous, but the idea that is sought to be conveyed is correct.—Editor.]
>
> In other words, Missouri operators are no longer in control of the price situation and they have combined to fight the smelting companies, with the evident purpose still further to boost the market for Missouri zinc ores, notwithstanding ores have more than doubled in price in the past few months and are now selling for better than $100 per ton.
>
> For a year or two preceding the recent extraordinary rise in spelter there was no spread between ore and spelter sufficient to show a profit to the smelting companies in the purchase of ores. Today the situation is reversed and while ore prices have more than doubled, spelter prices have more than trebled and the ore operators are "peeved."
>
> As a practical matter, when the market for zinc ores advanced beyond $60 per ton, production all over the country was speeded up and the supply of domestic ores and imported ores was very heavy, and with the relative shortage in smelting capacity and the urgent war demand for spelter it was not surprising that ore quotations were unable to keep up with the sensational advance in the "finished material."
>
> Now the Missouri miners allege that the buyers of ores—the smelters—are grinding the ore producers under the heel of monopoly and have oppressively conspired against them. In the opinion of the Eastern zinc interests the ore producers have not a legal leg to stand on. The idea of a "combination" among the smelters, who are now and always have been in the sharpest competition [illegible], [illegible] too absurd to be taken seriously.

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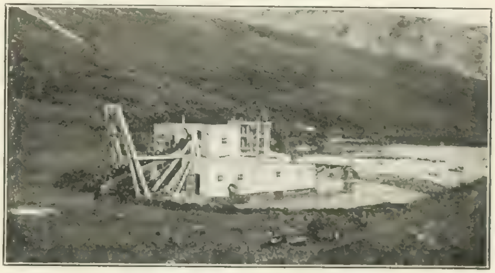
Flume-Type Elevator Dredges in Alaska

By Lewis H. Eddy*

Two new flume-type bucket-elevator dredges, built by the Flume Dredge Co., San Francisco, Calif., at the shops of the Straub Manufacturing Co., Oakland, Calif., were installed in the Nome country, Alaska, in 1914. One, in the Solomon River district, is owned and operated by [illegible] Flodin. The other, on Arctic Creek, is owned and operated by P. C. Servatius. Machinery and material were shipped from San Francisco and Seattle at the opening of navigation in the spring of 1914. Installation was completed and the boats began digging the first of August, and went into winter quarters in October, having had a profitable season. Operations will be resumed as soon as the ground thaws. The Flume Dredge Co. operates four of its own boats in Alaska, two in the Council district and two in the Solomon River district.

The economic and practical operation of this type of flume dredge in large areas of placer ground was demonstrated by the first one installed at Melsing Creek, Council district. With some minor changes and by placing the undercurrent within the housing instead of in the flume, the later dredges are identical in construction and are of the same dimensions and equipped with the same size buckets. The hulls are 60 ft. long, 28 ft. wide and 4 ft. deep, with 20-in. freeboard. Flumes are 74 ft. long and 30 in. wide. Buckets are of 2½-cu.ft. capacity, open-link. Riffles are of railroad iron. The undercurrent, built within the housing of the boat, consists of tapping the main flume with 6-ft. grizzlies. The material passing through the grizzlies is conducted to the undercurrent tables, also within the boat housing, which are the ordinary dredge tables provided with heavy screens of expansed metal over planks. Sluice water is furnished by a 12-in. centrifugal pump. The dredges are equipped with Western Gas Engine Co. engines.



FLUME-TYPE DREDGE, BUILT IN THE SOLOMON RIVER COUNTRY, ALASKA, IN 1914

DIGGING INTERRUPTED ONE HOUR FOR CLEANUP

The cleanup is made by running off the coarse gravel; then picking up the concentrates and putting them in the tank; and later running the concentrates through the cleanup boxes. This permits a short stop of digging, the cleanup for values being in progress after the digging ladder is again going, the riffles having been replaced in the flume as soon as the undercurrent and tables were cleaned. Digging is interrupted only about one hour for each weekly cleanup. The gold is usually coarse; in some streams quite nuggety, while in other streams there are no nuggets.

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*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

The advantages of the flume-type over the screen-type dredge for Alaska placers combine to permit the digging of pay ground only. Shallow draft, small power requirements, absence of mechanical aid in washing the gravel, recovery of the coarse as well as the fine gold, no conveying machinery for distribution of tailings and no water under pressure are the chief features of design and construction accountable for their economical and profitable operation. Lightness and simplicity of structure contribute to economy in upkeep costs, and the small initial cost of construction makes profit possible in placer diggings in Alaska that would otherwise be hazardous. The ground is shallow, from 7 to 12 ft. in depth, where this type of dredge is operated. It is designed for a maximum depth of 14 ft. Greater depth could be dug, if necessary, by reconstruction of the digging ladder. The labor includes three men on a shift. Common labor is paid 50c. per hr.; skilled labor, 62½c. per hr. Distillate costs 20 to 35c. per gal. laid down at the boats. Each boat will use 12,000 gal. in the season.

Freight from San Francisco or Seattle varies from $22 per ton to Solomon River plants, to $60 per ton to Secret Creek. Steamers to the Solomon River country land within 6 to 8 miles of the dredges. Steamers to Council district go up the river for a distance of 65 miles, and from there into the dredging camps transportation is by horse teams. At Solomon there is a railroad up the river carrying freight and passengers. Horses haul the freight cars and dogs haul the passenger cars. Inadequate transportation is responsible for retarding the advancement of the dredge-mining industry. Without such transportation large placer fields will remain undeveloped and unprospected.

John D. Ryan

Adams writes this in the *Boston News Bureau* of a very interesting and popular man in the copper industry:

> Friends of the president of the passing Amalgamated declare he knows copper and the vast field it covers not only by long experience, but by intuition. And events of the past eight months go far to affirm their assertion. For no man sensed more opportunely than John D. Ryan this year's astonishing rise in the copper metal. He predicted last December a great reversal in trade conditions, at least in his industry, and his predictions have been made good. Indeed, it is quite likely that, being a modest man, he would frankly admit that recovery has been faster and gone further than he himself anticipated six months ago.
>
> Ryan, by the way, has grown financially and otherwise almost as rapidly since the day he took his place, at the request of the late H. H. Rogers, at the head of Amalgamated's affairs. His corporate connections then were not overnumerous. Now they are both numerous and varied. He is president of several companies and director in many. Those he presides at the head of are Anaconda and Montana Power Co. His directorships, as I have indicated, extend variously. His one railroad is the St. Paul. His industrial companies are the Montana Power Co. and the Tobacco Products Corporation. His banking institutions are the Emigrant Industrial Savings, the Guaranty Trust and the Mechanics & Metals National Bank. His copper-mining companies are Anaconda, Inspiration and Greene-Cananea. So his multifarious official duties keep him busy
>
> Ryan, on the other hand, keeps himself physically in fine trim to discharge those duties. Big, athletic and in the prime of life, he also has naturally a capacity for work which is the envy of many of his colleagues. One of the latter said to me: "Ryan will go far. With his level head and unlimited vitality he can't help it." Go far? I should say so. Those who know him best insist that he is more ambitious to upbuild the properties he is identified with than he is to build up his personal fortune. He thinks less of himself than he does of his stockholders. And the Montana Power Co. is one of his pet projects. Not only does he hope to make it a big money maker—he desires also to see it a contributor, in a way, to the prosperity of all Montana and of the St. Paul R.R. by furnishing it power at prices lower than power costs in any Eastern center.

Railroad Construction Begun in Alaska

The construction of the Government railroad in Alaska has been begun. The preliminary base of operations is at Ship Creek, on Cook's Inlet. Thence, from tidewater, coal from the Matanuska field is expected to be shipped southward during the greater part of every year. The line, when completed in its entirety, will extend from Seward to Fairbanks, a distance of 471 miles, including the 71 miles of the Alaska Northern Ry., which extends from Seward, through the Kenai Peninsula, to Turnagain Arm. The dock on the right bank of Ship Creek near the mouth is practically completed. This dock is equipped with a 15-ton stiff-leg derrick operated by a hoisting engine, which takes the loads out of the scows in nets or large packages and places them on the dock or flat car. A gridiron with pile foundation was constructed to furnish level bases for the scows to rest upon when lying alongside the dock at low tide, and by this method lighters are unloaded at all stages of the tide. By utilizing water transportation along the east side of Knik Arm construction may be begun at various points. There is an active construction camp at Eagle River, a point 12 miles up the coast, and another has been started at Peters Creek, a point about 10 miles farther north. Camps will be established along tidewater, close to the railroad line, as fast as the final location is completed and the necessary construction arrangements made. Lieut. Mears reports: "We have now contracted with about 400 stationmen and are employing about 100 men on force account handling the terminal work and constructing wagon roads. I expect to rapidly increase this force to 1500 or 2000 men as fast as material and supplies can be shipped in here to accommodate that number. All of our work is being done by stationmen on a unit basis. Numerous gangs of stationmen have moved into Ship Creek seeking work on the railroad. We have had no difficulty whatsoever in securing all of the stationmen that are required."

Benzol Plants

The United States Steel Corporation has three benzol plants under construction. The plant at Farrell, Penn., is nearing completion and the other two at Gary, Ind., and Birmingham, Ala., will be finished in the fall. The plants now building have a capacity of approximately 26,000 gal. of crude benzol per day, or 9,500,000 gal. per year. The Otto Coking Co., of New York, according to the *Boston News Bureau*, has contracted to build a benzol plant in connection with the byproduct coke works of the Citizens Gas Co., of Indianapolis. This plant is to be in operation in 60 days.

Editorials

New Enterprises in Metallurgy

The last month has been unusually rich in announcements of importance to the metallurgical industry. Among these have been the report of the successful starting of the new system of metallurgy at Anaconda, with strong promise so far that the total extraction of copper is to be raised to some figure above 90% (instead of about 78%, at present); the inauguration of operations at Chuquicamata with so much smoothness as to make the management think it uncanny; and the news that the American Smelting & Refining Co. is going into the tin-smelting business. Of no less importance are the announcements this week that the Anaconda Copper Mining Co. is developing a copper mine in Chile and is contemplating acquiring interests in tin mining in Bolivia; and the official statement that the U. S. Steel Corporation is going to build a new and immense zinc smeltery near Pittsburgh, Penn.

Thus, we have witnessed the inauguration of two new departures in the hydrometallurgy of copper, which promise to be successful and of extraordinary industrial importance. We have witnessed, moreover, the beginning of plans that are going to give the United States a tin-smelting industry, the need for which our metallurgists and industrialists have long been urging. We surmise that the entry into this field by the accomplished, energetic and original metallurgists of the American Smelting & Refining Co., untrammeled by hoary precedents or preconceived ideas, will eventually lead to progress in the metallurgy of tin hitherto unequaled.

The new plans of the U. S. Steel Corporation for zinc smelting near Pittsburgh are of commercial concern, rather than metallurgical. The success of the Grasselli Chemical Co., which has two smelteries at Clarksburg, W. Va., and of the American Zinc & Chemical Co., which has an immense plant at Langeloth, Penn., has demonstrated that the region in the vicinity of Pittsburgh is a suitable locus for a zinc-smelting industry. It may be added that the Mineral Point Zinc Co. is operating a blende-roasting plant at Tiltonville, Ohio, and probably will some day erect distillation furnaces at that place.

The U. S. Steel Corporation is not a newcomer in the zinc-smelting business. It owns all of the capital stock of the Edgar Zinc Co., which for a great many years has operated smelteries at St. Louis, Mo., and at Cherryvale, Kan., works that have been large producers of spelter. Their production, however, has been far below the requirements of the U. S. Steel Corporation, which is the largest galvanizer and the largest single consumer of spelter in the United States. In *ante-bellum* days, in fact, the spelter market was determined more by the U. S. Steel Corporation than by any other single factor. With its buyer in the market for spelter, or out of it, there was apt to be the difference between strength and weakness. The sum that is now to be spent in construction is so large that a plant of great capacity is evidently contemplated. In the trade it is wondered whether the U. S. Steel Corporation is figuring upon the time when its works at Cherryvale (using natural gas) and at St. Louis (an antiquated, uneconomical plant) must be abandoned, or whether it is figuring upon producing its entire requirement of spelter—or whether it is figuring upon both of those things.

If the zinc-smelting capacity of the United States, which is already excessive for normal times—although temporarily strained to its utmost—is to be further expanded, and if the principal consumer of spelter is to disappear from the open market, there will arise questions that will be of supreme importance to all of the concerns that are now engaged in the zinc-smelting business. There is reason to believe that the new plans of the U. S. Steel Corporation are viewed with a great deal of alarm by the smelters.

An Alleged Zinc-Smelting Combination

The action of the Attorney-General of Missouri against the zinc smelters of the United States turned out to be not an indictment, as first reported, but merely the expression of a legal surmise affording grounds for the taking of testimony to find out whether prosecution ought to be instituted. The companies named in the "information" comprise substantially all of the zinc smelters of the United States. This was apparently designed to furnish broad grounds for a "fishing" expedition. Some of the smelters included in the list have not bought any ore in the Joplin district for a long time, while the purchases of a good many others have been relatively insignificant. In fact, out of the 274,000 tons of ore received by smelters from Missouri, Kansas and Oklahoma in 1914, the smelters who made sulphuric acid—chiefly in Illinois—took about 180,000 tons.

"These statistics," we said in an article in the JOURNAL, Mar. 6, 1915, "indicate the predominance of the sulphuric-acid makers in the market for the pure, high-grade ores. They take all the blende of Wisconsin and Tennessee, which they command geographically, and the major part of the production of the Joplin district, from which their competition has practically forced the Kansas and Oklahoma smelters, of whom the Edgar Zinc Co. is the only large buyer of the best sort of Joplin ore."

The action of the Attorney-General of Missouri was manifestly taken at the instigation of the mine operators of the Joplin district, who have long been of the opinion that the smelters buying their ores were acting in collusion to keep prices down. If there were any real ground for such a belief, action would have come more appropriately at a time when prices were low and the miners were being squeezed down to a narrow margin. But on the contrary, the dissatisfaction is expressed at a time when the price for ore had reached the highest figure on record, the complaint then being that the producers were not getting enough.

Everybody of good information knows that among the metallurgical industries of the United States in which unlimited and ruthless competition is rampant, the zinc-smelting industry occupies the first place. European and Australian visitors who have come here to negotiate the sale of ores have recently expressed their surprise at the recklessness of our smelters and the need for concentration and organization among them for the best interest of the industry as a whole. A reason why there has been no such concentration is the ease with which new people could go into the business. About 15 years ago there were some consolidations of isolated groups, but about as fast as anybody was bought out he turned around and built a new plant with the money that he had received from his old one.

The idea of a combination among the zinc smelters of the United States is simply an hallucination.

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Classification of Technical Literature

The classification, or filing, of technical literature is an ever-recurring subject, and thus far any discussion of it has left it where it began, in a very unsatisfactory position. The need of a proper system of classification and filing is evidenced by the frequency with which some man, of more temerity than his fellows, spends much time and effort in devising a scheme to fit his needs, which he then publishes for the benefit of his confreres.

Unfortunately, each of these trail-blazers, as he himself usually states, is viewing the problem from his own particular standpoint, and his suggestion, that the expectant reader adapt the same to his own needs, ends with disappointment the hope with which the reading of his article was begun.

All of this is not without fruition, however. Delegates from about 20 national technical and scientific societies have met in the United Engineering Societies Building in New York to discuss this problem and to perfect a permanent organization for the purpose of solving it and preparing a classification of the literature of applied science which may be generally accepted and adopted by these and other organizations. It is now conceded that such a classification is possible, and, if properly prepared, will serve equally well all branches of the engineering profession, thus solving the difficult problem of the individual engineer in his previous solitary effort at filing. A plan is proposed to this organization whereby a central office, presumably located at the Engineering Societies Building, shall collate all the existing classifications and, with the help of specialists in the various national societies interested, compile a general system which, although perhaps not perfect, shall justify general acceptance and adoption.

All of the other national societies will be invited to participate in this work, and they will invite the coöperation of the publishers of technical periodicals. It is suggested that, the classification having been properly worked out, the publishers may be induced to print in connection with each important article the symbol of the appropriate class in the system determined, so that by clipping these articles a file might easily be made which would embrace in one homogeneous system all clippings on all subjects pertaining to technical science. This will greatly lessen the work of filing, which at present is one of the serious drawbacks to a more general adoption of the practice among engineers. Another suggestion made is that the publishers be induced to adopt the practice, now largely followed by many, of beginning an important article only on the right-hand page. This will also facilitate the work of clipping and filing and very much lessen the labor of cross-reference indexing.

Thus, for the first time this big problem is being tackled by enthusiastic men on a coöperative basis, and it bids fair for the first time to be solved in a satisfactory way. This proposition is being handled on broad lines, and the organization will welcome, at the address given, specific suggestions regarding the subject.

⁂

The Lackawanna Coal Case

The United States Supreme Court on June 22 rendered a decision reversing that of the lower court in the suit brought by the Government against the Delaware, Lackawanna & Western R.R. Co. In order to comply with the Hepburn amendment or commodities clause of the Interstate Commerce Act, that company organized the Delaware, Lackawanna & Western Coal Sales Co., which buys the coal from the railroad company at the mines and conducts its sale, paying the railroad for transportation. Stock of the new company was sold to the stockholders of the railroad company. The Circuit Court held that this arrangement was a compliance with the terms of the law, and that the railroad divested itself of ownership of the coal before transporting it to market.

The Supreme Court holds that the distinction between the two companies is not sufficient. The coal sales company is managed by an officer of the railroad company, and is an agent bound by a monopolistic contract which prevents it from buying coal from other companies, from dealing in other coal, or from making competitive prices. The opinion of the Supreme Court declared the railroad retained an indirect interest in the coal and, by means of its contract, could control prices at New York. The court plainly indicated that the contract was monopolistic and directed the Government to bring a new proceeding against the Delaware, Lackawanna & Western to stop its alleged unlawful arrangement.

This decision does not necessarily apply to the Reading and Lehigh Valley cases now pending, as the conditions are somewhat different.

⁂

The price for lead came down as rapidly as it went up. Important sellers who at the close of one day said, "Oh, this is only a speculators' demoralization, which will not amount to anything, the consumptive demand for lead being so excellent," were themselves the leaders of the decline, with cuts of half a cent or so, the next day. Speculative operators started out to outdo the previous performances in spelter, but found that lead was not so important a "war material" as spelter. In the meanwhile the price for spelter has been experiencing a decline, which may best be characterized as a fadeaway. It went up to 25c. with the accompaniment of a brass band, but is slinking downward as if nobody wanted to hear any more about it. The Wall Street organs are still talking about a natural recession from which there will be a rally to 30c. per lb., "the proper price for spelter," which is to happen "when the buying demand is resumed." However, there is nobody in the business who expects a "comeback."

BY THE WAY

The tremendous rise in the price of zinc is causing cyanide mill men to begin a vigorous research for some substitute. One distinguished mine manager expresses the opinion that many a mill will ultimately turn to electrolytic precipitation. The desilverizers of lead bullion are also telling tales of woe with respect to how the present price for zinc has increased their refining cost.

*

Gold mining in midair is one of the latest spectacles to which Wall Street was treated, says the New York *Herald*. Suspended in what is known in the language of the sea as a "boatswain's chair," at the end of a rope leading from the roof of a skyscraper, a workman was busily engaged for hours in scraping into buckets gold-laden soot from the flue of the old United States assay office, now being razed.

*

Unable to buy food from local sources for its employees at Pachuca, the Cia. Real del Monte y Pachuca, through its parent company, the U. S. Smelting, Refining & Mining Co., has appealed to the American Red Cross for aid. Arrangements have been made to forward 25 carloads of corn for the relief of the 1000 employees of the company at Pachuca. Several carloads of grain and provisions contributed by the large packing houses have already been shipped by the American Red Cross for the relief of famine-stricken noncombatants in northern Mexico. On June 15, U. S. Consul Hanna reports having distributed American Red Cross corn to 12,000 starving Mexicans in the vicinity of Monterey.

*

At the recent annual meeting of the National Wholesale Liquor Dealers' Association, in Cincinnati, Samuel Woolner, its president, remarked in the course of his address: "The persons engaged in the liquor business contend that they are simply supplying a want and a need. The demand is here, otherwise there would be no supply; that the people have an unalienable, inborn and God-given right to their product; that it relieves more misery than it causes; that it produces more joy than sorrow; that it adds to the efficiency instead of taking away from it; that it is a tonic for the body, a stimulant for the body, producing stronger and healthier minds, which is a greater preventive for crime of all kinds, and causes a lesser demand for institutions such as jails and hospitals for the insane, feeble-minded, etc., than would be required under prohibition or total abstinence." We think that Mr. Woolner must be an optimist.

*

The following prospectus promises us the kind of a fortune we have been looking for. Our natural spirit of unselfishness, however, will not permit us to monopolize it. Hence, we offer to divide the "snap" with JOURNAL readers. Remittances may be sent in our care by dray or auto truck.—EDITOR.

"This proposition consists of 1000 acres of fine West Virginia coal lands, located in Calhoun County, approximately three miles from a railroad. The whole of this acreage is underlain with a seam of excellent steam coal carrying an average of $3 per ton in gold.

"The coal from this property can be utilized in order to supply power to large industrial enterprises near by, and the ashes that remain can be run over amalgam plates and an extraction of 98% of the [illegible] can be obtained. The remaining residue from the plates consists principally of aluminum oxide, and this can be treated in an electric furnace, thereby producing beautiful synthetic rubies, sapphires, and all other precious gems, whose principal constituent consists of the chemical compound aluminum oxide.

"There seems to be a wonderful monetary [illegible] attached to this magnificent opportunity and it only needs the fine touch and assistance of a few wealthy men to make this property one of the greatest, if not the greatest, revenue producer of the age. The fortunes to be won from this bounteous reserve of Mother Nature shall make the modern fortunes of our mining barons, such as Clark, Haggin, Jackling, seem like ordinary pikers. All we need is a mere bagatelle of $50,000 to place this mine successfully operating. Will you help?"

*

Another chapter in the Marañon River placer fiasco was begun in Delaware on June 8. On that date the grand jury, at Wilmington, returned a true bill against Raymond McCune for misuse of the mails in connection with the mailing of circulars of the Peru Gold Placers, Inc., and against Charles S. Miller on a charge of conspiracy with McCune and for withholding certain documents that would have led to an earlier examination of the property by the board of directors. Miller was formerly president of the company, and McCune was general manager and the author of the reports in question. As the specific act on which McCune was arrested was the mailing of a circular to a resident of Wilmington, where the corporation has its Delaware headquarters, it was decided by U. S. District Attorney J. P. Neilds to bring an action in that district. The charges were investigated by the grand jury, with the result noted. Some 50 witnesses were subpœnaed, including practically all the directors and 25 residents of Delaware who had received circulars through the mails. The principal witnesses examined by the grand jury were Frank R. Short, the engineer who investigated the property for the directors and reported it to be of no commercial value, and George P. P. Bonnell, who as treasurer went to Peru last year to represent the financial interests of the company and whose letters to directors here hastened the exposure of the worthlessness of the Marañon River placer. McCune's hearing in New York has been postponed until June 29. He has engaged former District Attorney Wise and evidently intends to put up the strongest defense possible to offset the Delaware indictment. Those who bought stock in the public offering of shares of the Peru Gold Placers, Inc., will not suffer a complete loss. The company has no debts, there is some cash in the treasury, and there are still some bills receivable, as the equipment in Peru has been sold, mostly on 90 days' time, to operators of the silver mines at Huallanca, about 30 miles distant from the Marañon placer. Further, it is understood that the directors and officers of the Peru Gold Placers, Inc., have signified their intention to relinquish all claim of participation in the assets, on account of stock bought by them, so that the share of the public therein may be as large as possible.

PERSONALS

John A. Fulton, superintendent at Melones Mine, Melones, Calif., was presented with a daughter on June 12.

D. D. Muir, of the U. S. Smelting, Refining & Mining Co., is in the East consulting on plans for the Ebner mine, at Juneau, Alaska.

A. G. Burrows, of the Ontario Bureau of Mines, is making investigations in the Porcupine District for a forthcoming geological report.

A. A. Hassan, of New York, has made a preliminary examination of the gold deposits in Montgomery County, Md., near Great Falls of the Potomac.

Philip Argall, of Denver, was in London last month and addressed the stockholders of Stratton's Independence, Ltd., of which he is consulting engineer.

Dr. R. Harris for the Canadian Geological Survey is conducting an investigation of the asbestos deposits of Quebec, especially those of the Thetford area.

J. B. McKennan, for a number of years manager of the Minnequa plant of the Colorado Fuel & Iron Co., has been appointed general manager of the company.

John A. Munroe, a well-known mining man of northern Ontario, who was at one time mayor of Elk Lake, and who enlisted with the Princess Patricia regiment, is reported as severely wounded.

Dr. D. D. Cairnes, of the Canadian Geological Survey, has gone to the Yukon to examine an area on the Stewart River including the gold-bearing quartz of Dublin Gulch and the silver-lead deposits near Mayo Lake.

O. E. Lafleur, formerly connected with the Berwind-White Coal Mining Co., has been placed in charge of the coal department of the Harris-Smith Coal & Coke Co., Uniontown, Penn. The company will soon remove its offices to Pittsburgh.

Dr. W. H. Collins of the Geological Survey of Canada will continue his work on the correlation of the pre-Cambrian formations north of Lake Huron, and will start the areal mapping of the Sudbury district and an investigation of the nickel-copper deposits.

Dr. E. L. Bruce will continue his investigations of the ore deposits of Amisk (Beaver) Lake district in northern Manitoba and Saskatchewan for the Canadian Geological Survey and A. McLean will complete the mapping of the Pembina Mountain area near the U. S. boundary.

Samuel W. Cohen has just returned to Cobalt from a three-months' trip to Nicaragua where he was engaged in the examination of gold mines under option to the Crown Reserve Mining Co., Ltd. Assisting Mr. Cohen in the examination were E. L. Steindler, A. Burnett, H. Bischoff and G. Miller.

George E. Farish, who since January has been in New York in connection with the sale of the Humboldt mines, Colorado, left June 17 to examine the Copper Basin group in southern California. Before returning, he will visit the San Francisco fair and also the Derry Ranch placer property at Leadville, Colorado.

Dr. M. E. Wilson will this summer continue the geological examination of the Buckingham area in Quebec for the Geological Survey of Canada, paying particular attention to the deposits of mica, graphite and apatite. Mineralogical investigations in the neighborhood of Templeton will also be carried on by Dr. Auguste Ledoux.

Austin D. Mixsell, who has been made a vice-president of the Bethlehem Steel Co., has reached that post after a period of 18 years in the service of the company, both in the manufacturing and sales departments. He joined the Bethlehem organization in 1897 in the metallurgical department and the five years succeeding were spent there in special steel making and in experimental work. After several years in the openhearth, treatment, forge, rolling mill, foundry and physical laboratory departments, he became chief of the estimating and inspection departments.

Captain Richard Bowden, who has been employed at the Trimountain mine of the Copper Range Consolidated, ever since the first work was done at the property has resigned his position, effective July 1. For a number of years Captain Bowden has been superintendent of the Trimountain property. He has decided to give up mining for a few years at least, although his plans for the future are not finally determined. Captain Bowden's many friends throughout the district will learn with regret that his future plans contemplate a removal from the copper country.

OBITUARY

George D. Roberts, president of the Exploration Oil Co., formerly the United Development Co., died suddenly of heart disease at Coalinga, Calif., June 22. Mr. Roberts was one of the most prominent oil operators in California and resided at Los Angeles. Years ago he was a Wells-Fargo messenger and his car was robbed by the notorious Sontagg and Evans gang in 1892. Roberts, although wounded by the robbers, took part later in running them down and capturing them.

Park Henshaw died at Chico, Calif., June 12, of paralysis of the brain. He was similarly stricken on March 10, 1913, but was believed to have recovered fully. Mr. Henshaw was born near Kahokia, Clark County, Mo., in 1846. As a boy he served in the Confederate Army in the Civil War and went to California in 1864, residing with an uncle near Oroville. Later he returned to Missouri and studied law, then went to California and began practice at Chico where he had lived ever since. Mr. Henshaw was one of the foremost men in Butte County in advancing the industries and was particularly devoted to mining. He was made colonel of a volunteer regiment in the Spanish-American war and served for a year.

Joseph Weissbein, president and manager of the Gold Flat Pittsburg Mines Co., died at Grass Valley, Calif., June 5 in a fire which burned his residence bungalow at the mine. It was believed at the time that he had been killed and the fire started to cover up the crime. Mr. Weissbein went to California in the early séventies from New York and in 1876 with his brother Jacob, established the Weissbein Bros. & Co. Bank. The brothers were owners in the W. Y. O. D. mine when the property was absorbed by the Pennsylvania Gold Mines Co. They were also largely interested in other mining operations. Recently the brothers sold their bank in Grass Valley to the Nevada County Bank and went to San Francisco where they organized a real estate firm, but continued to be interested in mining operations.

S. Gulishambaroff died at Tiflis in the Caucasus, May 14, aged 65 years. He was considered the foremost petroleum expert in Europe. His writings upon a multiplicity of matters associated with the petroleum industry will long remain as among the most valuable contributions to technological literature. As early as 1874 Mr. Gulishambaroff published works upon the petroleum industry of the Caucasus, while in the early eighties, after his first visit to the oilfields of the United States, he wrote his first account of the wonderful developments for oil in the western hemisphere. These comparatively early works were followed by a large number of others, all of which were recognized of such importance as to be translated from Russian into the English, French, Swedish, Dutch, Japanese, Italian, Spanish and Portuguese languages. Mr. Gulishambaroff, who occupied an official position for many years as adviser to the Russian Government on all matters relating to the industry—technical, legal ,and otherwise—completed his studies at the Technical Institute, St. Petersburg, in 1874, after which he devoted himself to technical research connected with the technology, commerce, and industry of Russia. So much a master did he become on the subjects which he took up that he undertook several commissions by the Russian Government to visit foreign countries for the purpose of investigating their economic and industrial conditions, and it was in this connection that he made three visits to America. In the year 1894, Mr. Gulishambaroff published his work upon liquid fuel, which passed through two editions, while three years later, the Imperial Geographical Society presented him with a gold medal for his publication dealing with the world's commerce during the nineteenth century; apart from this, he received many acknowledgments from scientific and technical institutions for the works he had writen and published.

SOCIETIES

American Institute of Mining Engineers—The members of the Minnesota Branch met with those of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, June 7, at Duluth for a two-day session. J. H. Hearding, General Manager of the Oliver Iron Mining Co., reviewed the mining industry of the Minnesota ranges, with the aid of moving pictures; W. N. Ryerson, of the Great Northern Power Co., gave an illustrated talk on his company's plant. Inspection of the new steel plant of Minnesota Steel Co. and the plant of the Universal Portland Cement Co. consumed the remainder of the session.

Editorial Correspondence

SAN FRANCISCO—June 16

Crude Oil Prices at the well for oil of less than 20 deg. gravity has been reduced 5c. per bbl. by the Standard Oil Co. This brings the price for the lower grades down to 32½c. per bbl. The reduction adds to the troubles of the low-gravity producers who had not recovered from the effects upon fuel oil business caused by the European war. The action of the Standard Oil Co. is said to be the result of competitive selling in domestic markets. The Shell Oil Co. has invaded the field covered for years by the Standard, Associated and the Union and these older concerns have been obliged to meet selling prices of the Shell. A year ago the consumer in the San Francisco Bay region paid approximately 75c. per bbl. at the tanks in central supply depots with an average additional charge of 7c. a bbl. for delivery. Many of these consumers are reported to have made contracts with other than the three older companies at 64c. per bbl., deliveries to begin in less than one year after signing contract. It is reported, also, that new business for immediate delivery has been signed up at prices below the rates quoted a year ago. The production of the Shell company in Coalinga district is estimated at more than 12,000 bbl. per day. A large percentage of this production is shut in pending the completion of the company's pipe line to Martinez. This company is not buying large amounts of oil from other producers, so that the reduction in prices paid the producer cannot be charged to the Shell people.

Cancellation of Patents to Oil Lands embracing 6400 acres in Elk Hills district, Kern County, was ordered by Judge Robert S. Bean of Portland, sitting in the U. S. District Court at Los Angeles, on June 11. Action was brought by the Government to regain title to 10 sections of land near McKittrick, which was patented to the defendant corporation under the act of Congress, July 7, 1866. These lands were granted to aid in the construction of the Southern Pacific R.R., mineral lands, except iron and coal, being excepted from the provisions of the grant. The court found that the lands were, at the time of proceedings resulting in the patent, within a known and recognized oil district and had been previously returned by the U. S. Geological Survey as oil-bearing lands. The court held that these lands are rough, broken up and of no value for agricultural purposes or any other purpose than for their oil contents. It was admitted that the statements in the affidavit of Charles Eberlein, that he caused the lands to be carefully examined by agents and employees of the Southern Pacific Co., was untrue. That, at the time the selections were made and the patent issued, officers of the company in charge were conscious that the lands were, if not actually, at least probably oil-bearing, and that the selections were made and strenuously urged to patent for that reason and not because of agricultural value. Nearly two months before the selection was filed Eberlein wrote to Mr. Kruttschnitt, vice-president of the Southern Pacific, saying he expected to tender a selection list covering lands in the township in question within a week or 10 days and asked that the matter be given special attention, to the end that these lands be covered by the proposed patent. In the meantime the Kern Trading & Oil Co. was organized to take over the oil lands of the Southern Pacific and operate them the same as in the fuel department. Without Eberlein's knowledge the lands belonging to the railroad company in the vicinity and adjoining the lands in this dispute were leased to the Kern Trading & Oil Co. The court declared that while no actual discovery of oil within the boundary of these disputed lands had been made, that was not necessary because they were known as oil lands at the time of the proceedings resulting in the patent. The court concluded that the topographical and structural formation and character of the lands and the surrounding area, and their proximity to known oil development to the south and west, and the geological structure and the known surrounding conditions, all clearly show that the land contained mineral-oil deposits of such quality and quantity as would render their extraction profitable and justify expenditure to that end. Willis N. Mills, special counsel for the Government, who made the closing argument before Judge Bean last January is reported to have estimated that the oil contents in the lands thus returned to the Government would supply the U. S. Navy with petroleum fuel for a period of 25 years. The value is said to be [illegible],000,000. Another suit involving oil lands in the sa[illegible]d of much greater value is still pending in the U. S. District Court. The motion of the Southern Pacific Co. to dismiss the action on the ground that the statute of limitations had supervened was recently denied by Judge Benjamin F. Bledsoe.

BUTTE—June 17

Butte Miners Quit Federation—Alleging that in the [illegible] years of its affiliation with the Western Federation of M[illegible] it had contributed $1,000,000 to the Federation for which it had not received one cent's worth of benefit, and hinting at irregularities in the handling of strike funds by Federation officers, the Butte Miners Union, the parent organization of the Western Federation of Miners has formerly withdrawn from the Federation, repudiated the contract which existed between the two organizations and ordered its charter returned to Federation headquarters at Denver. The action is the outcome of friction between the Butte Miners Union and the Western Federation which culminated a year ago in the dynamiting of Federation headquarters. Following is a sample of how the daily papers are used to coax recalcitrant miners back into the folds of the old union:

> **FOR 30 DAYS**
>
> For 30 days you can become a member of the Butte miners union upon payment of one dollar. Members are worth more than dollars. If you are engaged in the mining industry you should be a member of the miners' union. Get in. Get busy. Bring others in. Put Butte on the map again as the best union town in the country, and help to make the miners' organization the bulwark of the toilers.
>
> The day of the union knocker and character assassin has passed in Butte. They are the enemies of every worker—they try to create division and distrust. Such men are doing the work of the detective whether they are paid for it or not.
>
> The union men of Butte today realize how much they need the miners—and the miners need us. Our hand is outstretched to aid them. Today every obstacle in the way of the miners' reorganization is removed, and every labor union in Butte is ready to lend all possible aid. The future of the miners depends upon themselves. United they stand—divided they fall. Which side are you going to take? Do you stand for unity or division? Will you strive to maintain and improve conditions or will you aid in destroying them? Talk is cheap. Show your card.
>
> Every day's work, with copper around the present price, brings you an extra 50 cents per day because of the union contract. That is some of the union's work—you are glad to get the benefits derived from organization. Keep up your union if you want to keep up wages.
>
> The union hall is the place to discuss every grievance and shortcoming of the union. Go there to solve the problems of organized effort; learn to cooperate with others. You and the union will both be the better for it.
>
> Let us profit by the mistakes of the past. Let us take warning from the miserable conditions obtaining in many open-shop communities. Let us unite in rebuilding a miners' union that shall be a credit to the workers, protecting their interests, redressing their grievances, making happier their lives.
>
> In behalf of a happier future, in the interest of all, we urge every worker in the metal mining industry of Butte to join the miners' union. The enrollment book is at the Workingmen's Office in the Carpenters' hall.
>
> You need a union—the union needs you. War is hell—so is the open shop. Let's avoid it. Unite. Do it now.—The Silver Bow Trades and Labor Council Mediation Board.

SALT LAKE CITY—June 18

Utah Alunite Deposits near Marysvale in Piute County are to be developed. The alunite lies principally within the Custer group of claims owned by the Mineral Products Co., which is backed by the American Fertilizer Co. of Chicago, and the United States Smelting, Refining & Mining Co. A 7½-mile Bleichert tramway from the mine to the railroad in Sevier Valley is to be built. Three oil-driven air compressors have been ordered, and development will be started at once, so that the deposits will be well opened up, before the mill, which is to be built, is completed. The Marysvale alunite carries from 9 to 11% potash, the price of which has advanced considerably since potash salts have ceased to come in from Germany. It is used largely in fertilizer. Alumina will be obtained as a byproduct.

Greater Production and Increased Earnings [illegible] Utah mines are following from the rise in the price of [illegible]. Bingham and Tintic as well as Park City show [illegible] production. The Utah-Apex, United States Mining, [illegible] Metal & Tunnel, and Utah Consolidated at Bingham [illegible] producing a good tonnage of lead ores. The Utah [illegible] working at fu capacity on a better grade of ore than usual. The lead smelteries in the valley are working at capacity. The United States at Midvale has five furnaces on lead ores; the American Smelting & Refining Co. at Murray, five; and the International at Tooele is working all five of its lead furnaces. From 800 to 1250 tons of lead ore daily are being treated at each of the different plants. The smelting capacity is somewhat limited by the amount of ore that can be roasted, as a large percentage of the ores being received are sulphides, with the exception of ores from Tintic and Beaver County, which are principally carbonates. The amount of sulphides which can be roasted at Murray is limited to 500 tons daily by court ruling. Owing to the present high price of lead, it has been proposed to make settlements on non-contract ores on a basis of $4.50 per cwt. and 50% of the advance beyond that price in 90 days. Or it is proposed to split the difference between $4.50 and the present market, and pay cash, which latter plan appears to be most favored by the smelters. Full payment is being made for ores under contract, and on certain desirable smelting ores. Ore is also bid for on the local market. Few new contracts have been signed, as there is much ore on hand, and those contracts at present in force, must be cared for. The accumulated lead ores on hand have been a source of profit. The amount of zinc ores being marketed is relatively limited, as it is difficult to ship these unless they are carbonates and run 30 to 40% or over. Most of the mines are working two shifts, as usual, but are increasing their working forces.

SEATTLE—June 14

Cement Factory at Fairbanks is plan of Henry Ray. Tests on limestone taken from a large bed outcropping on Goldstream near Fox are reported to have been entirely satisfactory. Men will be put to work at once to prepare lime for mortar and it is hoped cement plant will be built later.

The Yukon Gold is sending engineers to the Kenai River country to examine placer ground there said to extend along the river for 11 miles. The advent of the Yukon Gold dredging operations into this part of Alaska is hailed by the northern operators with delight as it indicates an opening up of the vast region of known valuable dredging ground back of Seward. Dredging in a small way has been undertaken in that portion of Alaska before, but not with equipment sufficient to bring big returns.

Recent Reports from Fairbanks are that there is great activity on Ester Creek, the old producer. On 1 Above Discovery, Johnson & Sandstrom have finished sluicing their winter dump and are working from a new shaft. Doolin & Thorsen have struck good pay on 2 Above. George Ray, on 1 Above, is sluicing his winter dump. Short, leaser on part of the Ray ground, is blocking out 60,000 sq.ft. that he plans to mine this summer. Sullivan & Olson are working crew of 40 men and expect to strip 90,000 sq.ft. of bedrock this summer. Webber, now scraping in bottom of winter dump on Discovery, plans to sink new shaft. Max Love & Co., on 1 Below, is driving tunnels. Charley Lynn, on 5 Below, is sluicing tunnel dirt and preparing for summer work.

WALLACE—June 16

Smelting the Coeur d'Alene Ores in the district is the principal topic of conversation and discussion around Wallace at the present time. A local smeltery would have no difficulty in handling the ores which are produced in the districts and all of the local producers including the larger companies desire a local smelting plant which might give them lower treatment charges and would certainly eliminate the long freight haul necessary at present, but the initial cost of a smelting plant to serve this district is so great that no one company seems willing to undertake it and to date there has been no satisfactory coalition to this end. The Hercules is still at a deadlock over the renewal of its smelting contract, and much of the underground equipment has been pulled and the mine has completely closed down. Negotiations have not entirely ceased between the Hercules and the A. S. & R. Co., but there is at present no evidence of an approaching compromise which will reopen the Hercules mine. The Bunker Hill & Sullivan was unable to obtain any concessions from the smelting company and has renewed its old contract without change of rate. When ex-Senator Clark of Montana a few years ago began the development of his Sunset property, his plans were supposed to include the erection of a smeltery on Beaver Creek and this project is now recalled and discussed with interest.

DULUTH—June 19

Ore is Now Moving at a Rapid Rate from the docks at the head of the Lakes, the lowering of the rail rate from the mines to the ports having stimulated the shipments. The Oliver Iron Mining Co. is the heaviest shipper, moving large quantities from all of the Minnesota and Michigan ranges, with the exception of the Cuyuna range where it does not own any mines. From present indications the Oliver will clean up most of the ore that it has in stock in the Lake Superior district, which will mean that it will work its underground properties with larger crews next winter than it did during the winter just passed.

Railway Developments on the Cuyuna Range—The Northern Pacific and Soo Line still continue their struggle for tonnage on the Range. The Soo Line has thus far had the best of it, hauling practically all the ore that has been shipped, but N. P. interests have control of an immense amount of latent tonnage which must eventually place the latter road first. Recent additions to the N. P. list are the Hill Crest and Mahnomen pits, Croft Mine and Barrows Mining Co. shaft. The last named has no connection with the Barrows Mine, until recently operated by M. A. Hanna & Co. It is rumored, with apparently some foundation, that the Soo Line will extend its tracks northward 15 miles into the Emily District. This territory, where considerable tonnage has been shown up, is now without railroad facilities. The Brainerd Chamber of Commerce has started activities to secure an extension of the Soo Line to Brainerd, now an exclusive N. P. point.

LIVINGSTONE, MONT.—June 17

The New World Mining District has received considerable attention and work there new impetus by reason of permission granted by the Government to haul ore by motor truck through Yellowstone Park. The U. S. Geological Survey has been requested to examine the district and has responded with the following tentative promise:

> By reference from the office of the Secretary of the Interior, I am in receipt of your letter of May 4 requesting an examination of the New World mining district, Park County, Montana.
>
> A great many requests for examinations of this sort come to the survey which can not be taken up immediately because its staff of geologists and its appropriations are not large enough to enable it to do all of the work that ought to be done. The requests are, however, placed on record and are given careful consideration when plans for field work are taken up. The plans for this season are already well advanced, and it may not be practicable to grant your request at this time. It will, however, be considered in connection with plans for the 1916 field season. I have been much interested in reports of deposits in the area immediately north of Yellowstone Park and can assure you that if at any time a geologist can be spared for the work, he will be detailed to investigate them.

ST. JOHNS, NEWFOUNDLAND—June 17

There Have Been Negotiations toward reviving copper and pyrites mining down around Notre Dame Bay, but nothing has materialized except the efforts by the Cape Copper Co. of London in its continuation of development at Baie Verte. This company has made good profits in the years it has operated in Newfoundland, principally at Tilt Cove where it abandoned its leases a year or two ago. It is hoped in St. Johns that the attempt to establish a big industry at Bay of Islands on the west coast of Newfoundland will be successful. The Newfoundland Products Co. is the name of the organization which will manufacture carbide and other mineral products. Previous attempts to build up copper, oil, and mining businesses on the west coast have failed.

Iron Mining on Bell Island in Conception Bay is proceeding with about half the normal force at work; between the two companies, the Nova Scotia Steel & Coal Co. and the Dominion Iron & Steel Co., 700 men are now employed, which is an improvement over last winter. It is reported that the Nova Scotia company has secured British and American orders for 300,000 tons of ore which is about half of its usual annual output; German orders have of course been cut off by the war. Shipping by ocean steamers is in progress, and to keep full the big ore bins at its shipping piers across the island, the large stockpiles are being drawn from. It is a two-mile tramp across Bell Island, from the mines to the piers, which are situated on deep water on the sheltered side of the island; owing to the high cliffs at that place the ore-bins are constructed in natural excavations in the rock face. The Nova Scotia Co. is not working its submarine mine at this time, nor has it done so since the war began, but is getting it in first-class condition to start when necessary, concreting the roofs and curves and keeping the pumps going constantly. The long slopes and extensive underground workings are well planned and equipped. Their new slope, No. 3, is being rushed ahead by night and day shifts. It is customary in driving these long slopes under the sea, several thousand feet in length and inclined at 8°, to drive two slopes with a narrow pillar of rock between, in order to use one as an "air-shaft" and the other for hoisting. No. 3 slope is now 1600 ft. from collar to face, and is being advanced 50 ft. per week, with the bosses and miners working on a bonus system. The only actual mining being done is at the surface-pits, where the ore outcrops on Bell Island; 600 or 700 tons a day are being mined

The Mining News

ALASKA

THE SHIPMENTS OF COPPER ORE from Alaska to the United States in May, 1915, were 7649 gross tons, containing 3,525,600 lb. of copper.

TENAS PONTUS (Valdez)—Has resumed operations and big stamp mill near Shoup glacier has started crushing ore which was taken out during winter.

GRANBY MINING (Valdez)—Midas mine owned by this company will start shipping copper ore on aerial tram just completed, and work is being rushed to bring the property up to the highest efficiency.

RADIO CLAIM (Dawson)—Jimmy Lloyd plans to take a one-stamp prospecting mill to this property. Tunnel driven 70 ft. and winze sunk from inner end of this shows small body of ore from which assays of $180 have been obtained.

PEARSON & JOHNSON (Fairbanks)—Pearson & Johnson, laymen on the Cascaden-McCord bench claim, Livengood Creek, are working in pay estimated to average $2.75 per sq.ft. The ground on the adjoining creek claim runs about $1 per foot.

SHAMROCK CREEK (Fairbanks)—Pay going $1.50 per sq.ft. has been found on Shamrock Creek, tributary of middle fork of Big Chena River. Shamrock is in same district as Palmer Creek and Van Curler's Bar, where considerable work has been done in past.

NO. 21 GOLDSTREAM (Fairbanks)—Jim Russel, part owner and layman, has opened up a large block of ground that will be mined this summer. Difficulty previously experienced on account of lack of water during dry season has been obviated by building reservoir at mouth of Queenie Gulch.

HAPPY HOME ASSOCIATION (Fairbanks)—Judge Bunnell in district court at Fairbanks has decided case of George Smith vs. Mike Wagner, Mike Beegler and George Wheeler in favor of defendants. Suit was for title to Happy Home claim on Eva Creek and $15,000 worth of gold dust deposited in banks and had been in court over two years.

LITTLE ELDORADO ASSOCIATION (Fairbanks)—Recent cleanup of Whalley, White & Co., leasers, contained 130 oz of gold, which was very coarse, largest nugget being worth $57. Present shaft is nearer creek than old workings from which large production was made several years ago. Ground averages about $5 per sq.ft. of bedrock.

DRY CREEK (Shushana City)—New impetus has been given to prospecting of deep channels of Shushana district by discovery of rich pay on Dry Creek, tributary of Johnson. Except in few instances it has been impossible to reach bedrock on account of live water. Shaft in which recent discovery was made struck water at depth of 110 ft. Small drill hole was drilled to bedrock from bottom of shaft distance of 10 ft. Gold worth about $1 was recovered from 3-in. drillhole. Since discovery property has been bonded to J. J. Finnegan.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Made a record production for company in May, with output of 5,727,000 lb. of copper.

MASCOT COPPER (Dos Cabezas)—Last spike has been driven in new Mascot & Western R.R., 16-mile line connecting property of this company with main line of Southern Pacific. Company will shortly be in position to begin ore shipments.

COPPER QUEEN (Bisbee)—Is to concrete Sacramento shaft from top to bottom, distance of 1700 ft. Work to be done without interfering in any way with hoisting of ore. Shaft is main outlet for ores mined by company in Bisbee camp and it would not pay to close shaft at this time. Five-foot steel forms have been designed by George Morris, master mechanic, and Capt. J. P. Hodgson, underground superintendent. Is planned to put in 5-ft. section of concrete between every two working shifts. Two eight-hour shifts being worked at present. There is only one other concrete shaft in Bisbee district, that being Junction of Calumet & Arizona, concreted two years ago from surface to bottom at 1800 level.

Gila County

IRON CAP (Globe)—Is shipping 200 tons of 10% ore weekly to smeltery at El Paso. June 14, shipment of high grade to same point was begun with carload that averaged 25% copper, 25 oz. silver, and carried a small amount of gold.

BAKER & FERRYMAN (Roosevelt)—Purchasing supplies for cable ferry to be installed across Salt River to Sunset Camp, at mouth of Buckhorn Cañon, about 1½ miles below Roosevelt dam. A 900-ft. cable will be used and it will be arranged in such a manner that the current will carry the boat and its burden across in either direction.

OLD DOMINION (Globe)—Company has been running two furnaces up to June 10, when third furnace was started, and to date the copper production has been averaging over 40 tons per day. Basic converter shell, if it runs remainder of month, will have completed campaign of two years without having been off the stand. In concentrator tonnage of over 600 tons per day has been put through all of this month. New type of shaking screen will be installed below trommels at head of mills and in near future extra compartments will be added to Woodbury jigs. Recent changes made in flotation machine have allowed considerable bigger tonnage to be treated. In mine department tonnage hoisted this month has averaged between 900 and 1000 tons per day. [illegible] water on 12th level has decreased to about 6,500,000 [illegible] this decrease has enabled mine to shut down [illegible] on 10th level, so that all of water is now being [illegible] 12th level.

Maricopa County

MARICOPA QUICKSILVER (Phœnix)—Is making preparations to resume active development of its property in Mazatzal mountains.

INDEPENDENCE (Wickenburg)—Will install dry concentrator on its lead property west of Vulture mine. Site is now being graded.

SUNFLOWER CINNABAR (Phœnix)—Will resume operations at early date. Retort was installed on property some months ago but furnace may be installed soon.

Mohave County

UNITED EASTERN (Oatman)—Company has acquired water rights for its proposed mill to be built in Kingman District.

Pima County

NEW CORNELIA (Ajo)—Has received authority from Arizona corporation commission to issue $675,000 of securities for constructing proposed Tucson, Cornelia & Gila Bend railway. Contract calls for completion of road Jan. 1, 1916.

Santa Cruz County

DUQUESNE M. & R. (Duquesne)—This copper property belonging to estate of late George Westinghouse is having conducted tests on oil flotation at company plant at Washington Camp. Charles A. Bankerd is agent for Duquesne company.

CALIFORNIA

Amador County

HARDENBURG (Jackson)—Arrangements being made for settling affairs and to provide money for continuing development and operation. John Martin and Henry Malloch owning the controlling stock in South Eureka Mining Co. are principal stockholders in Hardenburg. They have agreed to turn back one-half of their Hardenburg shares to treasury to be sold and proceeds to be applied on debts and providing of fund for renewed operation. Under this plan all creditors have signed forebearance for six months and to protect them, company is to turn over all its property to C. L. Culbert, manager of the bank of Amador County, as trustee. Property is equipped with 20-stamp mill and is operated through vertical shaft.

Butte County

MORNING STAR (Stirling)—This mine, situated near Romsey Bar, will be reopened by F. W. Foster, of Oakland. Property has been idle about 10 years.

Del Norte County

PLATINUM in black sand along coast in this county near Crescent City is to be recovered by machinery manufactured in San Francisco, according to J. W. Sweet who has been overseeing construction of plant to be installed. It is reported that this method accomplished saving of 81 oz. of platinum during short period last winter. Plant will be operated by gasoline engine.

Eldorado

LARKIN (Diamond Spring)—Property sold to Charles F. Becker, of Sacramento, acting in interests of San Francisco men. Mine is reported to have produced $250,000 in gold from depth of 800 ft. It is believed orebodies persist to greater depth.

Kern County

PACIFIC MINERAL PRODUCTS (Los Angeles)—President Eisenmayer is preparing to make inspection of mineral resources in Mohave desert region. Company is in the market for talc, asbestos, soapstone, ocher, umber, manganese, jasper, molybdenite, wolframite, Scotch red, light and black granites, marble, kaolin, feldspar, chrome, fluorspar, barytes, mica, garnets, silica, graphite, magnesite, and non-metallic minerals.

Nevada County

BIRCHVILLE (Graniteville)—Company has appealed from judgment of superior Court which awarded Guiseppa Damiano $12,000 for injuries received in the mine in 1913. Suit was brought for $30,000.

UNION HILL (Grass Valley)—Strike recently made above west drift on 800 level has developed into high-grade deposit of ore. Average width 2½ ft. Drifting east and west is in progress in addition to extracting large amount of high-grade rock. 10 stamps of the 20-stamp mill are kept going on average milling ore.

GOLDEN CENTER (Grass Valley)—Peabody gold lode claim on northwest slope of Gold Hill has been [illegible] by operators of Golden Center. Peabody [illegible] the Peabody Gold Mining Co., of which [illegible] Schroeder, now in the German army, is president. [illegible] comprises 14 acres considered valuable mining [illegible]. This makes holdings of Golden Center about [illegible]. Golden Center recently acquired Catholic Church [illegible] about 14 acres. Mill returns show that ore is running [illegible] as $22 per ton.

Plumas County

ENGELS COPPER (Taylorsville)—Exploration of orebodies will be undertaken with diamond drills. Six machine drills are breaking ore and other drills will be added as soon as new air compressor recently purchased is installed. Purchase of three more motor-trucks is contemplated. One large caterpillar engine and three motor-trucks are at present employed to haul supplies and concentrates. With additional trucks it is estimated that 40 tons of concentrates can be shipped daily. Elmer E. Paxton is manager.

San Bernardino County

CALIFORNIA TRONA (Searles)—Is installing large brine-pumping plant, capacity of 1,200,000 gal. per day. Will also begin construction this summer of 100-ton potash plant on lines of new process worked out in New York. Expected that potash production will begin at Searles Lake in six months at rate of 30 tons per day and during succeeding four months be increased to 100 tons.

San Benito County

PACIFIC (Hollister)—This quicksilver mine has been purchased at bankruptcy sale by Bristow and Huckaby, of San José. Property is equipped with reduction plant which has been out of commission several months. It is expected new owners will reopen mine.

Shasta County

BALAKLALA (Coram)—Repairs of tramway and other surface equipment are in progress and arrangements being made for continuing and probably increasing production. Shipments of high-grade ore continue to Tacoma smeltery. Some development is in progress. No information is at hand as to what company proposes to do regarding resumption of smelting.

Sierra County

CROESUS (Alleghany)—Rebuilding of quartz mill being pushed under contract to Robert Hathaway, of Nevada City. Mining operations also are being continued upon large scale under management of W. B. Pearson.

ORO (Downieville)—Work has been resumed under bond to Dr. G. P. Reynolds and associates, of Alameda. This property contains two gold-bearing veins, one small but very high grade, other assaying $3 to $6 per ton.

CLEVELAND (Sierra City)—Winze being sunk 100 ft. to prospect shoot of $4 to $8 free-milling ore, and 10-stamp mill has been put into operation. R. G. Gillespie, of Pittsburgh, Penn., is operating under bond. Dan McGonigal has charge.

Siskiyou County

BLUE JEANS (Etna)—Siskiyou syndicate has increased crew of miners at this mine, and advanced development at Cub Bear. Installation of a stamp mill is contemplated.

Sonoma County

GREAT EASTERN (Guerneville)—Reported that this quicksilver mine will be reopened immediately, after clearing away accumulation of débris caused by caving of tunnel by earthquake of 1906. High price of quicksilver which is about double what it was at time mine closed down, is inducement for the reopening of the mine.

Trinity County

DELTA CON. (Delta)—Raising funds for building a mill in Dog Creek district.

Yolo County

UNION EXTENSION (Davis)—R. D. Mayes and A. J. Hillhouse, of Dixon, will undertake development work. The 300-ft. shaft will be deepened 100 ft. and two new drifts driven. Mine is equipped with stamp mill.

COLORADO

Clear Creek County

LAMARTINE (Idaho Springs)—Lindall-Eckberg Leasing Co. has opened 3-ft. vein of $15 ore.

NEW ERA (Idaho Springs)—Underground development being carried on in three headings. Veins are from two to three feet wide and assay about $30 per ton. Ore from old dumps is being run through mill. Averages about $5 per ton. Estimated that there are about 10,000 tons available.

ONEIDA-STAG (Idaho Springs)—In west workings 600 ft. below surface vein of smelting ore has been opened that averages 30 in. in width and assays 1.12 oz. gold and 3 oz. silver per ton. During last month mill has been running on ore produced from development work, averaging from $3 to $5 per ton, and paying cost of mining and milling. Will install new compressor plant. H. T. Rogers is local manager.

VINDICATOR MINES & TUNNEL (Idaho Springs)—Leasing company to be known as the Gold Standard Leasing Co. will be organized to take over and operate properties of Vindicator company. Contract has been let to advance drift on Tom Tuck vein to its intersection with Gold Leaf vein. Recent development on Tom Tuck vein has opened ore averaging $10 per ton in vein 6 ft. wide.

STANLEY (Idaho Springs)—First 1500 ft. of Road Adit level recently repaired and retimbered preparatory to additional development work through this level. At Salisbury Mill, Thomas Egan, leaser, is successfully treating ore from Stanley dumps averaging $2.40 per ton. Material is crushed in a 10-stamp battery to 40 mesh, passed over amalgamating plates, 16-ft. Wilfley table and two Egan concentrators. The recovery amounts to 71c. by amalgamation and $1.22 by concentration, or total of $1.93 per ton. Total operating cost is about $1.25 per ton. Improvements will be made in process and tonnage will be increased.

CONNECTICUT

New London County

LANTERN HILL SILEX (North Stonington)—Property acquired by H. G. Mayham, of New York and compressed air plant and mining equipment will be installed and production resumed. Spur will be built and rock shipped via Mystic.

IDAHO

Custer County

LOST PACKER MINE (Mackay)—Will install 50-ton flotation plant immediately to treat siliceous ores that have heretofore been too expensive to flux in company's smelting plant. Property is controlled largely by Salt Lake men.

Shoshone County

RED MONARCH (Wallace)—Has purchased oil-engine and compressor and will resume mining operations at once. Property adjoins Interstate-Callahan. Ralph Smith is manager.

FRISCO (Wallace)—Work on 6000-ft. flume carrying water for 600 hp. and also for milling purposes, will be completed soon, at which time working force will be increased to 200 men.

MARSH (Burke)—Full operations including sinking of shaft have been resumed at Marsh mine. All equipment in leased mill completely overhauled and in some cases old machinery discarded and replaced with modern.

STEWART (Stewart)—Net earnings for May, $73,000. Producing 15,000 tons of ore per month. Concentrates shipped to A. S. & R. contain between 40 and 50 oz. silver per ton and 50% lead. Company now has between 1700 and 1800 stockholders, largest number in its history.

PANDORA (Wallace)—Has petitioned court for dismissal of case recently filed by it against Snowstorm mine, requesting survey of underground workings on account of allegations that Snowstorm had penetrated Pandora ground and extracted ore. Satisfactory arrangements between two companies for survey have been made.

MARYLAND

Montgomery County

GREAT FALLS MINES (Potomac)—Is shipping gold ore valued at $20 to $35 per ton after sorting. Contemplates building 25-ton mill. C. L. Logue, formerly of Manhattan and Goldfield, is superintendent.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Is slowly adding to the force at No. 3 and 4.

SUPERIOR (Houghton)—There has been slight increase in output of copper, tonnage running 650 lately.

FRANKLIN (Houghton)—Tonnage of rock from Allouez conglomerate lode at this property now reaches 750 tons daily.

TAMARACK (Calumet)—Has increased daily rock tonnage to 1100 tons which rate will be maintained for at least two months.

LAKE (Houghton)—No shipments yet made at Lake where unwatering is proceeding as rapidly as possible. Similar conditions prevail at La Salle.

HANCOCK CONSOLIDATED (Hancock)—Rock shipments gradually increasing; now average from 15 to 17 cars every other day. This has been maintained since first of month.

MOHAWK (Mohawk)—Foundation for new steel rock house at No. 5 completed. Work starts immediately to erect new building. Old wooden rockhouse is torn down.

MICHIGAN (Houghton)—Question of milling opportunities in district is likely to become serious soon if present demand for metal continues. Michigan mill, which never operated, would require but little overhauling to put it in good condition to handle amygdaloidal rock.

NEW ARCADIAN (Houghton)—Outside of discovey of No. 8 conglomerate at New Arcadian, opening of copper rock in southerly lateral at 900-ft. level is most important development in history of operations by present management. North openings in amygdaloid have been satisfactory and are showing continuous high-grade stamp rock.

CONTACT (Houghton)—Resumption of operations at Elm River or Contact property will commence immediately. Elm River originally organized years ago and large amount of money spent unsuccessfully. New company has been organized to take over property and exploration work along new lines will start. Recent assessment of 50c. will provide funds for drilling work which will be undertaken in northeast corner of Section III.

Iron

CHASE (Ishpeming)—Mine about to be closed; ore supply is exhausted. Equipment will be moved. Chase was opened five years ago. Tonnage mined has been small.

CHATHAM (Iron River)—No ore has been shipped from here this year. Ore is still being stocked. This is unusual at this time of year. Ore is usually dumped into cars during shipping season even if stockpiles are not moved.

BALKAN (Alpha)—Winston Bros. have been given contract to mine 200,000 tons of ore from Balkan pit this summer. Same company is doing stripping. Drag lines will be used. Only 100,000 tons will be shipped; remainder will be placed in stock.

NORTH LAKE (Ishpeming)—All records for drifting on the Marquette range have been broken at this property. A rock drift over 4000 ft. long is being run. During May the footage was over 400 ft. Two crews of men are working eight hour shifts. There is no Sunday work. Only two drills are employed. Rock has to be trammed long distance. Is one of finest pieces of drifting work on range.

NEWPORT (Ironwood)—Has lost its suit in supreme court regarding its mine valuations. Taxes were paid under protest after Finlay valuation. Company maintained that lands which were thought to contain large ore reserves were assessed at too high a figure, as it was not known what ore was present there. Court held that if company desired to sell lands in question that large price would be asked for them and that valuation was not placed at too high figure. Similar cases are now pending in court but will probably be decided against the companies.

MINNESOTA

Cuyuna Range

IRON MOUNTAIN (Manganese)—Drift on 130 level in about 50 ft. has encountered iron ore running up to 32% Mn.

BARROWS (Barrows)—Work preliminary to shaft sinking is under way. Shaft will be drop shaft of steel and concrete. A 24-ton cutting shoe will be used. Northern Pacific spur now on property. Many innovations in shaft sinking to be tried.

Mesabi Range

MORTON (Hibbing)—Operations commenced underground on June 14. Mine closed since first of year. More than 50 men were put to work. More will be added as work goes on.

MONTANA

Madison County

CONREY PLACER (Ruby)—Machine shop and all machinery total loss from fire June 15. Loss estimated at $125,000. Manager Kammerer announces that shop will be rebuilt and machinery replaced but not on as extensive scale as before.

Silver Bow County

DAVIS-DALY (Butte)—Has drifted 55 ft. on new vein cut on 2500 level. Orebody holds about 11 ft. wide and averages 7.1% copper.

ANACONDA (Butte)—Original mine of this company which has been shut down for several weeks, resumed operations June 11, and about 450 additional men have been put to work. This will add about 1000 tons of ore per day to company's output. During shut-down needed repairs were made but particular attention was given to development work and large additional orebodies have been blocked out. Belmont mine, which has been down for several months, will start operations within few days. This will mean adding at least 150 men to working force and will also add to daily production of ore between 250 and 300 tons. During shut-down, shaft has been sunk 200 ft. further and skips have been put in. Belmont is most southerly mine of company in Butte district. The following awards were made to the Anaconda company on its display at the Panama-Pacific Exposition at San Francisco: 1. Gold medal of honor—Exhibit of copper from mine to finished product. 2. Gold medal—Ore specimens from Butte district. 3. Gold medal—Geological maps, mine models, etc. 4. Silver medal—Models of timbering and vein system. 5. Silver medal—Collaborators under award No. 1. 6. Gold medal—Collaborator connected with exhibit, F. A. Linforth. 7 Gold medal—Collaborator, George W. Pierce.

NEVADA

Churchill County

BARON (Eagleville)—Recent sampling of property has satisfied owners that property deserves mill, and 10-stamp mill will be provided immediately.

Esmeralda County

SANDSTORM-KENDALL (Goldfield)—Electric hoist installed at winze from 500 level and work will be resumed.

SILVER PICK CONSOLIDATED (Goldfield)—Main shaft now 700 ft. deep; east crosscut being driven to cut vein opened on 500 level.

GREAT BEND (Goldfield)—New surface plant now in operation and shaft being unwatered to 500 level. Rich ore was exposed on this level by leasers who were driven out by water.

GOLD COIN (Klondyke)—Shoot of mineralized rhyolite, 12 to 18 in. wide, assaying $90 per ton opened recently. Mineralized zone 12 to 15 ft. wide with narrow seams of high-grade ore.

ORIGINAL KLONDYKE (Klondyke)—Brandon & Miller have taken lease on this mine, located about 15 miles south of Tonopah, which was mined intermittently before Tonopah and Goldfield were discovered.

Lincoln County

PIOCHE ORE SHIPMENTS to Utah smelteries for week ended June 13 amounted to 56 cars estimated 2800 tons, valued at $35,000, compared with 80 cars week previous. Prince Con. shipped 52 cars; Pioche Amalgamated, 2; and Bristol Con. leasers 2.

NEVADA-UTAH (Pioche)—Test of 10-ton lot of ore at experimental plant of Salt Lake Engineering Works gave good results which presage early construction of mill at property.

Lyon County

MASON VALLEY (Thompson)—Stated leaching plant will be ready for operation in few days, capacity 100 tons daily.

Nye County

TONOPAH ORE PRODUCTION for week ended June 12 amounted to 10,392 tons, valued at $213,016, compared with 10,645 tons at $217,570 week previous. Producers were Tonopah Belmont, 3522; Tonopah Mining, 2750; Tonopah Extension, 1790; West End, 775; Jim Butler, 1100; Tonopah Merger, 351, miscellaneous leasers 104 tons.

NEW MEXICO

Grant County

PINOS ALTOS M. & M. (Pinos Altos)—New mill recently tested with satisfactory results will soon begin receiving custom ore.

SILVER CELL MINING & SMELTING (Pinos Altos)—Has started remodeling smeltery which will immediately be put into commission. Large quantity of ore blocked out in mine and negotiations are being made for purchase of suitable fluxing ore. C. E. Dimmick is manager.

DEVELOPMENT UNDER WAY on several copper mines in Fierro district. Shipments being made occasionally. Humbolt mine of Hermosa Copper Co., under lease to Nelson, Page & Smith. Kresgy mine being operated by J. Sinks. One shipment made to El Paso smeltery. Minters & Atteberry are shipping copper ore to Douglas, Ariz., from Burney mine. G. W. Hightower shipping to El Paso. Other prospects at Fierro being opened up. No activity at Phelps-Dodge property or C. F. & I. Co. mines.

UTAH

Beaver County

BEAVER HORSESHOE GOLD (Beaver City)—Articles of incorporation have been filed. Capitalization is $250,000; company owns claims 14 miles east of Beaver City. H. E. Ward is president.

Juab County

TINTIC ORE SHIPMENTS for week ended June 12 were 124 cars estimated 6200 tons at [illegible] compared to 116 cars week previous.

IRON BLOSSOM (Silver City)—Winze [illegible] ft. deep has opened cave below 600 level of No. [illegible]. There is lead and copper staining in bottom. Development looked upon as favorable, as ore has been mined in [illegible] on upper levels, though there have so far been no important orebodies opened at depth.

MAY DAY (Eureka)—Another contract has [illegible] to ship zinc ore, and shipments will amount to [illegible] tons monthly. About 30 leasers are working on ore of [illegible] character. Will ship about 10 cars of lead-silver ore [illegible]. In May shipments of zinc ore amounted to $14,892, and [illegible] ore from ground leased from Chief Consolidated brought $5028.

Salt Lake County

PRICE (Salt Lake City)—Will install electrically-driven air compressor and air drills as soon as transmission line now under construction is ready to deliver power.

COLUMBUS EXTENSION (Alta)—John F. Cowan has sold his interest in the property to party to whom he gave option shortly after he became interested in the Bannack Cons. at Bannack, Montana.

OHIO COPPER (Bingham)—Work in the mine has been started. One section of mill will be started first, to be followed by other sections. It is proposed to treat 2000 tons daily, with 250 men employed. Alfred Frank is president of leasing company.

UTAH METAL & TUNNEL (Bingham)—Oreshoot recently opened in tunnel continues to produce from two to three cars of ore daily from development. It has been followed for 200 ft. in length, with width still undetermined. Grade of ore when first opened $20 to [illegible] per ton is becoming higher, and gross earnings, at rate of one car daily, amount to $30,000 a month.

Summit County

PARK CITY ORE SHIPMENTS for week ended June 12 were 1622 tons valued at $69,000 compared with 1740 tons week previous.

BIG FOUR EXPLORATION (Park City)—Work of installing mill on Poison creek is progressing.

REVELATOR (Park City)—Streak of high-grade silver-lead ore 2 to 10 in. wide, carrying gold and copper opened on 150 level—deepest level—has been followed 31 ft. Ore occurs on contact between quartzite and limestone; and intersection of this contact with mineralizing fissure is looked for within next 50 ft. of work.

CANADA

Ontario

PORCUPINE CROWN (Porcupine)—Nineteen thousand tons of tailings valued at $3.50 per ton produced from the original experimental plant are being retreated.

WHITE RESERVE (Maple Mountain District)—This property, after being closed for two years, is being worked by syndicate headed by J. A. McAndrews, of Toronto.

HUDSON BAY (Cobalt)—Six hundred feet of crosscutting will be done on property at southwest boundary of town of Cobalt. There is large area of conglomerate in this locality which has not been thoroughly prospected.

SCHUMACHER (Schumacher)—Construction of mill has been completed and all machinery ordered. One of veins found by diamond drilling has been reached by crosscutting. It is 4 ft. wide and of good grade.

BURNSIDE (Kirkland Lake)—Charles E. Henrotin, a mining engineer, is suing C. A. Foster, Henry Cecil and Burnside Gold Mining Co. for $150,000, being 7½% of stock of company. Henrotin claims this amount under an agreement whereby he handed over options on property to the company. Burnside company has entered counter-claim against Henrotin for $50,000 damages.

HOLLINGER (Timmins)—Statement for four-weekly period ended May 20 shows gross profits of $139,187 from treatment of 23,821 tons of ore, average value of $9.56 per ton; working costs being $3.54 per ton milled. Earnings and ore values considerably below average, accounted for by power shortage this spring, in consequence of which development was retarded. Subsequently in trying to catch up with development much ore of inferior grade was extracted which resulted in reduction in average value of ore treated.

MEXICO

A. S. & R. CO.—On account of high price of lead will blow in smelteries at Monterey and Matehuala. Chihuahua plant has been in operation for some time, four furnaces now running, fifth will be started soon. Aguascalientes plant will not be started at present time. All these plants produce some copper but will operate now principally on lead ores.

SOUTH AMERICA

Chile

CHILE COPPER (Chuquicamata)—Cable [illegible] state as certain increase of present ores reserves of [illegible] to 400,000,000 tons without exhausting possibilities [illegible]. New 10,000-ton mill which started May 18 [illegible] to be running at full capacity by Jan. 1. Plans [illegible] for increasing capacity to 20,000 tons per day. On [illegible] treating 10,000 tons, cost is estimated at $2.106 per [illegible] cent per pound delivered in Europe or the United States of [illegible] per lb.

The Market Report

Metal Markets

NEW YORK—June 23

All of the principal metals, except tin, were dull and declining during the last week. In lead there was something akin to demoralization, while in spelter there was a quiet recession of several cents a pound. Copper on the other hand was relatively steady.

Copper, Tin, Lead and Zinc

Copper—Following the large buying of the first half of June there was a natural lull and a recession in prices upon the offerings of interests that want to sell all the time. A considerable business during the week was reported, although the aggregate was much less than the rate of production. The leading interests maintained their price of 20¼c., regular terms, while others sold at 19⅞@20c., r.t., in the early part of the week, and later 19.50@19.55c., cash, New York, was accepted for export business, and toward the close as low as 19.45c. This reflected some difference of opinion respecting the statistical position, it being held in some quarters that it has become somewhat impaired, while in other quarters it is believed to be as strong as ever. The position of the market at present is that if sellers must dispose of copper they have to offer it down, while if buyers want it they must pay nearly the top price.

It is stated, on reliable authority, that the Anaconda company has sold 10% of its expected output in 1916, at upward of 20c. per lb., regular terms, for delivery during various periods of 1916.

Visible Stocks of Copper in Europe on June 15 are reported as follows: Great Britain, 23,104; France, 2570; afloat from Chile, 550; afloat from Australia, 4000; total, 30,224 long tons, an increase of 1255 tons over the May 31 report.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer has withdrawn all quotations. Wire is quoted at 21@21½c. per lb. at mill.

Tin—The market exhibited no material fluctuations during the week.

Tin shipments from the Straits in May were 6550 long tons. For the five months ended May 31 the shipments were 27,785 tons in 1914, and 26,599 tons in 1915; a decrease of 1186 tons, or 4.3% this year.

Receipts of tin ore and concentrates at Liverpool during May are reported by H. A. Watson & Co., as follows: Bolivia, 3956 tons ore and 195 tons bars; Nigeria, 292 tons ore; South Africa, 140 tons ore; total, 4388 tons ore and 195 tons bars, equal to 2872 tons tin.

Lead—At the close of our last week of record the price of the A. S. & R. Co. was 7c. On June 17 it cut to 6¼c.; the next day to 6c.; and the next day to 5¾c. Each of these reductions was anticipated in the outside market, on June 17 there being sales at 6¼c. at the opening and 5¾c. at the closing, and thus also on following days. The aggregate of business during the week, so far as reported by producers, was small. Producers in general are well sold, and the market of last week was determined chiefly by offerings from second hands. The question for the immediate future is with respect to how much speculative lead there is yet to come out. Until there is further light on that subject the producers will probably make no further move. Toward the close of the week there were some large inquiries from abroad in the market.

On June 22 cable dispatches from London reported the disruption of the international lead convention owing to the secession of the Australian producers, who will sell their own product beginning with July.

Spelter—The price for spelter continued to drift downward during the week, but on the decline a larger tonnage of business was reported than during the previous week, this including some 500-ton lots. In the main the business was for early deliveries, but some contracts for deliveries late in the year were made. A little export business was done. The state of the British and French markets did not, however, permit much of this. According to cable advices early in the week the British government is now fully supplied with its requirements for spelter until next spring, while British galvanizers are operating at only 15 to 20% of normal. Later advices from London reported "nobody interested at any price." The London daily quotation is purely nominal.

Zinc Sheets are lower; base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged.

Butte & Superior's production of blende concentrates in May was 11,870 tons, averaging 52.11% Zn.

Exports from Baltimore for the past week included 143,600 lb. spelter and 342,110 lb. zinc dross to Liverpool.

"Five cents for No. 28 galvanized sheets is prohibitive for some uses, but that is now the usual minimum," says the "Journal of Commerce." "Long terne sheets as well as painted black sheets are offered as substitutes. Failures to carry out sheet contracts based on 8c. spelter have caused an upheaval in the trade."

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
17	4.7638	49⅛	19.55 @19.80	41	5.75 @6.25	5.67½ @6.17½	18.50 @20.00
18	4.7650	49⅛	19.55 @19.80	41	5.75 @6.00	5.62½ @5.92½	18.00 @19.00
19	4.7625	49⅛	19.50 @19.80	41	5.50 @5.75	5.35 @5.60	17.00 @18.00
21	4.7625	49	19.50 @19.80	41½	5.50 @5.75	5.30 @5.60	17.00 @18.00
22	4.7650	48⅞	19.45 @19.75	41¼	5.35 @5.75	5.20 @5.60	17.00 @18.00
23	4.7638	48⅝	19.45 @19.75	41	5.35 @5.75	5.20 @5.60	16.00 @18.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
17	23 5/16	83¾	84¼	96	20.86	168	165¾	25⅝	5.57	110	24.89
18	23⅛	82	83	95½	20.74	168½	166	26⅛	5.68	110	24.89
19	23⅜	...	...	...	...				...	...	...
21	23 5/16	83	84⅛	95½	20.74	170½	168	24 11/16	5.39	102½	22.27
22	23¼	82¾	84	95½	20.74	168¾	166½	24½	5.35	90	19.55
23	23¼	82	83	95	20.63	168	165¾	23 11/16	5.15	92½	20.10

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

E. H. Gary, president of the United States Steel Corporation, announced June 17 that the corporation had decided to build a zinc-smelting plant near Pittsburgh. Judge Gary said: "We have decided to build near Pittsburgh, probably at Donora, a new plant for the manufacture of zinc and its byproducts, including sulphuric acid, at a cost of from $2,500,000 to $3,000,000. We have for some years been considering the building of such a plant in order to supply material for our own use." The magnitude of the estimate indicates smelting works of large capacity.

The U. S. Smelting, Refining & Mining Co. has bought the smeltery of the Laharpe Spelter Co. at Altoona, Kan., and has taken over the entire stock of ore and all contract obligations. Its spelter will be sold through the regular channels of the U. S. organization. The smelter has entered into a contract with the Butte & Superior company to take 800 tons monthly of its ore on a toll basis, beginning in August and continuing presumably to the end of this year.

George E. Nicholson is building a four-block plant near Tulsa, Okla. It is expected that this will be in operation about Oct. 1.

The American Zinc, Lead & Smelting Co. is adding five blocks of furnaces to its Caney plant by contract with the Butte & Superior company.

It is reported that the old smeltery at Nevada, Mo., is to be repaired and reopened.

Joplin reports that another company of ore producers is to build a new smelting plant at Pittsburg, Kansas.

The report that the American Metal Co. has taken over the plant of J. B. Kirk at Iola, Kan., is denied. The Kirk plant is one of the works of the old Lanyon Zinc Co.

Zinc dust is quoted at 27@28c. per lb.

Notwithstanding the decline in prime Western spelter, high-grade metal maintains its price. Sales of spelter guaranteed 99.75% Zn were made this week at 34c. per lb.

Other Metals

NEW YORK—June 23

Aluminum is still strong. The chief domestic producer will quote only to regular customers, and the current market depends on imported metal, which is only in moderate supply. Quotations are firmer, at 31@33c. per lb. for No. 1 ingots, New York.

Antimony is strong on limited sales; supplies are limited and buying confined to absolute needs. Ordinary brands—chiefly Chinese and Japanese—are 37@40c. per lb., according to size of order. Cookson's is held at 46@50c. per lb., according to terms and deliveries.

A recent quotation in London is £125 per ton—equal to 27.16c. per lb.—for English regulus.

Nickel is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.

Quicksilver holds its price on a market which is active on a rather limited scale. New York quotation for large lots is unchanged at $95 per flask of 75 lb. for large lots; for smaller orders $95@100 per flask. San Francisco price advanced from $85@90 to $95. Demand is reported brisk at the high price. London price is £14 15s. per flask; same figures quoted from second hands.

Gold, Silver and Platinum

Silver—The market, after holding steady for some time around 23⅜d., has finally given way and declined to 23⅛d. in London. The market is dull and stagnant, with limited demand; offerings continue light or price would fall further. China is not buying and demand from India is only moderate. The Continental demand is also slight.

Platinum has been slightly more active but is still quiet. Prices are not materially changed, dealers asking $37@39 per oz. for refined platinum and $41@44 for hard metal.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—June 19

The base price paid this week for 60% zinc ore was $115@130 per ton; lower at the the end of the week. No sales of lead ore here reported.

SHIPMENTS WEEK ENDED JUNE 19

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,662,660	82,000	507,400
Year	88,676,630	3,122,090	12,456,870

Shipped during week to separating plants, 5,506,100 lb. zinc ore.

JOPLIN, MO.—June 19

Blende, high price $131, assay base per ton of 60% zinc premium ore, $128; medium grades $115@100; lower grades $90@75; calamine, base 40% zinc, [illegible]; average, all grades zinc, $112.64. Lead, high price $[illegible], base $[illegible] per ton, 80% metal content; average, all grades lead, $[illegible] per ton.

SHIPMENTS WEEK ENDED JUNE 19

	Blende	Calamine	Lead	Values
Totals this week	11,607,580	[illegible]	[illegible]	$756,370
Totals this year	277,232,240	24,[illegible]	[illegible]	11,118,220

Blende value, the week, $676,[illegible]; 25 weeks, $[illegible].

Calamine value, the week, $22,710; 25 weeks, $[illegible].

Lead value, the week, $56,940; 25 weeks, $[illegible].

Iron Trade Review

NEW YORK—June 19

The activity in the iron and steel trades continues to increase. The gain is not wholly in export trade, domestic orders showing gains, especially in railroad work.

The foreign orders include, besides shells and other war munitions, a number of locomotives and cars and a considerable tonnage of rails. In domestic orders the mills are getting in addition to railroad work a good many orders for plates and shapes for shipbuilding, and more are expected before long.

PITTSBURGH—June 22

Bookings by the steel interests since the first of the month have been somewhat in excess of shipments, although shipments are heavier than a month ago. Production is at about 80% of capacity, and the Pittsburgh and Valley mills are exceeding this average, the Carnegie Steel Co., indeed, having almost its entire capacity engaged.

The more recent increase in demand is attributable to still heavier demand for steel for direct export and for the manufacture of war munitions. The Russian and French governments have been heavy buyers of railway material. The Steel Corporation has been a heavy seller of war material and it is understood that its attitude in this matter has changed since the government's dissolution suit was decided.

Predictions are now general in the steel trade that the mills will be operating at capacity shortly, probably by sometime in August. While appearances in the steel trade proper are altogether favorable, sight should not be lost of the fact that coke, scrap and pig iron are all in better supply than demand and that prices of these commodities are not one whit higher than in January. The steel trade may become really prosperous, but the iron trade as a whole can hardly be considered prosperous until pig iron makes a better showing.

COKE

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie in May was 5,238,504 tons, being 90,838 tons more than in May, 1914. For the five months ended May 31 the totals were, in short tons:

	1914	1915	Changes
Anthracite	4,718,167	4,580,414	D. 137,753
Bituminous	18,288,294	16,597,074	D. 1,691,220
Coke	1,407,219	1,008,443	D. 398,776
Total	27,413,680	25,185,931	D. 2,227,749

The total decrease this year was 8.1%. The tonnage has taken an upward turn, as shown by the increase in the month of May.

Chemicals

NEW YORK—June 23

The general market has been a little more active and there seems to be a steadier tendency apparent.

Arsenic—The market remains quiet and unchanged with only a moderate business. Quotations are about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and prices somewhat stronger. The current quotation is $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller orders.

Nitrate of Soda—The market continues strong and steady although transactions are rather variable in quantity. Quotations are 2.20c. per lb. for spot and all positions this year.

The Nitrate Propaganda office, of Chile, reports the production of nitrate for April and the four months from Jan. 1 to Apr. 30, in short tons:

	1914	1915	Changes
April	283,290	100,[illegible]	[illegible]
Four months	1,041,189	391,[illegible]	[illegible]

Consumption in the United States for the four months is estimated at 216,058 tons in 1914, [illegible] 1915, an increase of 143,4[illegible] tons this year.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Ida., (post.)		July 1	$0.005
Belcher, Nev., (post.).	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Blue Bell, Ida	July 5	Aug. 4	0.003
Blue Star, Ida.	June 19	July 10	0.01
Carbonate, Ida	July 23		0.001
Cash Boy, Nev., (post.)		June 21	0.01
Challenge Con., Nev.	July 12	Aug. 4	0.05
*Contact Copper, Mich.		July 14	0.50
Contact Copper, Mich	May 15		0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida	June 5	July 8	0.001
Glen Metal, Ida.	May 31	July 1	0.002
Hancock Cons., Mich.	Sept. 1		1.00
Hancock Cons., Mich.	Jan. 3		1.00
Houghton, Mich.	May 25		1.00
Idora, Ida	June 3	July 2	0.005
Iron Mask, Ida.	July 1	Aug. 10	0.002
Majestic-Idol, Nev.	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Mineral Range, Utah	May 24	..	0.003
Monarch Pitts., Nev.	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0.005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich.	June 1		0.50
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0.50
New Yerington Cop., Nev	July 9	July 27	0.01
North Bunker Hill, Ida	June 12	July 17	0.002
Old Veteran, Ida.	July 5	July 31	0.002
Rainbow, Ida	July 7	Aug. 7	0.002
Revelator, Utah			0.01
Rhode Island, Ida	June 24	July 24	0.001
Royal, Ida.	June 1	July 6	0.0015
Silver Mountain, Ida., (post.)		July 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Sunset Dev., Ida	June 30	July 24	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0.01
Union, Nev	June 18	July 9	0.05
Virginia, Ida., (post.)		June 29	0.02
West Tonopah Con., Nev.	July 10	Aug. 10	0.01
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Sales at auction cluded: New York, 40 shares Metallurgical Securities Co. preferred, 40; 20 shares Metallurgical Securities common, $1 per share. Philadelphia, 5000 San Juan Gold Min. Co., $3 lot; 2000 Cons. Gray Eagle Mines, $1 lot; 1000 U. S. Min. & Sm., $1 lot; 480 United Mining com., $1 lot; 60 United Mining pfd., $1 lot; 300 Tortilita Copper, par $1, 25c. per share

COLO. SPRINGS June 18

Name of Comp.	Bid.
Acacia	03¼
Cripple Cr'k Con.	01
C K & N.	04
Doctor Jack Pot.	10½
Elkton Con.	.39½
El Paso	90
Findlay	.03
Gold Dollar	02
Gold Sovereign.	04¾
Golden Cycle	1.75
Isabella	18¾
Jack Pot	.06½
Jennie Sample	02
Jerry Johnson	04¼
Lexington	‡ 008
Mary McKinney.	35
Pharmacist.	01
Portland	1.40
Raven B. H.	.02
Vindicator	1.65

SALT LAKE June 21

Name of Comp.	Bid.
Beck Tunnel	05½
Black Jack	.09
Colorado Mining.	.10
Crown Point	.01¼
Daly-Judge	7.10
Gold Chain	11
Grand Central.	57
Iron Blossom	88
Little Bell	10
Lower Mammoth	04½
Mason Valley	2.50
May Day	20½
Opohongo	00¾
Prince Con	58
Seven Troughs	01¾
Silver King Coal'n	3.15
Silver King Con.	2.17
Sioux Con.	03½
Uncle Sam	05½
Yankee	.03½

TORONTO June 21

Bailey	02	Dome Exten.	12
Coniagas	.05	Foley O'Brien	30
Peterson Lake	.22	Hollinger	25.75
Right of Way.	03	Imperial	‡ 05¼
Seneca Superior.	¾	Jupiter	10
Silver Queen	01	McIntyre	40
T. & Hudson Bay	‡18.50	Pearl Lake	01
Timiskaming	34	Porcu. Crown.	.75
Wettlaufer-Lor	03½	Preston E. D.	02
Big Dome	17.12½	Rea	10

SAN FRANCISCO June 21

Comstock Stocks		Misc. Nev. & Cal	
Alta	04	Belmont	4.15
Andes	05	Jim Butler	.90
Belcher	20	Lone Star	06
Best & Belcher	06	MacNamara	03
Caledonia	18	Midway	16
Challenge Con	‡ 06	Mont.-Tonopah	27
Confidence	05	North Star	15
Con. Virginia	06	Rescue Eula.	09
Gould & Curry.	03	West End Con	83
Hale & Norcross	03	Atlanta	31
Julia	‡ 02	Booth	52
Mexican	34	C. O. D. Con	04
Occidental	.79	Comb. Frac.	09
Ophir	11	Jumbo Extension	1.55
Overman	05	Pitts.-Silver Peak	12
Potosi	‡ 03	Round Mountain	42
Savage	03	Sandstorm Kendall	09
Sierra Nevada	04	Silver Pick	11
Union Con	17	Central Eureka	‡ 16
Yellow Jacket	30	So. Eureka	‡1.50

N. Y. EXCH. June 21

Name of Comp.	Clg.
Amalgamated	76¼
Am.Sm.&Ref.,com	82
Am. Sm. & Ref., pf	114½
Am. Sm. Sec., pf. B	‡80
Anaconda	36¾
Batopilas Min	1⅜
Bethlehem Steel	171¾
Bethlehem Steel, pf.	115
Chino	46
Colo. Fuel & Iron.	33
Federal M. & S., pf.	50
Great Nor., ore., ctf.	57¼
Guggen. Exp.	64¾
Homestake.	119
Inspiration Con.	32
Mex. Petroleum	76¼
Miami Copper.	26
Nat'l Lead, com	64¾
National Lead, pf.	110
Nev. Consol.	15⅝
Ontario Min	3¼
Quicksilver, pf.	4½
Ray Con.	24½
Republic I&S, com.	30
Republic I&S, pf.	87⅝
SlossShell'd, com	36¼
Tennessee Copper.	38⅜
Utah Copper	68
U. S. Steel, com	61¼
U. S. Steel, pf.	109¾

N. Y. CURB June 21

Name of Comp.	Clg.
Alaska Juneau, w i.	13⅛
Alta Con	.70
Beaver Con	32
Big Four.	‡ 05
Blue Bell	03
Braden Copper.	7⅜
Buffalo Mines.	50
Can. Cop. Corpn.	‡1$\frac{1}{16}$
Can. G. & S.	03
Cariboo	‡ 50
Cashboy	.07
Chambers Ferland	16
Chile Cop.	20¼
Con. Ariz. Sm.	$\frac{13}{16}$
Con. Coppermines.	‡2½
Con. Nev.-Utah	½
Davis-Daly	‡1⅛
Diam'field-Daisy	07
Dia. Black B	03
Florence	53
Goldfield Con.	1$\frac{9}{16}$
Goldfield Merger.	23
Greene Cananea	40¼
Kennicott Cop.	29¼
Kerr Lake	4$\frac{7}{16}$
La Rose	.56¼
McKinley-Dar-Sa.	28
Majestic	.84
Mines of Am	2½
Nevada Hills	24
New Utah Bingham	3¼
Nipissing Mines	5.87½
Ohio Copper.	.22
Oro	09½
South Utah	‡¼
Stand'd Oil of N.J.	401
Standard S. L.	1½
Stewart	2$\frac{1}{16}$
Tonopah	7⅛
Tonopah Ex.	3
Tonopah Merger	41
Tribullion	$\frac{5}{16}$
Tularosa	$\frac{3}{16}$
Yukon Gold.	2¾

LONDON June 10

Alaska Tre'dwell	£7	3s	9d
Cam & Motor	0	14	9
Camp Bird	0	5	6
El Oro	0	7	3
Esperanza	0	7	3
Mexico Mines	3	12	6
Oroville.	0	14	0
Santa Gert'dis	0	7	6
Tomboy	1	5	0
Tough Oakes	0	8	6

BOSTON EXCH June 21

Name of Comp.	Clg.
Adventure	2½
Ahmeek.	390
Alaska Gold M.	37¾
Algomah	3
Allouez	56½
Am. Zinc	51⅝
Ariz. Com., ctfs.	7¼
Bonanza	35
Butte-Ballaklava	3¼
Butte & Superior.	69⅝
Calumet & Ariz.	66⅝
Calumet & Hecla.	585
Centennial	19
Cliff	‡1½
Copper Range	55¼
Daly West	3½
East Butte	13
Franklin.	10⅝
Granby	88½
Hancock	19¼
Hedley	28
Helvetia	50
Indiana.	6½
Island Cr'k, com.	47½
Island Cr'k, pfd.	89⅝
Isle Royale	28
Keweenaw	2¼
Lake	14¼
La Salle	6¼
Mass	13¾
Mayflower	4¼
Michigan.	2⅜
Mohawk.	78
New Arcadian	12
North Butte	33¼
North Lake	2¼
Ojibway	2
Old Colony.	4¼
Old Dominion	‡56½
Osceola	88
Quincy	87
Santa Fe	3
Shannon	8¼
Shattuck-Ariz	28
Superior.	29½
Superior & Bost.	3¾
Tamarack	37
Trinity	5
Tuolumne	55
U. S. Smelting	45¼
U. S. Smelt'g, pf.	47
Utah Apex.	4⅜
Utah Con.	14½
Victoria	3
Winona	4¼
Wolverine	62
Wyandot	1

BOSTON CURB June 21

Name of Comp.	Bid
Alvarado	‡ 70
Bingham Mines.	09¼
Boston Ely.	28
Butte & Lon'n Dev	24
Calaveras	1½
Calumet-Corbin.	05
Chief Con	.98
Corbin	85
Cortez	50
Crown Reserve.	70
Eagle & Blue Bell	1$\frac{1}{16}$
First Nat. Cop	2¼
Houghton Copper.	4½
Iron Cap Cop., pf.	‡6¼
Majestic	84
Mexican Metals	18
Nevada-Douglas	45
New Baltic	3¼
Oneco	1¾
Raven Copper.	.07
Smokey Dev.	30
So. Lake	6⅜
Tonopah Victor	‡ 32
Trethewey	10
United Verde Ext	4$\frac{5}{16}$

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	....	27.199	25.948	..
July	58.721	54.678	....	27.074	25.219	.
August	59.293	54.344	.	27.335	25.979	
September	60.640	53.290		27.986	24.260	.
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	.
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603		61.336		66.274	..
July	13.223		60.540		64.955	..
August	*		‡		‡	.
September	*		‡		‡	.
October	*		‡	.....	‡	.
November	11.739		53.227		*	
December	12.801		56.841		*	.
Year	.				......	

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		139.391	
December	33.601		147.102	
Av. year	34.301		.....	

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900		3.810	.	19.411	.
July	3.891		3.738	..	19.051	...
August	3.875		3.715	.	‡	..
September	3.828		3.658	..	‡	.
October	3.528		3.384	..	‡	.
November	3.683	.....	3.585	...	18.500	.
December	3.800	..	3.662	...	19.097	.
Year	3.862	.	3.737	..	.....	

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	.
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962	.	25.016	
December	5.592		5.430	..	27.369	
Year	5.213		5.061	.	....	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.47	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90		13.90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84	.	13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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